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NASJRB WILLOW GROVE  
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FINAL FIVE-YEAR REVIEW NAS WILLOW GROVE PA (PUBLIC DOCUMENT)  
9/1/2013  
TETRA TECH

**FINAL**

# **Five-Year Review**

for

## **Former NAS JRB Willow Grove Horsham, Pennsylvania**



**Contract No. N62470-08-D-1001  
Contract Task Order WE05**

**Prepared for:  
Naval Facilities Engineering Command  
BRAC Program Management Office East  
4911 South Broad Street  
Philadelphia, Pennsylvania 19112**

**September 2013**

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**September 2013**

Approved by:

A handwritten signature in black ink, appearing to read "Willington Lin", written over a horizontal line.

**Willington Lin  
BRAC Environmental Coordinator  
By Direction of BRAC PMO  
SIGNED IN MY OFFICIAL CAPACITY ONLY**

Date:

24 SEP 2013

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## ACRONYMS AND ABBREVIATIONS

ADAFs	age-dependent-adjustment-factors
ARAR	Applicable or relevant and appropriate requirement
ARS	Air Reserve Station
ATSDR	Agency for Toxic Substances and Disease Registry
BTAG	Biological Technical Assistance Group
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemicals of Concern
COPC	Chemical of Potential Concern
CSF	Cancer slope factor
CTE	central tendency exposure
CTO	Contract Task Order
CVOCs	chlorinated volatile organic compounds
Dhb	dehalobactor bacteria
DHc	dihalococcoides bacteria
DoD	Department of Defense
EFANE	Engineering Field Activity Northeast
EM	Electromagnetic
EPA	Environmental Protection Agency
EPC	exposure point concentration
EPIC	Environmental Photographic Interpretation Center
ERA	ecological risk assessment
ESI	Extended Site Inspection
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
FWENC	Foster Wheeler Environmental Corporation
gpm	gallons per minute
HA	Health Advisory
HHRA	Human Health Risk Assessment
HHRSE	human health risk screening evaluation
HI	hazard index
HJII	Horsham Joint Interagency Installation
HLRA	Horsham Land Redevelopment Authority
HQ	Hazard Quotient

## ACRONYMS AND ABBREVIATIONS (Continued)

HUD	Housing and Urban Development
IAS	Initial Assessment Study
ILCR	Incremental lifetime cancer risk
IR	Installation Restoration
IRA	Interim remedial action
IRACR	Interim Remedial Action Completion Report
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IUR	Inhalation unit risk
JII	Joint Interagency Installation
LNAPL	Light non-aqueous phase liquid
LUC	Land use control
LUCRD	Land use control remedial design
MCL	Maximum contaminant level
MNA	Monitored Natural Attenuation
MSC	Medium-specific concentration
NAPL	non-aqueous phase liquid
NAS JRB	Naval Air Station Joint Reserve Base
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NJDEP	New Jersey Department of Environmental Protection
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OU	Operable Unit
PA	Preliminary Assessment
PAANG	Pennsylvania Air National Guard
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfate

## ACRONYMS AND ABBREVIATIONS (Continued)

PMO	Program Management Office
ppm	part per million
PRAP	Proposed Remedial Action Plan
PRGs	preliminary remediation goals
RA	Remedial Action
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RfC	Reference Concentration
RfD	Reference Dose
RGs	Remediation Goals
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RMC	Resource Management Concepts, Incorporated
RME	Reasonable maximum exposure
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SMP	Site management plan
SSA	Site screening area
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TCA	Trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
Tetra Tech	Tetra Tech, Inc.
TPH	Total petroleum hydrocarbons
USGS	United States Geological Survey
µg/L	micrograms per liter
UST	Underground storage tank
VOC	Volatile organic compound

## EXECUTIVE SUMMARY

The Five-Year Review Report for the former Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove, Pennsylvania was prepared for Naval Facilities Engineering Command under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) WE05. This review serves to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This is the first five-year review for the former NAS JRB Willow Grove Superfund Site. The triggering action for this statutory review is the date of EPA's signature date on the interim Record of Decision (ROD) of Operable Unit (OU) 3 - Site 1 Groundwater. The purpose of the Five-Year Review is to determine whether the remedy at a site remains protective of human health and the environment. The methods, findings, and conclusions of the review are documented in the Five-Year Review reports. In addition, Five-Year Review reports identify issues, if any, found during the review and identify recommendations to address them. This report also includes summary information on all the Installation Restoration Program (IRP) sites at the former NAS JRB Willow Grove.

The interim ROD for Site 1 Groundwater (OU 3) was signed by the Navy on September 5, 2008, and U.S. Environmental Protection Agency (EPA) on September 29, 2008, with concurrence from the Pennsylvania Department of Environmental Protection (PADEP). The Remedial Action Objective (RAO) for Site 1 groundwater is to protect the health of future groundwater users by preventing their contact with groundwater that is contaminated with volatile organic compounds (VOCs) at concentrations greater than the regulatory benchmark levels. The selected interim remedy for Site 1 Groundwater (OU 3) is a limited action remedy which includes the implementation of land use controls (LUCs) and periodic groundwater monitoring, in conjunction with a review of site conditions and risks every five years. Investigation activities have indicated that the source of groundwater contamination at Site 1 is most likely due to the presence of an off-site, non-Navy source. The pumping of the production wells at the base has drawn contamination above regulatory benchmark levels into the base and the supply wells. Trace levels of contamination below regulatory action levels have been detected in shallow overburden wells at the site and may be the result of on-site activities. The implementation of the interim remedy was completed in accordance with the LUC remedial design (RD) and ROD for OU 3. LUCs were implemented to prevent exposure to chemicals of concern (COCs) in groundwater in accordance with the LUC RD. The Interim Remedial Action Completion Report (IRACR) for Site 1 groundwater (OU 3) was certified on December 21, 2011.

The interim remedy for Site 1 Groundwater (OU 3) is protective of human health. Land use controls (LUCs) have been implemented for groundwater use restrictions, and land use limitations. Periodic monitoring is performed on portions of the groundwater plume to ensure that there continues to be no unacceptable risk to human health from constituents of concern (COCs).

The technical evaluation for the Five-Year Review for Site 1 may be found in Section 2.0 of this document. Section 3.0 provides a summary of the status of the other Installation Restoration Program (IRP) sites at the former NAS JRB Willow Grove. The sites detailed in Section 3.0 are either in the Remedial Design stage, Remedial Investigation/Feasibility Study (RI/FS) stage, or have no action determinations, and are, therefore, not subject to evaluation in the Five-Year Review.

## Five-Year Review Summary Form

SITE IDENTIFICATION		
<b>Site Name:</b> Former Naval Air Station Joint Reserve Base Willow Grove		
<b>EPA ID:</b> PAD987277837		
<b>Region:</b> 3	<b>State:</b> PA	<b>City/County:</b> Horsham Township/Montgomery County
SITE STATUS		
<b>NPL Status:</b> Final		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> No	
REVIEW STATUS		
<b>Lead agency:</b> Other Federal Agency If "Other Federal Agency" was selected above, enter Agency name: Department of the Navy		
<b>Author name (Federal or State Project Manager):</b> Brian Helland		
<b>Author affiliation:</b> Naval Facilities Engineering Command, BRAC Program Management Office East		
<b>Review period:</b> December 2012 - September 2013		
<b>Date of site inspection:</b> January 31, 2013		
<b>Type of review:</b> Statutory		
<b>Review number:</b> 1		
<b>Triggering action date:</b> 09/29/2008		
<b>Due date (five years after triggering action date):</b> 09/29/2013		

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review:				
<b>OU(s): OU 3 – Site 1 Groundwater</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Final remedial action for Site 1 Groundwater (OU 3)			
	<b>Recommendation:</b> Develop ROD for Site 1 Groundwater (OU 3).			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	Navy	EPA	September 29, 2018

## Five-Year Review Summary Form (continued)

**Protectiveness Statement(s)**

*Operable Unit:*  
OU 3

*Protectiveness Determination:*  
Protective

*Addendum Due Date  
(if applicable):*  
N/A

*Protectiveness Statement:*

The interim remedy at Site 1 Groundwater (OU 3) is functioning as intended to protect human health and the environment. Land use controls prevent unrestricted use of untreated groundwater and there is periodic monitoring of the portions of the groundwater plume underlying Navy property to ensure that there is no unacceptable risk to human health from constituents of concern.

## 1.0 INTRODUCTION

### 1.1 PURPOSE

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of the review are documented in the Five-Year Review report. In addition, the five-year review reports identify issues, if any, found during the review and identify recommendations to address them. This report also includes summary information on all the Installation Restoration Program (IRP) sites at the former NAS JRB Willow Grove.

The Navy is preparing this five-year review report pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106] of this title, the President shall take or require such action. The President shall report to the Congress a list of the facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The agency interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

For federal facility sites under the jurisdiction, custody, or control of the Department of Defense (DoD), Executive Order 12580 relieves the U.S. Environmental Protection Agency (EPA) of this responsibility and delegates the responsibility to the Department of Defense. The U.S. Navy is the lead agency responsible for five-year reviews at the former Naval Air Station Joint Reserve Base (NAS JRB) Willow

Grove, working with EPA and Pennsylvania Department of Environmental Protection (PADEP) through the Federal Facility Agreement (FFA) dated June 27, 2005.

The Naval Facilities Engineering Command (NAVFAC) BRAC Program Management Office has conducted the five-year review of the remedial actions implemented at the following Operable Units (OUs) in the former NAS JRB Willow Grove:

- OU 3, Groundwater of Site 1 - Privet Road Compound [Record of Decision (ROD) dated 9/29/2008].

This is the first five-year review for the former NAS JRB Willow Grove. The triggering action for this statutory review is the date of EPA's signature on the interim ROD of OU 3, Site 1 Groundwater. The five-year review is required because hazardous substances, pollutants, and contaminants remain in groundwater at OU 3 above levels that allow for unlimited use and unrestricted exposure.

This five-year review was prepared consistent with EPA's Comprehensive Five -Year Review Guidance (EPA-540-R-01-007/OSWER Directive 9355.7-03B-P), June 2001; and the Navy/Marine Corps Policy for Conducting CERCLA Five-Year Reviews, May 2011.

This five-year review consisted of a review of relevant documents, interviews, and a site inspection. In addition, a presentation was made to the former NAS JRB Willow Grove Restoration Advisory Board (RAB), and a public notice (included as Appendix A) of the review was provided to the public at the initiation and prior to the completion of the five-year review. The completed report will be available in the information repository at the Horsham Township Library, 435 Babylon Road, Horsham, Pennsylvania.

## **1.2 SITE CHRONOLOGY**

A list of important historical events and relevant dates of the former NAS JRB Willow Grove is shown in Table 1-1.

## **1.3 FACILITY DESCRIPTION AND HISTORY**

### **1.3.1 Facility Description**

The former NAS JRB Willow Grove is located in Horsham Township, Montgomery County in southeastern Pennsylvania, approximately 20 miles north of the city of Philadelphia. NAS JRB Willow Grove occupies approximately 1,000 acres of the approximate 1,200 acres that the Department of Defense (DoD)

**Table 1-1  
Chronology of Site Events  
Five-Year Review  
Former NAS JRB Willow Grove**

<b>Event</b>	<b>Date</b>
A private airfield was established at the property.	1919
Aircraft operations began during the 1920s and the facility was named Pitcairn Airfield.	1920s
The 516-acre property was acquired by the Navy and expanded.	1942
The field was officially commissioned as Naval Air Station Willow Grove.	January 1943
The majority of the buildings currently on site were constructed during World War II. Expansion of the facility, primarily for runway clearance, continued in the 1950s. The site area increased to over 1,000 acres, including 161.7 acres deeded to the United States Air Force.	1940s and 1950s
Navy began jet training at the airfield.	1949
NAS Willow Grove provided materials, facilities, services, and training in direct support of all units assigned to the stations. Past activities included land filling, fire training exercises, and material storage.	1942 - 1975
An Initial Assessment Study (IAS) conducted by the Naval Energy and Environmental Support Activity (NEESA).	1986
The Site Inspection (SI) Studies Report was completed. Recommendations were no further action at Sites 4, 6, 8, and 9, and the performance of a Remedial Investigation at Sites 1, 2, 3, 5, and the Fuel Farm (Site 10).	May 1990
An Extended Site Inspection (ESI) for Site 7 was completed and no further action was recommended.	1992
Two 210,000-gallon underground storage tanks (USTs) were removed from Site 10. Site 10 petroleum product groundwater contamination cleanup was performed through a series of pilot and full-scale active remediation systems in later years.	1992
Remedial Investigation (RI) Report for Sites 1, 2, 3, and 5.	February 1993
Risk-Based Prioritization of Cleanup Site Work	April 1994
Proposal to National Priorities List (NPL)	September 23, 1994
Final listing on EPA National Priorities List (NPL)	September 29, 1995
Draft Phase II RI report for Sites 1, 2, 3, and 5 was submitted to regulators for review.	April 1998
Navy decided to de-link the reporting process for Installation Restoration (IR) Sites 1, 2, 3, and 5 and submit four separate Phase II RI documents.	1999
An interim remedial action (IRA) for polychlorinated biphenyl (PCB) contaminated soil at Site 1 was completed and approximately 1,100 tons of soils were removed.	November 1999
Navy discontinued active operation of the light non-aqueous phase liquids (LNAPL) recovery system at Site 10. However, quarterly bailing or recovery of product continued through 2002.	2001
Final RI report for Site 5 was submitted.	February 2002
Draft Site 5 groundwater (OU 2) Feasibility Study (FS) report was submitted to regulators and the RAB	February 2002
Preliminary draft Site 2 RI was submitted to regulators.	February 2002
Final RI report for Site 1 was submitted.	July 2002

<b>Event</b>	<b>Date</b>
Navy removed drums and debris and sampled soil at the EPA Environmental Photographic Interpretation Center (EPIC) drum and debris site [named Site Screening Area (SSA) 12] between Site 2 and Site 5.	2003
PADEP agreed with the Navy that no further remedial action or investigation (under the Air Station use scenario) is appropriate for Site 10 soils or groundwater.	September 2004
Site 5 RI Addendum 1, polycyclic aromatic hydrocarbon (PAH) Confirmation Sampling and Analysis for Site 5 Soil (OU 4)	October 2004
Site 1 RI Addendum 1, Residual Risk Evaluation Letter Report for Site 1 Soil (OU 1)	June 2005
A Federal Facility Agreement (FFA) was finalized between the Navy, EPA, and PADEP.	June 27, 2005
Site 1 RI Addendum 2, Technical Memorandum of Risk Assessment Evaluation for Site 1 Groundwater (OU 3)	August 2005
Navy submitted the Action Memorandum for Site 5 - Fire Training Area Soil Removal to mitigate the relatively limited area of soil contaminated primarily with PAHs.	August 2005
Site 1 RI Addendum 3, Remedial Investigation Addendum Report for Site 1 Groundwater (OU 3)	September 2005
PADEP issued a notice of agreement with the Navy recommendation for No Further Action (NFA) at Site 8 and Site 9 under Pennsylvania storage tank regulations.	October 31, 2005
NAS JRB Willow Grove was designated for closure under the authority of the Defense Base Realignment and Closure (BRAC) Act of 1990, Public Law 101-510 as amended.	November 9, 2005
Site 1 RI Addendum 4, Soil Investigation for Volatile Organic Compound Soil to Groundwater Impact for Site 1	March 2006
Site 5 RI Addendum 2, Soil Investigation for Volatile Organic Compound Soil to Groundwater Impact for Site 5	March 2006
Site 5 RI Addendum 4, Technical Memorandum of Risk Assessment Evaluation for Site 5 Soil (OU 4)	July 2006
Site 5 RI Addendum 5, Remedial Investigation Addendum Report for Site 5 Groundwater (OU 2)	September 2006
The NFA Record of Decision (ROD) for Site 1 Soil (OU 1) was signed by the Navy and EPA with concurrence from PADEP.	September 29, 2006
Site 5 - Fire Training Area Soil Removal was performed.	October 2006
Site 5 RI Addendum 3, Technical Memorandum of Risk Assessment Evaluation for Site 5 Groundwater (OU 2)	February 2007
PADEP agreed with the Navy that no further action of any kind is required for SSA 11 - Aircraft Parking Apron. The Navy received a letter from EPA indicating concurrence that no further remedial actions are needed for SSA 11.	February 12, 2007
Site 5 RI Addendum 6, Remedial Investigation Addendum Report for Site 5 Soil (OU 4) approved by EPA.	June 2007
The NFA Record of Decision (ROD) for Site 5 Soil (OU 4) was signed by the Navy and EPA with concurrence from PADEP.	September 21, 2007
The Record of Consensus Agreement No Action Decision for Site 6 was signed by the Navy BRAC Environmental Coordinator and the EPA Remedial Project Manager (RPM) with concurrence from PADEP.	December 12, 2007
Site 1 RI Addendum 5, Continued Groundwater Source Investigation Report for Site 1 Groundwater (OU 2)	January 2008

<b>Event</b>	<b>Date</b>
Focused Feasibility Study for Site 1 – Privet Road Compound Groundwater (OU 3) approved by EPA.	January 2008
Site 3 Interim Groundwater Monitoring Report – Round 1	August 2008
The Record of Consensus Agreement No Action Decision for Site 7 was signed by the Navy BRAC Environmental Coordinator and the EPA RPM with concurrence from PADEP.	August 20, 2008
Proposed Remedial Action Plan for Site 1 Groundwater (OU 3)	April 2008
Interim Record of Decision for Site 1 Groundwater (OU 3) was signed by the Navy and EPA with concurrence from PADEP.	September 29, 2008
Test Pit and Soil Sampling Letter Report for Site 3 Landfill	September 2008
A test pit investigation for the Site 4 tarry waste was conducted, and the tarry waste and related soils were excavated for off-Base disposal.	September 2008
Confirmation Soil Investigation Report for SSA 12	September 2008
Feasibility Study for Site 5 Groundwater (OU 2) approved by EPA.	November 2008
Site 3 Interim Groundwater Monitoring Report – Round 2	December 2008
SSA 12 was designated as Site 12. A separate RI and CERCLA decision process was initiated.	December 2008
Test Pit Investigation Report for Site 4 - North End Landfill	January 2009
Record of Consensus Agreement No Action Decision for Site 4 was signed by the Navy BRAC Environmental Coordinator, EPA RPM and PADEP Case Manager.	January 21, 2009
Site 2 - Antenna Field Landfill RI report was finalized.	April 2009
Site 2 RI Report Addendum for the updated Site 2 Human Health Risk Assessment (HHRA) was submitted.	June 2009
Site 2 Groundwater Confirmation Sampling Report was submitted.	June 2009
Site 3 Landfill Delineation Report	June 2009
Proposed Remedial Action Plan for Site 2 Soil (OU 5) and Groundwater (OU 9)	July 2009
Site 3 Interim Groundwater Monitoring Report – Round 3	August 2009
Navy transferred 18.25 acres to the Air Force as part of the BRAC 2005 requirement to construct a consolidated Armed Forces Reserve Center.	September 2009
Site 1 Groundwater Monitoring Results Report.	November 2009
The No Action ROD for Site 2 Soil (OU 5) and Groundwater (OU 9) was signed by the Navy and EPA with concurrence from PADEP.	June 17, 2010
Remedial Design for Land Use Controls for Site 1 Groundwater (OU 3) approved by EPA.	August 2010
Site 1 Land Use Controls - 2010 Annual Inspection Report	November 2010
Site 12 Phase I Remedial Investigation Data Report	January 2011
NAS JRB Willow Grove was officially disestablished.	March 30, 2011
Pilot Test Report for Site 5 Groundwater (OU 2) was finalized.	May 2011
NAS JRB Willow Grove was transferred to Navy BRAC PMO and entered caretaker status. Navy will dispose of NAS JRB Willow Grove in accordance with the laws and regulations governing the disposal of property.	September 2011
Site 1 Land Use Controls - 2011 Annual Inspection Report	September 2011
Remedial Investigation Report for Site 3 was finalized.	October 2011
Navy transferred 27.20 acre parcel to USAF	December 2011
Interim Remedial Action Completion Report for Site 1 Groundwater (OU 3) was certified by the Navy and EPA.	December 21, 2011
Navy transferred 3 acre parcel to FAA	January 2013

<b>Event</b>	<b>Date</b>
Groundwater Monitoring Report for Site 1, 2011 finalized.	April 2012
Site 1 Land Use Controls - 2012 Annual Inspection Report	September 2012
ROD for Site 5 Groundwater (OU 2) was signed by the Navy and EPA with concurrence from PADEP.	September 25, 2012
Final Remedial Design for Site 5 (OU 2) groundwater submitted.	May 3, 2013
Final Land Use Control Remedial Design for Site 5 was submitted.	May 29, 2013

maintains at the Air Station. The Willow Grove Air Reserve Station (ARS) of the Air Force occupies approximately 200 acres of land in the northeastern section of the Air Station. The former air station has flat to slightly rolling terrain, and is generally bounded by State Route 611 to the east, State Route 463 to the southwest, and Keith Valley Road to the north (Figure 1-1). The locations of the installation restoration program (IRP) sites at the former NAS JRB Willow Grove are shown on Figure 1-2.

The primary mission of former NAS JRB Willow Grove was to provide support for operations involving aviation training activities, and to train Navy reservists. NAS JRB Willow Grove had supported DoD tenants such as the Marine Corps Reserve, and the Army Reserve. NAS JRB Willow Grove was officially disestablished on March 30, 2011, and it was transferred to Navy Base Realignment and Closure (BRAC) Program Management Office (PMO) and entered caretaker status in September 2011.

### **1.3.2 Facility History**

The land that former NAS JRB Willow Grove occupies was originally a private airfield that was established in 1919. In 1926, aviation pioneer Harold Pitcairn purchased the property to develop, build, test, and fly different aircraft. Throughout the 1930s, Pitcairn developed and perfected aviation technologies that would later be used to develop the first helicopter. A 516-acre parcel was acquired by the Navy in 1942. In January 1943, the field was officially commissioned the NAS Willow Grove. Following World War II, NAS Willow Grove was designated a Naval Air Reserve Training Station. Training and operation support activities increased during the Korean War. The majority of the buildings currently on site were constructed during World War II.

In 1957, the Department of Defense purchased additional land, and the site area increased to over 1,088 acres, including 161.7 acres deeded to the United States Air Force. The Air Force maintained its own facilities and aircraft but used the airfield and associated facilities on a joint-user basis. The Navy provided emergency services and flight control operations. Past activities at NAS JRB (primarily land filling, fire training exercises, and material storage) resulted in potential releases at 12 Installation Restoration Program (IRP) sites between 1942 and 1975.

NAS JRB Willow Grove is being investigated through the Department of Defense IRP in accordance with CERCLA. The identified sites are in various stages of the multi-step process heading toward final disposition within the IRP. The Navy is participating in this process jointly with state and federal regulatory agencies.

The Navy initiated an Initial Assessment Study (IAS) conducted by the Naval Energy and Environmental Support Activity (NEESA) in 1986. Nine potentially contaminated sites were identified. Each of these sites was evaluated for potential health or environmental impacts by evaluating the characteristics of potential contaminants and the migration pathways and potential receptors for these contaminants. The study concluded that five sites (Sites 1, 2, 3, 4, and 5) should be subject to a confirmation study. In 1989, additional field activities included the installation of monitoring wells at eight different sites, and measurement of water levels in the wells to determine groundwater flow direction. Results were presented in the Site Inspection Studies Report (EA, 1990), and the Plan of Action for Extended Site Inspections and Remedial Investigations (EA, 1991). Recommendations were No Further Action (NFA) at Sites 4, 6, 8, and 9; and the performance of a Remedial Investigation (RI) at Sites 1, 2, 3, 5, and the Fuel Farm (Site 10).

In 1993, the RI Report for Sites 1, 2, 3, and 5 concluded that additional sampling was needed at all four sites to delineate the extent of contamination and/or the sources of contamination (Halliburton NUS, 1993). NAS JRB Willow Grove was placed on the National Priorities List (NPL) on September 29, 1995. The National Superfund database identification number is PAD987277837. In 1998, a draft Phase II RI report for Sites 1, 2, 3, and 5 (B&RE, 1998) was submitted to regulators for review.

In 1999, the Navy decided to de-link the reporting process for IR Sites 1, 2, 3, and 5 and submit four separate Phase II RI documents.

A Federal Facilities Agreement (FFA) was finalized June 27, 2005 between the Navy, the U.S. EPA, and the PADEP. The FFA ensures that environmental impacts associated with the sites at NAS JRB Willow Grove are fully investigated and proper response actions taken.

NAS JRB Willow Grove was designated for closure under the authority of the Defense BRAC Act of 1990, Public Law 101-510, as amended. BRAC legislation requires that the base closure be in full compliance with CERCLA. Section 2 (Definitions) of the FFA identifies NAVFAC Engineering Field Activity Northeast (EFANE) as the primary Navy local contact entity. Because the EFANE office was designated for closure under the 2005 round of BRAC, EFANE has been replaced by BRAC PMO East as the primary local Navy contact office. The CERCLA process provides guidelines for investigation activities of the sites at NAS JRB Willow Grove.

In May 2007, Special Legislation was enacted that stated, "The Secretary of the Navy shall, notwithstanding any other provision of law, transfer to the Secretary of the Air Force, at no cost, all lands, easements, Air Installation Compatible Use Zones, and facilities at NAS JRB Willow Grove designated for operation as a Joint Interagency Installation (JII) for use by the Pennsylvania National Guard and other Department of Defense components, government agencies, and associated users to perform national defense, homeland security, and emergency preparedness missions." Subsequent legislation in 2008 authorized the Secretary of the Air Force to convey all transferred Navy property to the Commonwealth of Pennsylvania at no cost for operating the Horsham Joint Interagency Installation (HJII).

In September 2009, the Navy transferred 18.25 acres to the Air Force as part of the BRAC 2005 requirement to construct a consolidated Armed Forces Reserve Center. In December 2011, an additional 27.20 acres were transferred to the Air Force. The transfer obligates the Air Force to comply with all provisions of the FFA between the Navy, EPA, and PADEP and all associated CERCLA actions and requirements related to the FFA for this property.

In November 2009, the governor of Pennsylvania announced that the Commonwealth of Pennsylvania had withdrawn its plan to own, operate, and maintain the Horsham JII proposed for NAS JRB Willow Grove. As a result, the Under Secretary of Defense advised all parties that the Navy would then dispose of NAS JRB Willow Grove in accordance with the laws and regulations governing the disposal of property made available as a result of the closure or realignment of a military installation under BRAC, as amended.

NAS JRB Willow Grove was officially disestablished on March 30, 2011. The base continued to provide services and facilities, on a limited basis, until September 2011. Management of the facility was transferred to BRAC PMO and entered caretaker status. Decisions regarding the future use of the land are coordinated by the Horsham Township Land Reuse Authority (HLRA). On March 21, 2012, the HLRA officially approved the proposed NAS JRB Willow Grove Redevelopment Plan and Homeless Assistance Submission. The final plan identified the most appropriate uses for the redevelopment of the 862-acre property which was declared surplus by the Navy in 2010. On April 27, 2012, the NAS JRB Willow Grove Redevelopment Plan and Homeless Assistance Submission was submitted to the U.S. Department of Housing and Urban Development (HUD) and the Navy. In January 2013, three acres of former NAS JRB Willow Grove were transferred to the Federal Aviation Administration.

In accordance with the FFA, IR Program cleanup activities are performed under CERCLA except at those sites subject to the PADEP Underground Storage Tank (UST) Program or the Pennsylvania Land

Recycling Program (Act 2). Twelve IR sites and 10 OUs have been identified at NAS JRB Willow Grove. Table 1-2 presents the status of these sites.

**Table 1-2  
Site Status  
Five-Year Review  
Former NAS JRB Willow Grove**

<b>SITE</b>	<b>NAME</b>	<b>OPERABLE UNIT (OU)</b>	<b>STATUS</b>
1	Privet Road Compound	Soil - OU 1 Groundwater - OU 3	Soil (OU 1) NFA ROD signed September 2006. Groundwater (OU 3) Interim ROD signed September 2008. Groundwater (OU-3) IRACR Signed
2	Antenna Field Landfill	Soil - OU 5 Groundwater- OU 9	No Action ROD Signed June 17, 2010
3	Ninth Street Landfill	Soil - OU 6 Groundwater- OU 10	RI completed October 2011/FS Pending
4	North End Landfill	---	Consensus Agreement for No Action January 2009
5	Fire Training Area	Soil - OU 4 Groundwater - OU 2	Soil (OU 4) NFA ROD signed September 2007 Groundwater (OU 2) ROD signed September 2012. Remedy Implemented July 2013
6	Abandoned Rifle Range No. 1	---	Consensus Agreement for No Action December 2007
7	Abandoned Rifle Range No. 2	---	Consensus Agreement for No Action August 2008
8	Building 118 Abandoned Fuel Tank	---	NFA Agreement October 2006
9	Steam Plant Building 6 Tank Overfill	---	NFA Agreement October 2006

SITE	NAME	OPERABLE UNIT (OU)	STATUS
10	Navy Fuel Farm	---	NFA under CERCLA Property transferred to Air Force September 2009
SSA 11	Aircraft Parking Apron	---	Eliminated From Consideration
12	South Landfill	OU 11	Draft RI submitted April 2013, FS to Follow

#### 1.4 REPORT ORGANIZATION

This report has been organized to address the various components and general format requirements specified in the Comprehensive Five-Year Review Guidance, OSWER No. 9355.7-03B-P (EPA, 2001). This report consists of the sections listed below:

- Section 1.0 discusses the purpose of the report, provides a summary of the history and site chronology of the former NAS JRB Willow Grove.
- Sections 2.0 is the five-year reviews for OU 3 at the former NAS JRB Willow Grove. This section includes the OU chronology, background, summary of the remedial actions performed, the five-year review process, technical assessment, issues, recommendations and follow-up actions, and protectiveness statements.
- Section 3.0 provides a brief summary of the history, investigations performed, and current activities underway at each of the active and completed IR Sites or OUs at the former NAS JRB Willow Grove.
- Section 4.0 identifies when the next five-year review is required at the former NAS JRB Willow Grove.

The following appendices are included in the report. Appendix A contains copies of public notices; Appendix B includes site inspection forms; Appendix C includes Site 1 (OU 3) groundwater land use control (LUC) inspection reports. Appendix D includes supporting documentation for the vapor intrusion evaluation.

## 2.0 OPERABLE UNIT 3- SITE 1 – PRIVET ROAD COMPOUND GROUNDWATER

This section presents the findings of the five-year review for the remedy that was implemented at the Site 1 groundwater (OU 3). The triggering action for this review is the date of EPA's signature date, September 29, 2008, of the OU 3, Site 1 interim Groundwater Record of Decision. This statutory review is required by regulation because the selected remedial action results in hazardous substances, pollutants, or contaminants remaining in groundwater above levels that allow for unlimited use and unrestricted exposure.

### 2.1 SITE CHRONOLOGY

A list of important Site 1 groundwater (OU 3) historical events and relevant dates in the site chronology is shown in Table 2-1.

**Table 2-1  
Site 1 Groundwater (OU 3) Chronology  
Five-Year Review  
Former NAS JRB Willow Grove**

<b>Event</b>	<b>Date</b>
Site 1 - Privet Road Compound was constructed to serve as a transfer station for wastes after closure of the Ninth Street Landfill.	1967
The compound operated as an open disposal area where wastes were temporarily stored to await off-site disposal or burned and/or buried on site.	1967 to 1975
An Initial Assessment Study (IAS) conducted by the Naval Energy and Environmental Support Activity (NEESA).	1986
The Site Inspection (SI) Studies Report was completed. Recommendations included the performance of a Remedial Investigation at Sites 1, 2, 3, 5, and the Fuel Farm (Site 10).	May 1990
Remedial Investigation (RI) Report for Sites 1, 2, 3, and 5 completed.	February 1993
NAS JRB Willow Grove was placed on the National Priorities List (NPL)	September 29, 1995
Draft Phase II RI report for Sites 1, 2, 3, and 5 was submitted to regulators for review.	April 1998
Navy decided to de-link the reporting process for IR Sites 1, 2, 3, and 5 and submit four separate Phase II RI documents.	1999
An interim remedial action (IRA) for polychlorinated biphenyl (PCB) contaminated soil at Site 1 was completed and approximately 1,200 tons of soils were removed.	November 1999
Final RI report for Site 1 was submitted.	July 2002
Site 1 RI Addendum 1, Residual Risk Evaluation Letter Report for Site 1 Soil (OU 1)	June 2005
Site 1 RI Addendum 2, Technical Memorandum of Risk Assessment Evaluation for Site 1 Groundwater (OU 3)	August 2005
Site 1 RI Addendum 3, Remedial Investigation Addendum Report for Site 1 Groundwater (OU 3)	September 2005

<b>Event</b>	<b>Date</b>
Site 1 RI Addendum 4, Soil Investigation for Volatile Organic Compound Soil to Groundwater Impact for Site 1	March 2006
The NFA Record of Decision (ROD) for Site 1 Soil (OU 1) was signed by the Navy and EPA with concurrence from PADEP.	September 29, 2006
Site 1 RI Addendum 5, Continued Groundwater Source Investigation Report for Site 1 Groundwater (OU 3)	January 2008
Focused Feasibility Study for Site 1 – Privet Road Compound Groundwater (OU 3) approved by EPA.	January 2008
Proposed Remedial Action Plan for Site 1 Groundwater (OU 3)	April 2008
Interim Record of Decision for Site 1 Groundwater (OU 3) was signed by the Navy and EPA with concurrence from PADEP.	September 29, 2008
Navy transferred 18.25 acres to the Air Force including Site 1 as part of the BRAC 2005 requirement to construct a consolidated Armed Forces Reserve Center.	September 2009
Site 1 Groundwater Monitoring Results Report, 2009.	November 2009
Remedial Design for Land Use Controls for Site 1 Groundwater (OU 3) approved by EPA.	August 2010
Site 1 Land Use Controls - 2010 Annual Inspection Report	November 2010
Site 1 Groundwater Monitoring SAP	July 2011
Site 1 Land Use Controls - 2011 Annual Inspection Report	September 2011
Navy transferred an additional 27.20 acres to the Air Force	December 2011
Interim Remedial Action Completion Report for Site 1 Groundwater (OU 3) was signed by the Navy and EPA.	December 21, 2011
Groundwater Monitoring Report for Site 1, 2011 finalized.	April 2012
Site 1 Land Use Controls - 2012 Annual Inspection Report	September 2012

## **2.2 BACKGROUND**

### **2.2.1 Physical Characteristics**

Site 1, the Privet Road Compound, lies within a heavily developed section of the NAS JRB near the eastern boundary of the Base, adjacent to Privet Road (Figure 2-1). The Privet Road Compound was constructed as a transfer station which operated from 1967 to 1975 to handle materials not accepted by the trash pickup service. The suspected former waste handling area was approximately 2 acres. After use as a transfer station, a bowling alley and parking lot were constructed at the site.

The land associated with Site 1 and Site 10 was conveyed to the Air Force as part of the BRAC 2005 requirement to construct a consolidated Armed Forces Reserve Center. The construction of the Army Reserve Training Center was completed in 2011. A new storm water retention basin was also constructed at Site 1 in 2011. The bowling alley was demolished to allow construction of the Reserve Center.

Storm water drains from the site into the new storm water retention basin, and then discharges to a detention basin located north of Site 1 on Air Reserve Station (ARS) property. Storm water from the ARS

detention basin discharges via a National Pollutant Discharge Elimination System (NPDES) outfall to the Little Neshaminy Creek drainage system north of the Air Station.

Soil and well borings installed during investigation activities provide site-specific hydrogeological information. These borings encountered a variably thick overburden section underlain by weathered sandstone. The overburden consisted of sandy silt, silty sand, and silty clay. The thickness of the overburden (or the depth to the top of the weathered bedrock) ranged from approximately 4 feet in the vicinity east of Privet Road (near monitoring well 01MW04) to about 9 feet in the northeastern corner of the compound (near monitoring well 01MW01). In general, the bedrock lithology beneath Site 1 was more variable than that seen at the other sites. That is, thin and vertically alternating sequences of sandstone, siltstone, and shale (or claystone) were typically encountered.

### **2.2.2 Land and Resource Use**

The compound was constructed to serve as a transfer station for wastes after closure of the Ninth Street Landfill in 1967. The compound was used to process wastes from 1967 to 1975. During operations at the compound, wastes were temporarily stored on site to await off-site disposal, or were burned and/or buried on site. Burning and burial ceased by 1975; however, stored waste material was not completely removed from the site until 1977 (NEESA, 1986). Beginning in 1981, the site was used as a staging area for dumpsters maintained for the disposal of items not accepted by the regular trash pickup, such as metal scrap, wood crates, and bundled cardboard.

Under provisions of the Defense BRAC 2005, 18.25 acres of land including Site 1 was transferred to the U.S. Air Force in September 2009. This purpose of this transfer was to provide an enclave to construct an Armed Forces Reserve Center. Proper building construction techniques which took into account the existing environmental restrictions at Site 1 and Site 10 were included in the design effort by the Army. The consolidated Armed Forces Reserve Center was completed in 2011.

Current site usage is military/industrial. Groundwater underlying the former NAS JRB Willow Grove is used for drinking water. Two deep water supply wells are located east of Site 1, on the opposite side of Privet Road. The water produced from these wells contains volatile organic compounds (VOCs) at concentrations above the regulatory-permitted levels. In 2011, the property containing the two supply wells was transferred to the Air Force, which plans to continue to operate the water supply wells and the associated treatment systems. The Public Water Supply permit for these wells was transferred from the Navy to the PA Air National Guard on September 14, 2011. Site 1 groundwater does not currently pose a threat to public health because the site is under military control, and the water drawn from the supply wells is treated by air stripping to remove VOCs before use. Future land use is anticipated to remain military/industrial, and no future residential uses are planned for Site 1.

### **2.2.3 History of Contamination**

Between 1967 and 1975, the compound was used as an open disposal area where wastes were burned and buried. Materials reported to have been disposed at the site include general refuse, sewage sludge, industrial pretreatment plant sludge, oil and grease emulsion, paint wastes, trichloroethene (TCE), and polychlorinated biphenyl (PCB) fluids from transformers.

Groundwater sample analysis detected TCE, tetrachloroethene (PCE) and 1,1,1-trichloroethane (TCA) in the three Base supply wells (NW1, NW2, and AFW3) in 1984. Further investigations indicated that the principal contaminants associated with Site 1 groundwater are TCE and PCE. Since these compounds were detected infrequently and at low concentrations in the site soils, the site did not appear to be a contributing source of the groundwater contamination. The actual source of the groundwater contamination is difficult to trace because of the complex hydrogeology, and because of the effect that intermittent pumping of the two supply wells has on the direction of groundwater flow. Based on the analytical and hydrogeological data gathered to date, however, it appears that the principal source is located offsite, upgradient of Site 1 and the supply wells.

### **2.2.4 Initial Response**

The Privet Road Compound was initially investigated in 1986 as part of a preliminary assessment (PA), formerly identified as the Initial Assessment Study (IAS), of NAS JRB Willow Grove that was conducted under the IRP. A Site Inspection (SI) was performed at the Privet Road Compound in 1989 (EA, 1990). The SI report recommended that an RI/FS be performed at the site based on the presence of groundwater contamination at levels above potential ARARs. A RI of Site 1 was conducted in two phases between 1991 and 2000.

Based on the Site 1 Soil Action Memorandum (EFANE, 1999), the Navy performed a PCB soil removal action in June 1999, which excavated approximately 1,200 tons of PCB-contaminated soils from the area near the bowling alley located on the Privet Road Compound Site. All soils containing PCBs at a concentration above 1 part per million (ppm) were removed and transported off-site for proper disposal. The NFA ROD for Site 1 Soil (OU 1) was signed on September 29, 2006.

The final Site 1 RI report (Tetra Tech, 2002) explains that leakage from PCB-containing transformers stored at the Privet Road Compound Site produced an area of surface and subsurface soils contaminated with PCBs. The groundwater sampling program conducted for the RI indicated that the PCBs were limited to the soil and that they did not impact the Site 1 groundwater. Also, concentrations of chlorinated compounds were found in groundwater beneath Site 1 in excess of Maximum Contaminant Levels (MCLs). The Privet Road Compound was named as a probable historical contributing source to the

VOCs in local groundwater. However, it was not considered a major continuing source of chlorinated VOC contamination in the area, and no concentrated source of VOCs was found. Additional groundwater investigations to further quantify the contribution from historical off-Station source areas were considered warranted.

Based on an analysis of the distribution of contamination in the unconfined and confined aquifers and on the interpreted groundwater flow directions under pumping and non-pumping conditions, the RI concluded that the most significant source of VOCs is an off-Base source southeast of the Privet Road Compound, possibly in the vicinity of the former Kellett Aircraft Facility. This source creates a mixed TCE and PCE plume contributing to the deeper (greater than 160 feet below ground surface) groundwater contamination detected in the Navy supply wells. In response to EPA requests for further delineation of potential VOC sources in the vicinity of the Navy Fuel Farm and the Public Works Building, the Navy installed additional monitoring wells to address these data gaps in 2003. These wells were sampled for VOCs in June 2003 and September 2004. The analytical data from the new wells indicated that the source of the PCE in the unconfined aquifer at Site 1 was not in the vicinity of Navy Supply Well No. 1 or the Public Works Building, and that the Fuel Farm is not a significant source of TCE. The interpretation supported the conclusion of the RI that the contamination in the confined aquifer at Site 1 is attributed to an upgradient, source, in the general vicinity of the former Kellett Aircraft facility. The full discussion of the results is contained in the Site 1 RI Addendum 3 for Groundwater – Privet Road Compound (Tetra Tech, 2005d).

In 2005, the Navy performed an additional investigation to determine the quality of the groundwater migrating onto the Air Station from upgradient, off-Base locations. Three new monitoring wells (01MW09S, 01MW10S, and 01MW10D) were installed. 01MW09S was installed at a location in a direct line between the former Kellett facility and the Navy supply wells. 01MW10S and 01MW10D were installed at a location geologically down gradient of the former Kellett facility and generally along bedrock strike from the Navy supply wells. The wells were sampled for VOCs. The analytical results confirmed the RI conclusion that the VOCs detected in the Navy supply wells are not related to Site 1, but are migrating onto Air Station property from an upgradient location. The full discussion of the results is contained in the Site 1 RI Addendum 5 - Groundwater Continuing Investigation (Tetra Tech, 2008b).

Based on the Site 1 - Privet Road Compound Remedial Investigation and the Focused Feasibility Study (FFS) for Site 1 Groundwater (Tetra Tech, 2008c), the Navy prepared the Proposed Remedial Action Plan (PRAP) for Site 1 Groundwater (OU 3), that proposed a limited action including implementation of land use controls and periodic groundwater monitoring in conjunction with a review of site conditions and risks every 5 years (Tetra Tech, 2008d). A public meeting was held at the Horsham Township Public Library, near NAS JRB Willow Grove on April 30, 2008 to present the Site 1 Groundwater PRAP. In accordance

with CERCLA Sections 113(k) and 117(a), a public comment period for the PRAP was held from April 16 through May 30, 2008.

## 2.2.5 Basis for Taking Action

### Contaminants

Hazardous substances that have been detected in Site 1 groundwater include:

#### Inorganics

Arsenic

Barium

Chromium

Lead

Manganese

#### Organics

Carbon tetrachloride

Chloroform

TCE

PCE

The human health risk assessment (HHRA) results indicated that the estimated reasonable maximum exposure (RME) incremental lifetime cancer risks (ILCRs) for a lifetime resident ( $2 \times 10^{-4}$ ) exceeded EPA's target risk range under a future residential land use scenario. Arsenic and PCE were the major contributors to the ILCR for the lifetime resident.

The RME non-carcinogenic risk for adult residents [hazard index (HI) = 1.2] approximated the acceptable value. The HI for child residents (HI = 2.7) exceeded one, although the HIs for the individual target organs were all less than one.

## 2.3 REMEDIAL ACTIONS

### 2.3.1 Remedy Selection

The interim ROD for Site 1 Groundwater (OU 3) was signed on September 29, 2008. The Remedial Action Objective (RAO) for Site 1 groundwater is to protect the health of current and future groundwater users by preventing their contact with groundwater that is contaminated with VOCs at concentrations greater than the regulatory benchmark levels.

In the FFS for OU 3, two remedial alternatives were evaluated to address the RAO. Of the two alternatives evaluated, the selected interim remedy for Site 1 Groundwater (OU 3) is a limited action remedy that includes:

- LUCs to prevent unrestricted use of untreated groundwater.
- Periodic monitoring of the portions of the groundwater plume underlying Navy property to ensure that there continues to be no unacceptable risks to human health from chemicals of concern (COCs). Also, the development of a Monitoring Plan as part of the Remedial Design to be submitted for regulatory review and concurrence.
- A review of site conditions and risks every 5 years, as required by CERCLA, since hazardous substances, pollutants, and contaminants remain in groundwater above levels that allow for unlimited use and unrestricted exposure.

To further define and implement the RAO, the ROD specified the following for the LUCs for Site 1 groundwater:

- Land use restrictions will be identified in a Navy document that identifies the restriction on the use of site groundwater prior to and following closure of the Base and transfer of the property. The restrictions will be protective of human health by preventing unacceptable risks resulting from direct exposure to contaminated water.
- In the event the affected property is transferred to another federal agency, the interim remedy will be included in the DoD Form 1354, Transfer and Acceptance of Military Real Property. The receiving agency will be bound by the same environmental restrictions as the Navy.

If property is transferred to a non-federal entity, a transfer deed shall require the LUCs imposed as part of a CERCLA remedy to run with the land and bind all property owners and users. In addition, the ROD specified that periodic monitoring be performed to ensure the Navy and regulatory agencies have the data necessary to evaluate and ensure the protectiveness of the remedy.

### **2.3.2 Remedy Implementation**

The LUC RD (Tetra Tech, 2010b) for OU 3 was completed in August 2010 and defines the land use controls required by the OU 3 interim ROD.

The implementation of the interim remedy was completed in accordance with the LUC RD and ROD for OU 3. LUCs were implemented to prevent exposure to COCs in groundwater in accordance with the LUC RD. The LUCs are identified in the Base Master Plan (Air National Guard, 2010). A groundwater LUC has been established which states that no new groundwater wells may be installed without the written consent of PADEP and EPA. The LUC also states that access to existing and any additional monitoring

wells, including supply wells, will be limited by the Navy or any subsequent land owner to the organization responsible for groundwater monitoring. Figure 2-1 shows the area affected by the LUCs.

The Sampling and Analysis Plan (SAP) for Site 1 Groundwater Monitoring (Tetra Tech, 2011d) was approved by EPA in July 2011. Groundwater samples were collected from three on-site monitoring wells and two Navy supply wells to monitor the nature of contamination. The Interim Remedial Action Completion Report (IRACR) for Site 1 Groundwater (OU 3) (Tetra Tech, 2011g) was issued on December 21, 2011.

### **2.3.3 Operations and Maintenance**

The post-ROD activities have been conducted in accordance with the LUC RD to ensure the remedy continues to provide adequate protection of human health and the environment. Annual inspections of the LUCs have been conducted in August of each year beginning in 2010. Compliance monitoring included on-site inspections of Site 1, interviews of property owner and workers, and completion of an Institutional Control Inspection Checklist. The LUCs will be maintained within the boundaries of the site indefinitely, or until all parties (Navy, EPA, and PADEP) agree that groundwater contamination is at such levels to allow for unlimited use and unrestricted exposure. Levels of contaminants at Site 1 wells are at levels below regulatory benchmarks. The supply wells at the site contain levels above benchmarks; however, apparently contamination originates from an off-site, non-Navy source and is drawn onto the Base by the pumping of the supply wells.

The Site 1 groundwater SAP that specifies groundwater monitoring locations and frequency has been approved by the EPA (Tetra Tech, 2011d). The first sampling event was initiated in September 2009. The second sampling event was conducted in September 2011, and additional sampling will be performed in 2013. Results are compared to regulatory benchmarks.

As stated in the interim ROD for OU 3, the Navy's original 2008 cost estimate for implementation of the limited action remedy (LUCs and periodic groundwater monitoring in conjunction with a review of site conditions and risks every five years) was \$ 248,471 over a 30-year period. The approximate cost to date for remedial actions, including operation and maintenance (O&M) and monitoring at OU 3, is \$25,144.

## **2.4 FIVE-YEAR REVIEW PROCESS**

This is the first five-year review for this site. This section provides a summary of the five-year review process and the actions taken to complete the review.

#### **2.4.1 Administrative Components**

The U.S. Navy's Naval Facilities Engineering Command, BRAC Program Management Office East, is the lead agency for this five-year review. The regulatory agencies that are part of the review team include the EPA and PADEP.

The review included the following components:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Interviews
- Five-Year Review Report development and review

#### **2.4.2 Community Involvement**

On February 20, 2013, a notice was published in *the Intelligencer* newspaper that a five-year review is being conducted, and that public participation is encouraged and welcomed. In addition, the five-year review process was presented to the public at the NAS JRB Willow Grove RAB public meeting on April 24, 2013. Interviews will be scheduled with individuals who express an interest in participating in the five-year review; no interviews have been scheduled.

#### **2.4.3 Document Review**

This five-year review consisted of a review of relevant documents including the RI Report, the FFS, the PRAP, the interim ROD, the LUC RD, the SAP for periodic groundwater monitoring, the Interim Remedial Action Completion Report, groundwater monitoring results, and annual LUC inspection Reports. Additionally, EPA guidance on Drinking Water Standards and Health Advisories, Pennsylvania Act 2 Statewide Health Standards Medium Specific Concentrations (MSCs) for Groundwater (PADEP, 2012), and Pennsylvania Safe Drinking Water regulations (25 PA Code 109) were reviewed.

Because the selected remedy is an interim action, it is not necessary to achieve the ARARs at this time beyond those associated with the limited action taken in the interim remedy, as long as ARARs will be attained by the final remedy, in accordance with CERCLA Section 121(d)(4)(A) and the NCP at Section 300.430(f)(1)(ii)(C)(1). Currently, this interim action will not comply with ARARs for attainment of groundwater quality criteria because no action will be taken to reduce contaminant concentrations in

groundwater beneath the site. The limited action to implement LUCs restricting groundwater use does not invoke any ARARs.

#### **2.4.4 Data Review**

##### Groundwater Monitoring

Groundwater monitoring is documented in reports prepared by Tetra Tech in November 2009 and April 2012 (Tetra Tech, 2009g and 2012a). Since the interim ROD was signed, two rounds of biennial groundwater monitoring have occurred. The third round of groundwater monitoring will be conducted in 2013.

The Sampling and Analysis Plan for Site 1 Groundwater Monitoring (Tetra Tech, 2011d) provided the wells to be sampled, the sampling frequency, and the analytical parameters. Since the 2009 monitoring round, monitoring wells 01MW01SO and 01MW01S were abandoned and replaced with monitoring wells 01MW01SO-R and 01MW01S-R because of the construction of the Army Reserve Training Center and an associated storm water retention basin. Groundwater samples were collected from monitoring wells 01MW01S-R, 01MW01SO-R, and 01MW06S to monitor the groundwater contamination that exists in the unconfined aquifer at Site 1. The samples were analyzed for the VOC primary compounds of PCE and TCE, and the associated secondary degradation compounds of cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride. Groundwater samples also were acquired from Navy supply wells 01MWNW1 and 01MWNW2 to monitor the nature of the groundwater contamination that is originating at the upgradient, off-Base location. All samples were analyzed for Target Compound List (TCL) VOCs and Target Analyte List (TAL) metals.

Results from replacement monitoring well 01MW01S-R in 2011 were similar to those detected in well 01MW01S during the 2009 sampling. TCE and PCE concentrations detected during post-ROD sampling events were below the project action levels and were lower than those detected during earlier sampling events (1991 and 1997). A trace level (0.083 J ug/l) of the secondary degradation compound cis-1,2-DCE was detected.

Replacement well 01MW01SO-R showed low levels of TCE, PCE, and cis-1,2-DCE; however, the levels were similar to those found in 01MW01SO, and were below project action levels. The original well (01MW01SO) did not previously show any PCE contamination, and in 2009 did not show the presence of VOCs.

Results for well 01MW06S in 2011 were similar to those from the 2009 sampling; although a low level of cis-1,2-DCE (0.046 J ug/l) was detected. TCE and PCE were detected at levels below project action levels, and at concentrations lower than those detected in 1997.

The VOCs detected in the two supply wells were similar to those historically detected there. The 2011 concentrations of VOCs in the supply wells were lower than the historically detected concentrations, and continued to follow a general trend of decreasing concentrations over time. PCE continued to be present in supply well 01MWNW1 at a concentration of 14 ug/L, which is above the project screening level of 5 ug/L.

Table 2-2 presents a summary of all available results for significant VOCs (TCE and PCE) detected during pre- and post- interim ROD monitoring events.

**Table 2-2**  
**VOC Concentrations in Site 1 Groundwater (OU 3)**  
**Five-Year Review**  
**Former NAS JRB Willow Grove**

DATE	01MW01S*/ 01MW01S-R		01MW01SO*/ 01MW01SO-R		01MW06S		01MWNW1 (SUPPLY WELL)		01MWNW2 (SUPPLY WELL)	
	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE
2011 <sup>^</sup>	0.13 J	0.083 J	0.28 J	0.85	0.24 J	0.7	3.4	<b>14</b>	1.1	1.4
2009 <sup>^</sup>	0.11 J	0.59 J	0.5U	0.5U	0.32 J	0.94	3.4	<b>20</b>	0.91 <sup>(2)</sup>	1.2
2000 <sup>(1)</sup>	--	--	--	--	--	--	<b>9 J</b>	<b>39</b>	1.6 J	3.6 J
1997	10U	<b>6 J</b>	1 J	10U	2 J	4 J	<b>6 J</b>	<b>36</b>	3 J	2 J
1991	3 J	32 B	--	--	5U	3 B	<b>13<sup>(2)</sup></b>	<b>53<sup>(2)</sup></b>	<b>6 L<sup>(2)</sup></b>	4 J <sup>(2)</sup>

Notes:

All concentrations reported in units of micrograms per liter (ug/L)

**Positive detections above Safe Drinking Water Act Maximum Contaminant Levels (MCLs) are bolded.**

\* These wells were sealed to facilitate construction of the consolidated reserve center. Replacement wells have been installed and these wells are listed in the SAP for future Groundwater Monitoring. The replacement wells were sampled in 2011.

<sup>^</sup> Post-interim ROD sampling event

(1) Highest concentration detected during packer testing

(2) Highest concentration detected among field and field-duplicate samples

U = Undetected at listed reporting limit

J = Estimated value

B = Blanked value; detected concentration not significantly above detections in Quality Assurance/Quality Control samples

L = Reported concentration is biased low; actual concentration may be higher

Results indicate that VOC contamination in both shallow and deep bedrock (production) wells have decreased over time. The levels present in shallow wells are below MCLs. The levels of VOCs in the production wells have also trended downward since first detected in 1991. The decreasing trend correlates to a reduction in production well pumping rates as water usage has decreased since Base closure.

#### **2.4.5 Site Inspection**

A site inspection was conducted on January 31, 2013 by Tetra Tech, Navy BRAC Program Management Office and PAANG personnel. The purpose of the inspection was to assess the protectiveness of the remedy, the condition of the site, the condition of the monitoring wells, and the LUCs. An additional site inspection was conducted on April 24, 2013 with EPA, PADEP, Horsham Township Authority, Tetra Tech, Navy BRAC PMO, and PAANG personnel.

The required LUCs are identified in the Base Master Plan (Air National Guard, 2012). The LUCs are in place and prevents direct exposure to contaminated water. No new uses of groundwater were observed.

In September 2009, most of the Site 1 LUC area was transferred to the U.S. Air Force. The Armed Forces Reserve Center was constructed in 2011. The storm water retention basin and part of the building fully occupy the former Privet Road Compound. Site conditions and land use of the Site 1 area have been changed. However, the land use will remain military use in the future, and no future residential uses are planned. An additional 27.20 acres, including additional areas of Site 1 was transferred to the Air Force in December 2011.

During construction of the Armed Forces Reserve Center, monitoring wells 01MW01SO, 01MW01S, and 01MW01I were abandoned to allow for the installation of the retention basin. Monitoring wells 01MW01SO and 01MW01S were replaced with two new wells (01MW01SO-R and 01MW01S-R) located along Johnston Street near the corner with Griffiss Street in April 2011.

Because of how the landscaping for the new building was designed, monitoring wells 01MW02S, 01MW02I, 01MW03S, and 01MW03I are located in a drainage swale that drains into the storm water retention basin. PAANG confirmed that the stick-up heights of these four monitoring wells are high enough to prevent their submersion when the swale fills with storm water.

Two deep water supply wells located east of Site 1 have been transferred to the Air Force Reserve and are operated by the PAANG. The Public Water Supply permit for these wells was transferred from Navy to the PAANG on September 14, 2011. Site 1 groundwater does not currently pose a threat to public

health because the site is under military control, and the water drawn from the supply wells is treated by air stripping to remove VOCs before use.

During the site inspection, there were no observed instances of non-compliance with the LUCs placed on Site 1 groundwater (OU 3).

#### **2.4.6 Interviews**

PAANG Environmental Manager Captain Seth Foulkes was interviewed on January 31, 2013. No significant problems regarding Site 1 Groundwater (OU 3) were identified during the interview. Captain Foulkes confirmed that no permits, construction, directives, or other guidance had been issued that would change the use of site groundwater. No new groundwater wells have been installed other than two replacement monitoring wells 01MW01SO-R and 01MW01S-R. PAANG has taken over the operation of the two supply wells, and has assumed the responsibility for compliance with the drinking water permit associated with their use from the Navy. The two deep water supply wells and the treatment system are in good working order.

### **2.5 TECHNICAL ASSESSMENT**

The following conclusions support the determination that the interim remedy for Site 1 groundwater (OU 3) is expected to be protective of human health and the environment.

#### **2.5.1 Question A: Is the remedy functioning as intended by the decision documents?**

The review of documents, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the interim ROD.

LUCs were implemented to prevent use of untreated groundwater in accordance with the LUC RD. The Air National Guard has operational control of the two supply wells, and the LUCs in place contain the same environmental restrictions as they did with the Navy. LUCs have been identified in the Base Master Plan prepared by the Air National Guard. No activities were observed that would have violated the LUCs at OU 3.

#### **2.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?**

##### Changes in Standards and To Be Considered

The Site 1 Groundwater (OU 3) ROD and LUC RD require periodic groundwater monitoring and comparison to regulatory criteria. EPA MCLs and PADEP MSCs are employed. The substances

detected in the most recent (August 2011) groundwater sampling at Site 1 were evaluated to determine whether their MCLs or MSCs were revised since the date of the ROD (2008):

- Trichloroethene: MCL of 5 ug/L (MCL has not changed since the ROD).
- Tetrachloroethene: MCL of 5 ug/L (MCL has not changed).
- cis-1,2-Dichloroethene: MCL of 70 ug/L (MCL has not changed).
- Chloroform: MCL of 80 ug/L (total trihalomethanes) (MCL has not changed).
- Carbon tetrachloride: MCL of 5 ug/L (MCL has not changed).
- 1,1-Dichloroethane: Revised MSC of 31 ug/L (old MSC was 27 ug/L).
- 1,1-Dichloroethene: MCL of 7 ug/L (MCL has not changed).
- Arsenic: MCL of 10 ug/L (MCL has not changed).
- Barium: MCL of 2000 ug/L (MCL has not changed).
- Beryllium: MCL of 4 ug/L (MCL has not changed).
- Chromium: MCL of 100 ug/L (total chromium) (MCL has not changed).
- Copper: Treatment technology action level of 1300 ug/L (action level unchanged).
- Lead: Treatment technology action level of 15 ug/L (action level unchanged).
- Selenium: MCL of 50 ug/L (MCL has not changed).

Since the Site 1 ROD was issued in 2008, only one of the above-listed regulatory criteria was changed: the PADEP MSC for 1,1-dichloroethane. The change in this MSC is not expected to impact implementation of the remedy.

#### Changes in Exposure Pathways

The Armed Forces Reserve Center has been built at the Site 1 area. Taking into account the existing environmental restrictions at Site 1, proper building construction techniques were included in the design effort by the Army. This includes building on a slab on grade which would reduce the potential for vapor intrusion. The land use will remain military use in the future, and no future residential uses are planned.

The exposure assumptions used in the initial Site 1 HHRA included these receptors: current occupational workers, current adolescent and adult trespassers, future excavation workers, future recreational children, and future residents. The HHRA concentrated on a hypothetical residential exposure scenario, since residents were identified as the critical receptors in the initial study. According to current land use, these assumptions are considered to be conservative and reasonable in evaluating risk.

The RI concluded that VOCs occur chiefly in the deep monitoring wells, and that they are detected infrequently and at lower concentrations in the shallow monitoring wells. No source could be identified for

the low-level groundwater VOC concentrations found in shallow groundwater on Navy property in the vicinity of Site 1. These low level concentrations are limited to isolated detections in shallow groundwater and do not represent definable plumes. The RI also concluded that an off-Base property located east of Route 611 was identified as the possible source area and origination point for the deep contaminant plume responsible for contamination of the supply wells.

The RI indicated that PCE was detected rarely within both the unconfined aquifer (at 6 ug/L) and the confined aquifer (at 5 ug/L) at the 01MW01 monitoring well cluster located at the current storm water retention basin, but that PCE was not detected in other (more southern) 01MW02 and 01MW03 monitoring well clusters located in the current drainage swale. TCE was detected within the unconfined aquifer at the 01MW01 monitoring well cluster (at 1 ug/L), and the 01MW06 monitoring well cluster (at 4 ug/L) located immediately downgradient of the northwestern corner of the former Privet Road Compound.

During post-ROD sampling events, TCE and PCE concentrations were detected within the unconfined aquifer at monitoring well clusters 01MW01S, 01MW01SO and 01MW6S below 1 ug/L. TCE and PCE concentrations in these wells appear lower than those detected during the RI (1991 and 1997) sampling events. A summary of results for significant VOCs (TCE and PCE) detected during the post-ROD monitoring events compared to historical sample results is presented in Table 2-2.

Because the principal contaminants associated with Site 1 groundwater are the VOCs PCE and TCE, the potential vapor intrusion pathway was evaluated. Using the results of the post-ROD sampling, and based on the OSWER Vapor Intrusion Assessment - Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator (Version 2.0, May 2012 RSLs), no vapor intrusion risk at levels exceeding EPA's acceptable risk range was identified in the unconfined aquifer at Site 1. In addition, the levels of site COCs detected in the site monitoring wells are well below the PADEP vapor intrusion guidance default values for residential exposure. Therefore, vapor intrusion would not be an issue of concern for Site 1 groundwater (OU 3). Appendix D provides the vapor intrusion supporting documentation.

#### Changes in Toxicity and Other Contaminant Characteristics

Oral cancer slope factors (CSFs), cancer inhalation unit risks (IURs), noncancer oral reference doses (RfDs), and noncancer inhalation reference concentrations (RfCs) were revised for several compounds. The most recent Site 1 HHRA for groundwater was performed 7 years ago (Tetra Tech, 2005b), and identified VOCs and metals as chemicals of potential concern (COPCs) for a hypothetical lifetime resident exposed to untreated tap water. Although several of the toxicity values have changed for COPCs since the date of the risk assessment or the date of the OU 3 ROD, cancer risks remain the principal concern

for groundwater at the site. COPCs from the 2005 groundwater HHRA and their associated current toxicity values are listed below, followed by a list of information sources.

- Chloroform: A new oral CSF [ $3.1\text{E-}2 \text{ (mg/kg/day)}^{-1}$ ] (source = C), IUR [ $2.3\text{E-}5 \text{ (ug/m}^3\text{)}^{-1}$ ] (source = I), and inhalation RfC ( $9.8\text{E-}2 \text{ mg/m}^3$ ) (source = A) were published. Since an oral CSF was not available at the time of the 2005 HHRA update, the new cancer toxicity data would contribute to an increase in estimated cancer risks for the residential receptor, if the same groundwater concentration of chloroform is assumed. The 2005 HHRA was prepared using oral RfD [ $1.0\text{E-}2 \text{ mg/kg/day)}^{-1}$ ] and inhalation RfC ( $4.9\text{E-}2 \text{ mg/m}^3$ ). The new inhalation RfC is slightly less stringent than the value used in the 2005 HHRA.
- Trichloroethene: Updated toxicity criteria were published (source = I) and include new oral CSFs [mutagenic -  $9.3\text{E-}3 \text{ (mg/kg/day)}^{-1}$  and non-mutagenic -  $3.7\text{E-}2 \text{ (mg/kg/day)}^{-1}$ ], IURs [mutagenic -  $1.0\text{E-}6 \text{ (ug/m}^3\text{)}^{-1}$  and non-mutagenic -  $3.1\text{E-}6 \text{ (ug/m}^3\text{)}^{-1}$ ], oral RfD ( $5.0\text{E-}4 \text{ mg/kg/day}$ ), and inhalation RfC ( $2.0\text{E-}3 \text{ mg/m}^3$ ). The 2005 HHRA was prepared using oral CSF [ $1.3\text{E-}2 \text{ (mg/kg/day)}^{-1}$ ], oral RfD ( $5.0\text{E-}1 \text{ mg/kg/day}$ ), and inhalation RfC ( $6.0\text{E-}1 \text{ mg/m}^3$ ). The new cancer toxicity criteria would contribute to an increase in estimated cancer risks for the residential receptor, if the same groundwater concentration of trichloroethene is assumed. The revised RfD and RfC noncancer toxicity criteria would contribute to an increase in noncancer hazard quotients (HQs).
- Tetrachloroethene: A new oral CSF [ $2.1\text{E-}3 \text{ (mg/kg/day)}^{-1}$ ], IUR [ $2.6\text{E-}7 \text{ (ug/m}^3\text{)}^{-1}$ ], oral RfD ( $6.0\text{E-}3 \text{ mg/kg/day}$ ), and inhalation RfC ( $4.0\text{E-}2 \text{ mg/m}^3$ ) were published (source = I). The 2005 HHRA was prepared using oral CSF [ $5.4\text{E-}1 \text{ (mg/kg/day)}^{-1}$ ], oral RfD ( $1.0\text{E-}2 \text{ mg/kg/day}$ ), and inhalation RfC ( $4.9\text{E-}1 \text{ mg/m}^3$ ). The new cancer toxicity criteria would contribute to an increase in estimated cancer risks for the residential receptor, if the same groundwater concentration of tetrachloroethene is assumed. The revised RfD and RfC noncancer toxicity values are not of concern because cancer risks as opposed to noncancer hazards are still the most sensitive endpoint for tetrachloroethene, and the 2005 HHRA revealed that HQs were more than an order of magnitude below criteria.
- Carbon tetrachloride: Updated toxicity criteria were published on IRIS and include a new oral CSF [ $7.0\text{E-}2 \text{ (mg/kg/day)}^{-1}$ ], IUR [ $6.0\text{E-}6 \text{ (ug/m}^3\text{)}^{-1}$ ], oral RfD ( $4.0\text{E-}3 \text{ mg/kg/day}$ ), and inhalation RfC ( $0.1 \text{ mg/m}^3$ ). The 2005 HHRA was prepared using oral CSF [ $1.3\text{E-}1 \text{ (mg/kg/day)}^{-1}$ ], oral RfD ( $7.0\text{E-}4 \text{ mg/kg/day}$ ), and inhalation RfC ( $1.8\text{E-}1 \text{ mg/m}^3$ ). The revised toxicity values would result in slightly lower cancer risks and noncancer HQs, if the same groundwater concentration of carbon tetrachloride is assumed.

- Chromium: An oral CSF is now available for hexavalent chromium [ $0.5 \text{ (mg/kg/day)}^{-1}$ ] (source = N). Since an oral CSF was not available at the time of the 2005 HHRA, the new toxicity data would contribute to an increase in estimated cancer risks for the residential receptor, if chromium is assumed to be present as the carcinogenic hexavalent chromium species. Chromium was not a risk driver in the 2005 HHRA.
- Barium: A new oral RfD (0.2 mg/kg/day) was published (source = I), which is less stringent. Barium was not a risk driver in the 2005 HHRA.

The sources of the above-referenced revised toxicity values are: I = EPA Integrated Risk Information System (IRIS) (EPA, 2010); A = Agency for Toxic Substances and Disease Registry (ATSDR, 2012); N = New Jersey Department of Environmental Protection (NJDEP, 2009); and C = California Office of Environmental Health Hazard Assessment (OEHHA) (Cal EPA, 2012).

Although there have been revisions published to the above toxicity factors, the Site 1 Groundwater (OU 3) ROD and the LUCs prevent exposures to receptors by restricting construction of any new wells without permission from EPA and PADEP. These controlling mechanisms require periodic groundwater monitoring and comparison to regulatory criteria, so that changes in toxicity values would therefore not directly affect the remedy implementation.

#### Changes in Risk Assessment Methodologies

There have been several changes in HHRA methodology since the issuance of the ROD in 2008 or since the Site 1 groundwater risk assessment was updated (Tetra Tech, 2005b):

- Certain chemicals were classified as mutagens, which require a modified cancer risk calculation using age-dependent-adjustment-factors (ADAFs). The adjustments multiply the effective cancer potency by either 10 or 3 during early life exposure periods (EPA, 2005b). For groundwater at Site 1, ADAFs would apply to hexavalent chromium and TCE.
- Risk assessment methodology was revised for calculating inhalation cancer risks and inhalation noncancer hazard quotients (EPA, 2009). This would affect risks to residential receptors exposed to VOCs during showering. The revised method utilizes IURs and RfCs in place of inhalation slope factors and inhalation RfDs, respectively. Body weight and breathing rate have been factored out of the new inhalation risk calculations. While the mechanics of the calculation are different, note that for Site 1 groundwater exposure, the change would only affect the child resident, since the exposure scenario involving the adult resident involves a default body weight and a default inhalation rate,

which cancels out. Therefore, the cumulative lifetime COPC intake for cancer risk (child plus adult exposures including ingestion, dermal, and inhalation pathways) would be only slightly different.

Changes in risk assessment methodologies since the issuance of the ROD in 2008 or since the Site 1 groundwater risk assessment was updated does not impact the protectiveness determination.

### **2.5.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

No other information that could call into question the protectiveness of the interim remedy has been discovered. Annual LUC site inspections are conducted to verify that procedures are in place to assure protectiveness of the remedy. LUC inspections have confirmed that no new groundwater wells used for potable supplies have been installed at the site. Water from the supply wells continue to be treated with air stripping technology and are sampled regularly according to permit requirements.

### **2.5.4 Technical Assessment Summary**

According to the data reviewed, site inspections, and interviews, the interim remedy is functioning as intended by the interim ROD. The Armed Forces Reserve Center has been built at the Site 1 area. The land use is anticipated to remain military use in the future. These changes in the physical conditions at the Site 1 do not affect the protectiveness of the remedy. Although there have been several changes in toxicity values and HHRA methodology, these changes do not affect the protectiveness of the interim remedy. There is no information that calls into question the protectiveness of the interim remedy.

## **2.6 ISSUES**

No issues were identified during the five year review.

## **2.7 RECOMMENDATIONS AND FOLLOW-UP ACTIONS**

The recommendations and follow-up actions are outlined in Table 2-3.

## **2.8 PROTECTIVENESS STATEMENT**

The interim remedy at Site 1 Groundwater (OU 3) is currently protective of human health, welfare and the environment. Exposure pathways are being controlled by the implementation of groundwater use restrictions and land use controls. Periodic monitoring is performed on portions of the groundwater plume to ensure that there continues to be no unacceptable risk to human health from constituents of concern (COCs).

The remedy at Site 5 Groundwater (OU 2) currently protects human health and the environment because construction is complete and the remedy is operating. No exposure is occurring, but institutional controls have not been fully implemented. In order for the remedy to be protective in the long-term, institutional controls, including groundwater use restrictions and land use controls, need to be implemented.

**Table 2-3  
OU 3 Recommendations and Follow-Up Actions  
Five-Year Review  
Former NAS JRB Willow Grove**

Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Yes or No)	
				Current	Future
Develop ROD for Site 1 Groundwater (OU 3). The Air Force will resume responsibility from the Navy for continuing groundwater monitoring.	Navy	EPA	N/A	No	No

### 3.0 OTHER SITES OR OPERABLE UNITS

This section includes a description of the IR sites at the former NAS JRB Willow Grove which are being investigated under the CERCLA remedial process. The sites are grouped into 'active sites,' where investigations are on-going or a ROD has not been in place; and 'completed sites,' where investigations are complete and either a No Action or a No Further Action ROD or decision document is in place. The locations of the sites discussed in this section are shown on Figure 1-2. Site Screening Area 11 - Aircraft Parking Apron (SSA 11) is not discussed in this section. The Navy submitted the final report of PADEP Act 2 soil sampling and analysis at SSA 11 in March 2004. This "site" has never formally entered either the IR or UST program. It was agreed by PADEP and the Navy that no further action of any kind is required for SSA 11, the (PADEP, 2004). The Navy received a letter from EPA dated February 12, 2007 indicating concurrence that no further remedial actions are needed for SSA 11.

#### 3.1 ACTIVE SITES OR OPERABLE UNITS

The active sites include two IR sites where RI/FS processes are on-going. Remedies have not yet been selected at the IR sites in the investigation phase. The five-year review processes have not been conducted for these sites.

##### 3.1.1 Site 3 – Ninth Street Landfill (OU 6 – Site 3 soil; OU 10 – Site 3 groundwater)

Site 3 - Ninth Street Landfill occupies approximately 9 acres and is located immediately north of Ninth Street along the western boundary of NAS JRB Willow Grove. From approximately 1960 to 1967, Site 3 was used as a landfill by the Public Works Department and as an open disposal ground by various operations at the Base. The landfill method consisted of burning the refuse and burying the residue in trenches. Wastes included general wastes, bulk items, paint waste, asbestos, and sewage sludge. Transformers containing PCBs were also stored and serviced in a salvage yard established on the landfill after the landfill's closure in 1967 (EA, 1990). Between 1980 and 1983, clean fill and construction debris were deposited in the area southwest of the storm water retention basin.

The PA was completed in 1986 and the SI was completed in 1990. Monitoring wells were installed and sampled. Soil samples were also collected from four soil borings. These samples were analyzed for volatile organics and petroleum hydrocarbons. Phase I RI activities at Site 3 were conducted by the Navy in 1993. Site 3 investigations included excavating four test pits, installing four additional monitoring wells, soil sampling, and sampling surface water and sediments. Phase II RI activities at Site 3 consisted of initial activities completed in 1997 and follow-on activities completed in 2005 to 2006. The initial field activities included installation of seven monitoring wells, collection of

groundwater samples from the new and existing wells, collection of surface soil samples from twelve locations, collection of sixteen subsurface soil samples, and sampling of surface water and sediment at two locations. The draft Phase II RI Report was submitted for review in April 1998. In 1999, the Navy decided to de-link the reporting process for the IR sites (1, 2, 3, and 5) and submit four separate Phase II RI documents.

Follow-on RI investigations were performed by the Navy to delineate the nature and extent of the buried waste, and soil and groundwater contamination at Site 3. The Test Pit Investigation performed in October 2007 included the excavation of 18 test pits and the collection of 25 subsurface soil samples. The Landfill Delineation Investigation performed from December 2008 to January 2009 included the completion of a geophysical survey of the site to identify areas of buried waste, the excavation of 12 test pits, the collection of 25 subsurface soil samples, the collection of 6 co-located surface water/sediment samples, and the collection of 24 surface soil samples. The Interim Groundwater Monitoring Investigation included the completion of three rounds of groundwater/surface water sampling in March 2008, October 2008, and April 2009. In January/February 2009, two monitoring wells (03MW09O and 03MW09S) were installed and sampled.

Based on results from the draft Phase II RI and all subsequent activities including the test pit investigation, landfill delineation investigation and interim groundwater monitoring investigations, Tetra Tech prepared a draft RI Report that included an updated human health risk assessment and ecological risk assessment for Site 3 in May 2010. The Site 3 RI Report was finalized in October 2011. Based on the results of the RI, additional sampling for chromium speciation in soils was recommended to determine the appropriate remediation goals. Analysis for total chromium and hexavalent chromium was performed on samples collected in December 2011.

Analytical results from the soil and groundwater samples indicate that the principal classes of contaminants in Site 3 Landfill soils are SVOCs, pesticides, PCBs, dioxins/furans, and metals. VOCs, including PCE, were detected at three test pit locations. Ethyl benzene was the only VOC that exceeded screening concentrations (for soil to groundwater only). Distribution of the contaminants in site soils at concentrations above regulatory screening values was sporadic, indicating localized disposal practices over time. Groundwater upgradient of and beneath the landfill contains PCE contamination, which has migrated off-Base to the adjacent golf course property. The maximum detected PCE concentration was 12.4 ug/L in October 2008. There is no current risk to human receptors. Estimated risks to future human receptors exceed EPA acceptable maximum ranges for various future scenarios.

The hydrogeologic interpretation and the existing analytical data suggest that there was more than one source of the PCE contamination in the groundwater at Site 3. One source of the contamination in the

unconfined groundwater zone was likely in the vicinity of well cluster 03MW06, upgradient from the landfill. The landfill was a likely secondary source of PCE to groundwater. The data suggest that the source of contamination in the confined groundwater zone is also located upgradient of the 03MW06 well cluster. PCE has been detected in the soils of the landfill, but not in the soils of the other two potential source areas. The historical analytical results indicate a significant decrease in the groundwater PCE concentrations since the Phase I investigation, which suggests that the sources are depleted.

A FS is being prepared and will incorporate the results of the RI to develop and evaluate potential remedial alternatives to address the unacceptable human health risks associated with the contaminated soil and groundwater at Site 3. After the remedial alternatives developed in the FS have been reviewed by EPA, PADEP, and the NAS JRB Willow Grove RAB, the Navy will select a preferred remedy for Site 3. A Proposed Remedial Action Plan (Proposed Plan) will then be prepared to present the selected remedy for public comment. After a public comment period of 45 days, all questions and concerns from the public will be addressed in a Responsiveness Summary and the selected remedy will be documented in a ROD.

### **3.1.2 Site 5 – Fire Training Area Groundwater (OU 2)**

The Fire Training Area is located in the south-central portion of NAS JRB, approximately midway between Runway 10/28 and State Route 463. The site is located immediately south of Taxiway Juliet and covers an irregularly shaped area of approximately 1.25 acres. The training area was used from 1942 to 1975 for large-scale firefighting exercises, which included the disposal and burning of flammable liquid wastes generated by the Naval Air Station. Wastes, including solvents, paint chemicals, xylenes, toluene, and various petroleum compounds, were consumed at the rate of up to 4,000 or more gallons per year in these firefighting exercises. The area was also reportedly used for the drum storage of these flammable materials during the periods between burning exercises.

The Fire Training Area is primarily covered by grasses, with some woody and brushy vegetation present within the southern portion of the area. The burn area, consisting of the "burning ring" that has actually been found to have been a section of a partially buried steel tank, wide open at the top with an intact bottom below surrounding grade, was located in the south-central portion of the site (Tetra Tech, 2002).

Brown & Root Environmental (B&RE) conducted RI field activities at Site 5 in 1991. The RI concluded that additional sampling was needed to further delineate the extent of contamination and/or the sources at the site. The Phase I RI report recommended a Phase II RI and a FS (Halliburton NUS, 1993).

In 1997 Phase II RI fieldwork was conducted and in 1998, a draft Phase II RI report was submitted to regulators for review (B&RE, 1998). In 1999, the Navy decided to de-link the reporting process for IR sites (1, 2, 3, and 5) and submit four separate Phase II RI documents.

In 2000 additional field work was completed at Site 5 to verify that site groundwater contamination was not moving off-Base toward the Horsham Township Municipal water supply well number 26 (HTMW 26). Sentinel monitoring wells installed on Navy property to monitor water quality between Site 5 and HTMW 26 are now sampled annually by the Base to verify contamination is not migrating closer toward the municipal water supply well.

The final RI report for Site 5, completed in February 2002, documented halogenated VOC contaminants in groundwater and a range of organic compounds [mainly polynuclear aromatic hydrocarbons (PAHs)] in limited site surface soils (Tetra Tech, February 2002). The final RI Report for Site 5 combined the results from the draft Phase II RI Report and previous findings for Site 5, with the results of activities performed from April 1998 through October 2000 (Tetra Tech, 2002).

Site 5 RI Addendum 2, Soil Investigation for Volatile Organic Compound Soil to Groundwater Impact (Tetra Tech, 2006b) was submitted in response to regulatory concerns that existing soil data were generated through obsolete sampling methods. The analytical data confirmed the validity of previous soil analyses. RI Addendum 5 for Site 5 Groundwater (OU 2) (Tetra Tech, 2006d) presented results of additional work which was performed to fill data gaps concerning groundwater quality at several locations, to determine whether 1,4-dioxane was present, and to obtain additional chemical data needed to evaluate monitored natural attenuation (MNA). The results indicated that 1,4-dioxane was present only in shallow groundwater near the former drum storage area. Site 5 RI Addendum 3, Technical Memorandum of Risk Assessment Evaluation for Site 5 Groundwater (Tetra Tech, 2007a) included a limited update of the HHRA for groundwater in response to changes in risk assessment methodology. The revised HHRA estimated unacceptable risk for future child and adult residents and future lifelong residents exposed to untreated groundwater. A risk screening for vapor intrusion indicated that this migration pathway did not present unacceptable risk.

The FS for Site 5 Groundwater (OU 2) was finalized in November 2008 (Tetra Tech, 2008h). This FS identified and evaluated five remedial alternatives for Site 5 groundwater to address unacceptable risks identified during the RI. The FS included a remedial alternative of in situ enhanced biological anaerobic reductive dehalogenation (bioremediation) and natural attenuation to promote the in situ remediation of the VOCs in groundwater. A bioremediation pilot test was conducted to evaluate the potential efficacy of this remedial alternative. The project plans are documented in the SAP for the Bioremediation Pilot Test at Site 5 (Tetra Tech, 2008g).

Preliminary soil sampling and monitoring well installation for the Site 5 groundwater pilot study commenced in May 2008. Field demonstration testing for bioremediation was conducted to evaluate the effectiveness of several different electron donors. In April 2009, a bioremediation pilot study was implemented to remediate groundwater at Site 5. The first injection and groundwater recirculation segment of the biostimulation phase of the bioremediation pilot test was initiated on April 7, 2009 and concluded on June 26, 2009. The primary objective of biostimulation was to promote population growth of native bacterial populations by creating more favorable environmental conditions. The second round of biostimulation at Site 5, consisting of approximately two times the quantity of sodium bicarbonate and six times the quantity of sodium lactate as that added in the first injection segment, commenced on February 17, 2010 and finished on April 26, 2010. Analytical sampling associated with the second biostimulation injection segment consisted of two sampling events. The analytical results indicated success for most of the parameters monitored, except for the lack of a convincing bacterial population capable of degrading vinyl chloride. The Bioaugmentation Event 1 commenced on July 14, 2010 and was completed on July 16, 2010. The KB-1 Plus culture was injected into injection wells TW-1, TW-3, 05MW17S, and 05MW01S to accelerate the biodegradation process by introducing large numbers of dihalococcoides (Dhc) and dehalobactor (Dhb) bacteria containing the required functional genes into the aquifer's bacterial population. The third round of biostimulation commenced on November 12, 2010 and was completed on December 10, 2010. Similar to the first and second biostimulation events, this round included groundwater extraction, the addition of chemical amendments, and the reinjection of groundwater.

The Pilot Test Report for Site 5 Groundwater (OU 2) was finalized in May 2011. The test report indicates that bioremediation has proven to be an effective strategy in destroying the Site 5 groundwater contaminants through the anaerobic, reductive dechlorination process, and that the Site 5 groundwater recirculation system was very effective at distributing the biostimulation amendments throughout the remediation cell.

In order to maintain the conditions favorable for anaerobic degradation of chlorinated volatile organic compounds (CVOCs) for an extended period of time, the fourth round of biostimulation at Site 5 commenced on April 12, 2011 and was completed in May 2011. This was the first injection of lactoil which replaced the original substrate of sodium lactate. The switch to a slow-release substrate was meant to create long-term favorable conditions without the need for frequent amendment injection and recirculation.

In June 2011, the Proposed Plan for Site 5 Groundwater (OU 2) was finalized (Tetra Tech, June 2011). A public meeting was held to present the Navy's plan for Site 5 Groundwater on June 22, 2011. The public

comment period was set for June 15 through August 1, 2011 to encourage public participation in the decision. The ROD for Site 5 Groundwater (OU 2) (Tetra Tech, September 2012) addressed all comments from regulatory agency reviewers, as well as including comments from the public in the Responsiveness Summary Section. The Site 5 Groundwater (OU 2) ROD was signed by the Navy and forwarded to EPA for signature on September 18, 2012. EPA signed the OU 2 ROD on September 25, 2012. The selected remedy includes in-situ anaerobic bioremediation combined with monitored natural attenuation (MNA) for remediation of VOC-contaminated groundwater within the source area, MNA with long-term monitoring for the diffuse portion of the plume, and LUCs to prevent human contact with COCs until contaminants in the groundwater are at levels that allow for unlimited use and unrestricted exposure.

The results of the groundwater sampling round conducted in August 2012 indicated that the bioremediation was continuing, and that the environmental conditions were favorable to marginally acceptable. Status Report for the Bioremediation of Site 5 was submitted in December 2012. Another injection of lactoil was recommended to maintain the anaerobic environment. The fifth round of biostimulation commenced on December 27, 2012 and was completed on February 14, 2013.

In December 2012, the draft Remedial Design for Installation of Additional Injection Wells at the Source Area Bioremediation for Site 5 Groundwater (OU 2) was submitted to regulators for review. The final Remedial Design for Site 5 Groundwater was submitted on May 3, 2013. Seven additional injection wells will be installed to introduce additional bioremediation amendments to the shallow groundwater in the areas that may be beyond the influence of the injections into 05MS01S. Amendments will be added manually to these wells.

The draft Remedial Design for LUCs for Site 5 Groundwater (OU 2) was submitted to the regulators in January 2013. The final Site 5 Groundwater (OU 2) LUC RD was submitted on May 29, 2013. LUCs will be implemented within the Site 5 boundaries to prohibit the use of untreated groundwater, to require that when future buildings are constructed that the potential for vapor intrusion of VOCs from the subsurface into the buildings is mitigated, and to require that existing buildings install a system to mitigate potential intrusion of VOCs from the subsurface into the structure or be subject to a vapor intrusion investigation that documents that an unacceptable risk to future occupants is not present at that structure.

The remedy has been installed with completion of new injection wells in July 2013. LUCs have not been fully implemented. A Remedial Action Completion Report (RACR) will be prepared to document the remedial actions completed for Site 5 Groundwater.

### 3.1.3 Site 12 – South Landfill

Site 12 occupies approximately 11 acres of an undeveloped area southwest of Runway 10/28 in the southern portion of the Base, immediately northeast of Site 2 – Antenna Field Landfill. Investigations completed at the site have identified approximately nine distinct waste/debris burial trenches comprising a 1.5 acre subset of the total area. A drainage ditch separates Site 12 from Site 2. Site 12 consists of what is believed to be the historical landfill that was previously investigated as Site 2, since the Site 2 investigations failed to find significant buried waste.

Between 1948 and 1960, the landfill was the principal disposal area for the solid waste generated by the facility. Landfill activities consisted of trench excavation with subsequent burning and burial of waste material disposed within the trenches. Wastes reportedly disposed in the landfill included general refuse, paint wastes, sewage and industrial pretreatment plant sludges, TCE, and carbon tetrachloride.

During the investigations conducted prior to the RI, construction debris, bottles, china, and aircraft parts were observed in the study area. Hummocky, uneven ground was also observed, which was potentially indicative of buried waste materials. Based on the observations made during these investigations, an electromagnetic (EM) geophysical survey of Site 12 was conducted to locate potential buried waste materials and to delineate the lateral extent of these materials. The EM survey was conducted in April 2008. Various anomalies were detected and mapped during the survey, which confirmed the presence of buried waste at the site. In December 2008, Site 12 was added to the Navy program for full RI/FS activities.

The Site 12 Phase I RI field work was completed in January 2010 and included test pit excavations and the collection of surface and subsurface soil samples, surface water samples, and sediment samples. The surface and subsurface soil samples were biased towards areas that contained buried waste, based on the results of the EM survey. Contaminants exceeding the EPA RSLs and/or the PADEP MSCs consisted of SVOCs, pesticides, and metals in surface soil; SVOCs, pesticides, dioxins, and metals in subsurface soil; SVOCs, pesticides, and metals in surface water; and VOCs, SVOCs, pesticides, and metals in sediment. Test pit sample analyses and visual observations confirmed the presence of buried waste and associated soil contamination at the locations of EM anomalies. The test pit excavations confirmed that the suspected disposal areas identified by the EM survey were in fact well-defined pits and trenches containing waste and debris.

To further determine the nature and extent of contamination and to evaluate risks to human health and the environment, Phase II Remedial Investigation field work commenced in December 2011. Soil sampling was completed in January 2012 and the groundwater monitoring well construction and sampling was completed in March 2012. A draft RI report for Site 12 was issued in April 2013.

Contaminants in Site 12 media include VOCs, PAHs, pesticides, PCBs, dioxins/furans, and metals. Distribution of the contaminants in site soils at concentrations above regulatory screening values was sporadic, indicating localized disposal practices over time. In groundwater, metals exceeded screening criteria were detected in most of the Site 12 monitoring wells. In addition, dioxins/furans exceeded screening criteria in one monitoring well cluster, and VOCs in two monitoring wells. The soil sample results did not identify the source of the VOC groundwater contamination. Estimated risks to future human receptors exceed EPA acceptable maximum ranges for various future scenarios.

Once the RI Report is finalized, an FS is required to evaluate alternatives to address the potential unacceptable human health and ecological risks. The Navy's preferred remedial alternative will be presented in a Proposed Plan. The selected remedy will be documented in a ROD for the site.

### **3.2 COMPLETED SITES OR OPERABLE UNITS**

The completed or closed sites include IR sites with either No Action or No Further Action RODs. Since there are no cleanup actions required and no unacceptable risks at these sites, five-year reviews are not required.

#### **3.2.1 Operable Unit 1 – Site 1 – Privet Road Compound Soil**

The former Privet Road Compound was constructed to serve as a transfer station for wastes after closure of the Ninth Street Landfill in 1967. The compound operated between 1967 and 1975 and was used as an open disposal area where wastes were burned and buried. The compound was also used to store several PCB-containing electrical transformers. Use of the site as a transfer station and for transformer storage resulted in the contamination of soil.

Work undertaken pursuant to CERCLA at NAS JRB Willow Grove includes the PA, also known as the IAS (NEESA, 1986); SI (EA, 1990); the first- and second-phase RI (Halliburton NUS, 1993; B&RE, 1998); and a soil removal action [Foster Wheeler Environmental Corporation (FWENC), 1999]. The Phase I RI report characterized the physical and chemical nature of several sites including Site 1 and identified data gaps requiring further study. Recommendations for further investigation included in the Phase I RI report were incorporated into subsequent discussions among the Navy and regulatory agencies for additional work, and led to the Phase II activities that were reported in the Phase II RI report.

The final Site 1 RI report (Tetra Tech, 2002b) explains that leakage from PCB-containing transformers stored at the Privet Road Site produced an area of surface and subsurface soils contaminated with PCBs. PCBs (mainly Aroclor 1260) were detected in surface and subsurface soil samples at concentrations up

to 230,000 µg/kg, in excess of health-based levels. Limited migration of PCBs had occurred, as evidenced by the detection of PCB in only one sediment sample. Also, concentrations of chlorinated compounds were found in groundwater beneath Site 1 in excess of MCLs.

Based on the Site 1 Soil Action Memorandum (EFANE, 1999), the Navy performed a removal action in June 1999, which excavated approximately 1,200 tons of PCB-contaminated soils from the area near the bowling alley located on the Privet Road Compound Site. Soil excavation was carried out in three stages until post-excavation confirmation sampling and laboratory analysis demonstrated successful cleanup to the residential level (1 ppm PCB). The contaminated soil was transported off-site for proper disposal. Clearance sampling confirmed that the area had been cleaned to 1 ppm (FWENC, 1999).

Based on the soil removal action performed, and the corresponding Site 1 soil closeout report prepared in 1999 (FWENC, 1999), the Navy prepared the Site 1 Soil PRAP for NFA in September 2004 (Tetra Tech, 2004a). The Site 1 Soil (OU 1) ROD, specifying no further action for Site 1 soil, was signed by the Navy and EPA with concurrence from PADEP in September 2006.

### **3.2.2 Site 2 - Antenna Landfill (OU 5 – Site 2 soil; OU 9 – Site 2 groundwater)**

The Antenna Field Landfill is located in the southern portion of the Air Station southwest of the runway in a relatively undeveloped section of the Naval Air Station (Figure 1-2). The landfill has been estimated to be approximately 4 acres in size. The landfill area was reportedly used between 1948 and 1960 as the principal disposal area for solid waste generated by the Air Station. Landfill activities reportedly consisted of trench excavation with subsequent burning and burial of waste material disposed within the trenches. Upon cessation of disposal operations, the landfill was regraded with a soil cover and vegetated with grass that is kept mowed by Air Station groundskeepers.

Investigations undertaken pursuant to CERCLA at NAS JRB Willow Grove Site 2 include the IAS, the SI, a Phase I and Phase II RI, and a post-Groundwater Confirmation study. The Phase I RI, performed in 1991, characterized the physical and chemical nature of several sites including Site 2 and identified data gaps requiring further study. Recommendations for further investigation led to the Phase II RI activities at Site 2 that began in 1996. The draft Phase II RI Report was submitted in April 1998. In April 1999, EPA provided the Navy with a review of EPIC historical aerial photographs showing unidentified anomalies near the northeastern portion of Site 2 that turned out to be discarded drums and debris. In 2003, the Navy performed a field inspection, housekeeping cleanup (debris removal), and a confirmation sampling effort in the area of the EPIC anomalies/discarded debris. A new Site Screening Area (SSA 12) was defined at that time as the portion of Site 2 northeast of the usually dry drainage ditch running through Site 2, roughly cutting Site 2 in half. In December 2008, the Navy, in agreement with EPA and PADEP,

decided to initiate a separate RI/FS and CERCLA decision process for the northeastern portion of Site 2, in the area now designated as Site 12 - South Landfill.

In August 2008, the Navy submitted the draft Site 2 RI Report that was accepted as final by Navy, EPA, and PADEP in March 2009 (Tetra Tech, 2009c). The Navy prepared a RI Report Addendum for Site 2 - Antenna Field Landfill in June 2009. The RI Report Addendum included an updated evaluation of Site 2 risk which incorporated the revised data set corresponding to the reduced size of the exposure unit for Site 2, and updated risk calculations to comply with EPA HHRA guidelines current in May 2009. The June 2009 RI Report Addendum supported the 1997 HHRA conclusion that no action is required at Site 2. Post-RI groundwater confirmation sampling analysis and reporting for Site 2, completed in June 2009, confirmed groundwater results obtained in 1997.

The RI concluded that the Site 2 Antenna Field Landfill is a probable source of metals and PAHs. PAHs, pesticides, and metals were detected in soils at Site 2. Contaminants adsorbed to soil particles can be transported through erosion and runoff to the sediments and surface waters of the intermittent stream. The results of the RI, HHRA, and ecological risk assessment (ERA) showed that there are no unacceptable risks to human health or the environment in excess of background from unrestricted exposure to site media at Site 2.

In July 2009, the Navy submitted the final Proposed Plan for Site 2. This Proposed Plan recommended that no action be taken at Site 2. On March 30, 2010, the No Action ROD for Site 2 was signed by the Navy and forwarded to the regulators. PADEP concurred with the Site 2 ROD selected remedy (no further action) in a letter dated May 14, 2010. On June 17, 2010, the No Action ROD for Site 2 was signed by EPA and was completely executed.

### **3.2.3 Site 4 - North End Landfill**

Site 4 - North End Landfill reportedly was used from approximately 1967 to 1969 to accept overflow wastes from the Privet Road Compound (Figure 1-2). The site is approximately 3.5 acres in size and is located between the northern end of Runway 15/33 and the Perimeter Road. Disposed waste materials are believed to be items not collected during routine trash pickup such as bulk items, sewage sludge, and oils and lubricants. During the site's operation, it is reported that wastes were covered; however, observations from the IAS showed waste materials, including oil, at the surface (NEESA, 1986).

Based on the SI (EA, 1990), combined with the results of the site screening process, the Navy recommended NFA for this Site. PADEP concurred with the Navy recommendation for NFA at this site (PADEP, 2005). The Navy prepared a summary discussion of review and presented a status update at the December 19, 2006 Navy Willow Grove IRP partnering team meeting. All available past investigation

results, correspondence, and notes were summarized and recommendations for future actions were presented for discussion among the team. EPA's Biological Technical Assistance Group (BTAG) visited Site 4 on March 28, 2007 to review site conditions. BTAG did not recommend further investigation or action at this site.

The IAS and the SI described a pool of tarry waste that covered about 50 square feet and was underlain by very soft tarry earth at Site 4. The Navy contracted Tetra Tech to conduct a site screening investigation at Site 4 to further identify the nature of this tarry waste. Site screening investigation field work was carried out, and the location of historical soil boring NELB-1 that reportedly was obtained from the tarry waste area was located in March 2008. To obtain information about the nature and extent of contamination, a soil sampling investigation at Site 4 tarry waste area was conducted in May 2008. A test pit investigation for the Site 4 tarry waste was conducted in September 2008. The tarry waste and related soil were excavated for offsite disposal. In January 2009, the Test Pit Investigation Report for Site 4 was submitted.

Based on the results of the Site Screening Process performed in accordance with the FFA, the Record of Consensus Agreement No Action Decision for Site 4 was signed by the Navy BRAC Environmental Coordinator, EPA RPM and PADEP Case Manager on January 21, 2009.

### **3.2.4 Site 5 Soil (OU 4) – Fire Training Area**

Site 5 is located immediately to the south of Taxi way Juliet and covers an irregularly shaped area of approximately 1.25 acres north of the Marine Reserve Training Center and the Marine Reserve Compound (Figure 1-2). The Fire Training Area was used from 1942 to 1975 for firefighting exercises, which included the temporary staging and subsequent burning of flammable liquid wastes generated by the Naval Air Station. Wastes included solvents, paint chemicals, xylenes, toluene, and various petroleum compounds which were consumed at a rate of at least 4,000 gallons per year in these firefighting exercises. The area was also reportedly used for the drum storage of these flammable materials during the periods between burning exercises.

Work undertaken pursuant to CERCLA at NAS JRB Willow Grove Site 5 includes the PA (also known as the IAS), (NEESA, 1986); SI (EA, 1990); the first and second phase RI (Halliburton NUS, 1993; B&RE, 1998); and a soil removal action (Tetra Tech, 2007c). The final Site 5 RI report (Tetra Tech, 2002a) explains that historical leakage and/or spillage from drum storage and handling in the Fire Training Area resulted in an area of surface and subsurface soils contaminated with PAHs. The RI determined that migration of PAHs was limited, as evidenced by low concentrations of PAHs which were below the level considered to be a risk to human health or the environment detected in two sediment sample locations

receiving drainage from the site. No PAH impact on site groundwater was detected in groundwater samples taken.

Site 5 RI Addendum 1, PAH Confirmation Sampling and Analysis Report (Tetra Tech, 2004b) was prepared to confirm the status of petroleum compounds in Site 5 soil. Based on the Action Memorandum for Site 5 - Fire Training Area Soil Removal (Tetra Tech, 2005c), a soil removal action for PAH-contaminated soil at Site 5 began in December 2005.

In January 2006, soil was excavated and removed to a depth of approximately 2 feet in the "burn ring" area. The "burn ring" was a section cut from the end of an approximately 20-foot diameter cylindrical tank, and partially buried below the surface of the surrounding soil. The burn ring (tank section) and soil were removed for disposal off site. A total of 286 tons of soil was excavated in the first phase of the soil removal and transported to a permitted facility for disposal. Maximum concentrations of PAHs exceeding preliminary remediation goals (PRGs) after the first phase of soil removal included: benzo(a)anthracene at 61.0 mg/kg, benzo(a)pyrene at 26 mg/kg, benzo(k)fluoranthene at 9.0 mg/kg and dibenzo(a,h)anthracene at 5.7 mg/kg. The results of confirmatory soil sampling revealed that several PAH compounds exceeded the  $10^{-5}$  cancer risk level PRG range for a lifelong resident, and the total residual risk ( $7.39 \times 10^{-4}$ ) exceeded the acceptable carcinogenic risk range. To address the unacceptable total residual risk, the Navy performed an additional excavation at the site in August 2006 as the second phase of the removal action. A total of 227 tons of soil were excavated and transported to a facility permitted for disposal. The total residual risk remaining after the soil removal was  $8.65 \times 10^{-5}$  which is within the acceptable carcinogenic risk range for the lifelong resident scenario. Subsequently, the excavation site was backfilled with clean soil and restored with seed and mulch.

Based on the soil removal action completed in 2006 and the corresponding Site 5 soil closeout report by the Navy contractor RMC Environmental, Inc., the Navy prepared the Site 5 Soil Proposed Remedial Action Plan for No Further Action in June 2007. The NFA ROD for Site 5 Soil (OU 4) was signed by the Navy and EPA with concurrence from PADEP in September 2007.

### **3.2.5 Site 6 - Abandoned Rifle Range No. 1**

Abandoned Rifle Range No. 1 is located adjacent to Horsham Road near the southwestern corner of the Marine Reserve Compound (Figure 1-2). The Marine Reserve Training Center building and parking area that was constructed in mid-1995 now covers virtually all of what is estimated as Site 6.

The range was built in 1942 and consisted of a firing mat and an earthen rampart. The rampart was approximately 1 acre in size. It is not known when the range was closed; however, the second range was not built until 1965, so it is assumed that this site was active until that time. After the site was closed, the

rampart was regraded. There are no records indicating whether or not the lead from the fired rounds was removed; therefore, it is assumed that the lead was mixed with the earth from the rampart during the regrading (NEESA, 1986). EA Engineering performed ESI fieldwork at Site 6 in 1991. Results indicated no apparent threat to health or the environment, and no further action was recommended (EA, 1992).

PADEP concurred with the Navy recommendation for NFA at this site (PADEP, 2005). The Navy prepared a summary review and presented a status update on December 19, 2006. Based on the results of the Site Screening Process performed in accordance with the FFA, the Record of Consensus Agreement No Action Decision for Site 6 was signed by the Navy BRAC Environmental Coordinator and the EPA RPM on December 12, 2007. PADEP agreement with the decision was documented in a letter from PADEP that was included as an attachment to the Record of Consensus Agreement document. Copies of the fully-executed Site 6 Record of Consensus Agreement document were distributed in January 2008.

### **3.2.6 Site 7 - Abandoned Rifle Range No. 2**

The site is located in the northwestern corner of the facility, west of the north end of Runway 15/33 (Figure 1-2). Construction and operation of the range were similar to Site 6 and consisted of a 1-acre earthen rampart to collect fired rounds of ammunition. The range operated from 1965 until 1977, when the current range located in Building 176 at the Army Reserve Compound was constructed. The rampart, along with the spent ammunition, was regraded in 1977. This area was subsequently used as a landfill for inert materials including clean fill, broken concrete, asphalt, and cinderblocks. In addition, dry wastewater treatment sludge and emulsified oil and grease from on-site oil/water separators were reported to have been buried at the site (NEESA, 1986).

Based on the ESI (EA, 1992), and the results of the site screening process, the Navy recommended NFA for this Site. PADEP concurred with the Navy recommendation for NFA at this site (PADEP, 2005). The Navy prepared a summary review and presented a status update at the scheduled December 19, 2006 Navy Willow Grove IRP partnering team meeting. All available past investigation results, correspondence and notes were summarized and recommendations for future actions were presented for discussion among the team. EPA's BTAG visited Site 7 on March 28, 2007 to review conditions. BTAG did not recommend further investigation or action at this site.

In January 2008, the Navy prepared a technical memorandum presenting a human health risk screening evaluation (HHRSE) of soil and groundwater at Site 7. The HHRSE compared existing data to EPA Region III risk-based concentrations (RBCs) to conservatively estimate the potential for adverse carcinogenic and non-carcinogenic health effects from exposures to soil and groundwater.

Concentrations of all chemicals detected in soil were less than their respective RBCs for residential exposures to soil with the exception of arsenic. Concentrations of arsenic exceeded the RBC at most sampling locations, but concentrations of arsenic were within background levels for soil. Manganese was the only chemical detected in groundwater at concentrations exceeding the RBCs for tap water.

Based on discussion at the NAS JRB Willow Grove partnering team meeting held at EPA Region 3 in June 2007 between the Navy, EPA, and PADEP, the Navy agreed to prepare a site screening process consensus agreement for No Action at Site 7. The Record of Consensus Agreement No Action Decision for Site 7 was signed by the Navy BRAC Environmental Coordinator, EPA RPM, and PADEP Case Manager on August 20, 2008.

### **3.2.7 Site 8 - Building 118 - Abandoned Fuel Tank**

The site consists of a former underground 500-gallon heating fuel tank located approximately 50 feet north of Building 118 (Figure 1-2). The tank was placed in service in 1959 and was abandoned in place in 1980 when it was replaced with a 290-gallon above ground tank. The tank contained only No. 2 heating fuel and serviced Building 118. In 1980, oil was observed seeping into the basement of Building 118. This occurred on an intermittent basis, and the oil was removed after each occurrence. The tank was investigated as a result of the seepage. The tank was empty and soils in the excavation around the tank did not indicate the presence of released materials; however, the fill and riser pipes were removed and the tank was buried in place (NEESA, 1986).

PADEP issued a notice of agreement (PADEP, 2005) with the Navy recommendation for NFA at Site 8 (Building 118 Abandoned Fuel Tank) under Pennsylvania storage tank regulations (Act No. 32; P.L. 169 and PA Code Title 25, Chapter 245). EPA sent a letter agreeing that the site had non-CERCLA issues and could be closed out from a CERCLA perspective (EPA, 2006).

### **3.2.8 Site 9 - Steam Plant Building 6 Tank Overfill**

When the main steam plant (Building 6) was converted from coal to oil in 1969 through 1970, spill containment for the fuel oil tank was not constructed. In 1978, a fuel oil supplier delivered No. 2 fuel oil to a filled tank while leaving the delivery truck unattended. The fuel backed up through the vent pipe, and approximately 3,000 to 5,000 gallons of fuel oil were released. The spill was located in the area between Building 6 and Building 114 (Figure 1-2). This area is now bermed to contain spills resulting from fuel delivery.

The NAS JRB Willow Grove fire department responded to the spill event and flushed the fuel with water. Runoff was directed to drainage swales downstream of the steam plant. The spill was directed

toward the Air Reserve Facility's detention basin on the northern side of the facility. The basin was equipped with oil spill containment devices. The total affected area was less than 1 acre (NEESA, 1986).

PADEP issued a notice of agreement (PADEP, 2005) with the Navy recommendation for NFA at Site 9 (Steam Plant Building 6 Tank Overfill) under Pennsylvania storage tank regulations (Act No. 32; P.L. 169 and PA Code Title 25, Chapter 245). EPA sent a letter agreeing that the site had non-CERCLA issues and could be closed out from a CERCLA perspective (EPA, 2006).

### **3.2.9 Site 10 - Navy Fuel Farm**

Site 10 is located south of the Air Reserve facility along the north side of Privet Road (Figure 1-2). The site formerly had two partially buried, 210,000-gallon fuel tanks (Tank No. 115 and Tank No. 116) containing aviation fuel. Two smaller USTs were located in the southeastern corner of the site. One tank contained diesel fuel and the other was used for storage of waste oil. The waste oil tank was formerly used for fuel storage. In 1986, Tank No. 115 was overfilled and fuel was released to the ground. The same year during excavation for utility work on the southern side of the site, non-aqueous phase liquid (NAPL) was observed floating on top of the water in the trench. The NAPL was observed in the area of a dry well located near the northeastern corner of Building 81, which is located south of the 210,000 gallon tanks. The dry well was used to discharge effluent water siphoned from the bottom of the fuel tanks (EA, 1990). In March 1989, aviation fuel was detected emanating from two patches of dead grass on the west side of Tank No. 115. In 1991, the two main fuel tanks and the waste oil and diesel fuel USTs were removed. Inspection of the waste oil tank during removal revealed that the tank was not intact, as holes up to 1 inch in diameter were reported.

In 1995, groundwater remediation pilot systems were investigated to address the petroleum (aviation fuel) contamination under the PADEP UST program. The Final Study Report for Product Recovery Pilot System was completed in 1996 (EA, 1996).

In 1998, a LNAPL recovery system designed to remediate the fuel spill was installed.

In 2001, the Navy discontinued active operation of the LNAPL recovery system for the jet fuel spill. Quarterly floating product recovery by bailing, or capture by absorption onto recovery "socks" placed in the well, continued until January 2003.

PADEP approved the final Work Plan for various fieldwork efforts at Site 10 (EA, 2003). Field work included installation and sampling of monitoring wells and soil borings to evaluate current site

conditions. A final RI for Site 10 soil was submitted in December 2003 to support no further investigation at this time (EA, 2003).

In September 2004, the Navy submitted the Request for No Further Action for IR Program Site 10 Groundwater (EA, 2004b). PADEP agreed with the Navy that no further remedial action or investigation at this time is appropriate for Site 10 soils or groundwater. However, PADEP noted in their letter (PADEP, 2004) that groundwater and soil at Site 10 do not meet criteria for unrestricted use, and that it may be appropriate to seek full closure under Act 2 if land use changes.

Under provisions of BRAC 2005, the land associated with Site 1 and Site 10 was conveyed to the U.S. Air Force to provide an enclave to construct an "Armed Forces Reserve Center" to consolidate regional Army Reserve training activities into a central location at a military enclave to be established at NAS JRB Willow Grove. Proper building construction techniques to take into account the existing environmental restrictions at Site 1 and Site 10 were included in the design effort by the Army. In September 2009, the Navy transferred 18.25 acres to the Air Force. The consolidated Armed Forces Reserve Center was completed in 2011.

### **3.2.10 SSA 11 - Aircraft Parking Apron**

SSA 11 is located at the north end of the main runway between the Navy and Air Force parking aprons. During construction of an Air Force building in the area in 1992, organic odors were detected by the construction crew. It was suspected that a fuel spill may have occurred in this area. Soils from this area were excavated and samples were submitted for analysis; however, the reliability of the data was questioned. PADEP requested additional sampling to determine if attainment for Act 2 protection for closure could be demonstrated. Soil and groundwater samples were collected in 2003 and a report submitted to PADEP in 2004 (EA, 2004c). Based on the investigation results, PADEP agreed with Navy's determination that SSA 11 did not meet the criteria necessary to be considered a site in the IR or UST program and a no further action determination was agreed to. EPA provided concurrence that no further remedial actions were required at SSA 11 in February 2007.

## 4.0 NEXT REVIEW

Former NAS JRB Willow Grove has OUs that require statutory five-year reviews. This report represents the first five-year review conducted at the former NAS JRB Willow Grove. The next five-year review for the former NAS JRB Willow Grove will be required within five years of the signature date of this review.

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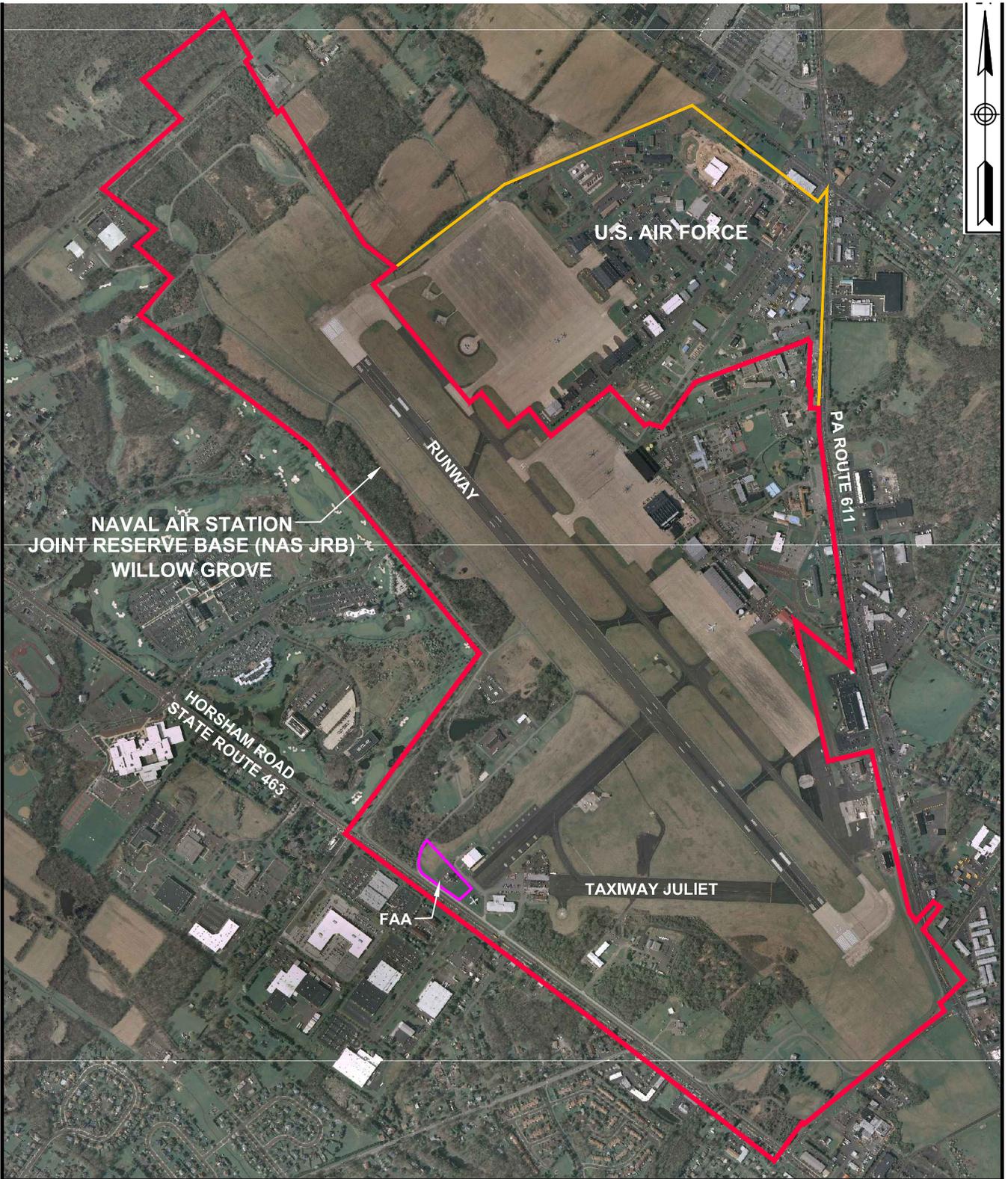
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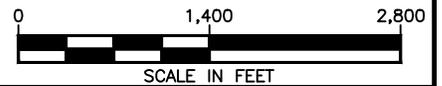
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## FIGURES

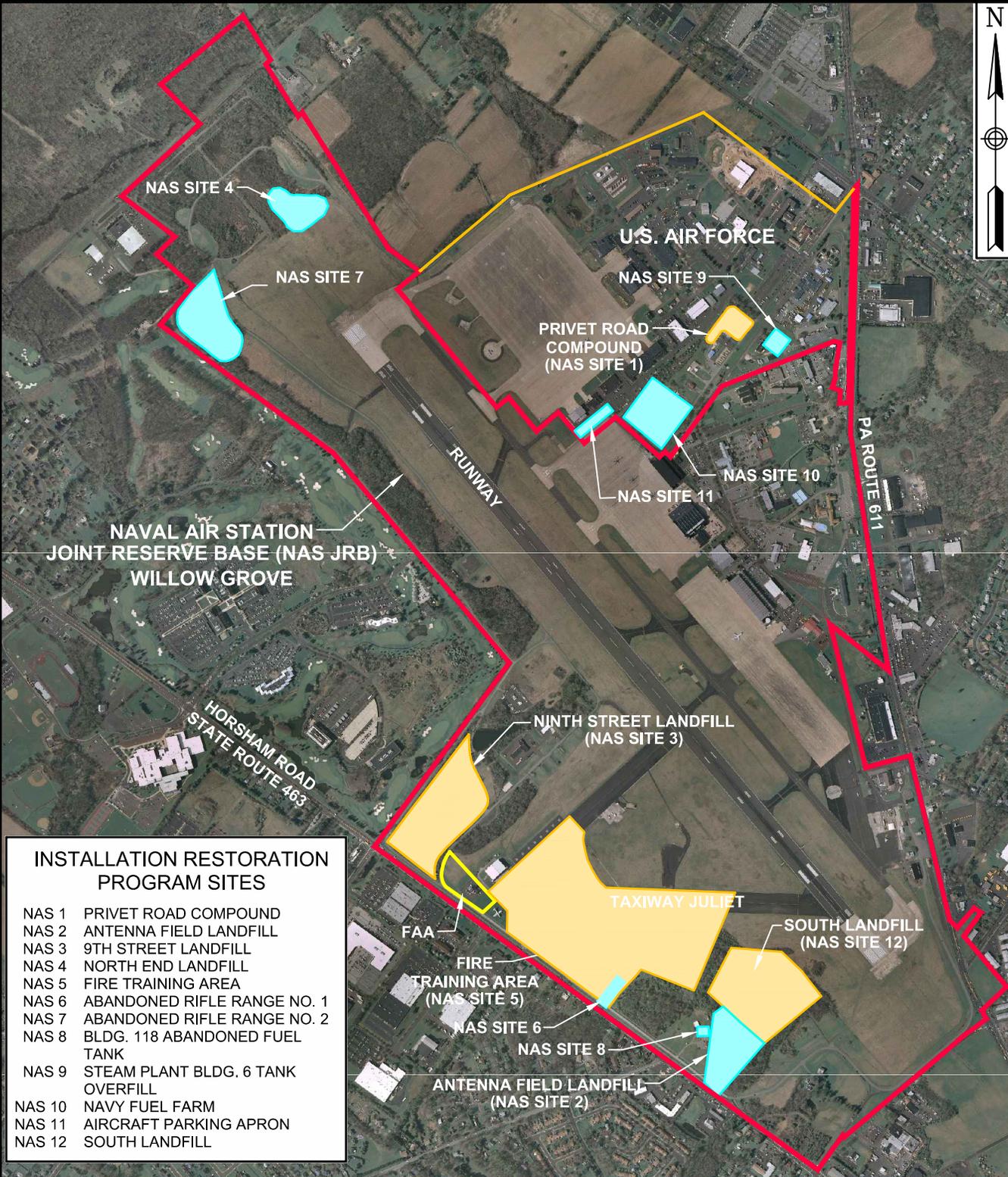


AERIAL BASE MAP PROVIDED BY THE PAMAP PROGRAM,  
 PA DEPARTMENT OF CONSERVATION AND NATURAL  
 RESOURCES, BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY



FACILITIES LOCATION MAP  
 NAS JRB WILLOW GROVE  
 WILLOW GROVE, PENNSYLVANIA

SCALE AS NOTED	
FILE 112G02014BM01	
REV 0	DATE 05/01/13
FIGURE NUMBER FIGURE 1-1	



**INSTALLATION RESTORATION PROGRAM SITES**

NAS 1	PRIVET ROAD COMPOUND
NAS 2	ANTENNA FIELD LANDFILL
NAS 3	9TH STREET LANDFILL
NAS 4	NORTH END LANDFILL
NAS 5	FIRE TRAINING AREA
NAS 6	ABANDONED RIFLE RANGE NO. 1
NAS 7	ABANDONED RIFLE RANGE NO. 2
NAS 8	BLDG. 118 ABANDONED FUEL TANK
NAS 9	STEAM PLANT BLDG. 6 TANK OVERFILL
NAS 10	NAVY FUEL FARM
NAS 11	AIRCRAFT PARKING APRON
NAS 12	SOUTH LANDFILL

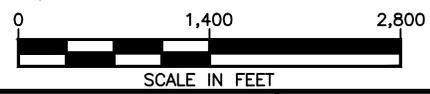
**LEGEND**

	ACTIVE SITE
	COMPLETED SITE*

\* SEE TABLE 1



AERIAL BASE MAP PROVIDED BY THE PAMAP PROGRAM, PA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY



**LOCATION OF IR SITES  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA**

SCALE AS NOTED	
FILE 112G02014BM01-1	
REV 0	DATE 06/14/13
FIGURE NUMBER FIGURE 1-2	



**APPENDIX A**  
**PUBLIC NOTICE**

## Vets

Continued from Page B6

He sounded encouraged though by the recent announcement from Wal-Mart that it planned to hire 100,000 people in the next five years. Jackson may not exactly fit the company's hiring criteria because he left the military more than a year ago.

"Wal-Mart would be the career I would be looking for," he said. Schmiegel said the second problem he sees most frequently among young veterans is the desire to go home regardless of job prospects.

"They are making a decision of the heart. They are not going to where the jobs are. They are not going to the industries that are hiring," Schmiegel said.

His organization has developed a computer website with Google and various federal agencies designed to point veterans to the 100 fastest-growing cities and the five or six industries within those communities that are doing the most hiring. The aim is to push veterans to use their educational benefits to get training in a high-demand field and then relocate.

Curtis Coy, an undersecretary at the Veterans Affairs Department, said expanded educational benefits are playing an important role in lowering the unemployment rate as hundreds of thousands of veterans attend college through a program that covers tuition and fees, housing, books and relocation expenses. Participation in the Post 9/11 GI Bill program has jumped from about 366,000 in 2010 to 646,000 in the latest year. Some of those enrolled are spouses or children of a veteran. The program allows veterans to transfer

their benefits to immediate family members if they have six years of service and commit to another four.

Coy said he's confident the employment trend is moving in the right direction. He says younger veterans often need a little time to figure out what they're going to do when they get out of the service. "I'm a 24-year veteran so I'm acutely aware of standing there at the steps going, 'So what do I do now?'"

Sgt. Jesus Sanchez, 33, who will be leaving the Army National Guard this year after 10 years of service, attended the Oklahoma City job fair to get a head start in his job hunt. He specializes in managing the flow of medical supplies and is looking to do the same in the civilian world, but said he found many jobs appealing, including working at Wal-Mart.

"A job's a job," he said.

## Builders

Continued from Page B6

The latest index, based on responses from 402 builders, comes as the U.S. housing market is strengthening after stagnating for roughly five years after the housing boom collapsed.

Steady job gains and near-record-low mortgage rates have encouraged more people to buy homes. Prices have been rising. In part, that's because the supply of previously occupied homes for sale has thinned to the lowest level in more than a decade. And the pace of foreclosures, while still rising in some states, has slowed

sharply on a national basis.

The trends have led homebuilders to increase construction. Last year, builders broke ground on the most new homes in four years.

All told, sales of new homes jumped nearly 20 percent last year to 367,000, the most since 2009. Still, many economists don't foresee a full housing recovery before 2015 at the earliest.

"The index remains near its highest level since May of 2006, and we expect homebuilding to continue on a modest rising trajectory this year," said David Crowe, the NAHB's chief economist.

Even so, builders remain concerned about the sturdiness of the U.S. economy and unemployment, which ticked up to 7.9 percent last month from 7.8 percent in December.

Many builders are facing higher

costs for building materials and having trouble obtaining financing for construction. Some also are facing a shortage of workers in markets where residential construction has picked up sharply, such as Texas and Arizona.

An index that measures current sales conditions fell one point to 51. And a gauge of traffic by prospective buyers declined four points to 32 from 36 in January.

But builders' outlook for sales in the next six months improved one point to 50.

Though new homes represent only a fraction of the housing market, they have an outsized impact on the economy. Each home built creates an average of three jobs for a year and generates about \$90,000 in tax revenue, according to NAHB statistics.

## Stocks

Continued from Page B6

gain of 21 percent, and Office Depot shot up 43 cents to \$5.02, a gain of 9 percent. Staples also rose as investors anticipated that more mergers could be on the way.

Analysts cautioned that antitrust regulators could block mergers in the office-supply business. Staples, for instance, tried to buy Office Depot in 1997, but was stopped by the Federal Trade Commission.

Health insurers fell after the release of preliminary government data that suggests rate cuts to Medicare Advantage plans for next year

will be steeper than anticipated.

The two largest Medicare Advantage providers, Humana and UnitedHealth, sank. Humana had the biggest loss in the S&P 500, dropping 6 percent, or \$4.98, to \$73.01. UnitedHealth fell 66 cents to \$56.66.

The government says it expects costs per person for Medicare Advantage plans to fall more than 2 percent in 2014. The government uses this figure as a benchmark to determine payments for these privately run versions of the government's health care program for the elderly and disabled.

In the market for U.S. government bonds, the yield on the 10-year Treasury note rose to 2.03 percent from 2 percent late Friday.

## Late payments rise on credit cards

Ramped-up holiday season spending typically keeps some borrowers from making timely payments on their credit cards in the last three months of the year, and 2012 was no exception.

The rate of credit card payments at least 90 days overdue jumped to 0.85 percent in the fourth quarter from 0.78 percent a year earlier, credit reporting agency TransUnion said Wednesday.

That's an increase of about 9 percent. The rate also climbed 13 percent from the third quarter, when it was 0.75 percent, the firm said. The average credit card debt per borrower in the U.S. fell 1.6 percent to \$5,122 from the last three months of 2011, though it grew 2.5 percent from the July-September quarter, TransUnion said.

From the Associated Press

## glasses galore



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Village @ Newtown  
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Southampton  
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### FIVE-YEAR REVIEW

### FORMER NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE, PA



The Department of the Navy, in cooperation with the U.S. Environmental Protection Agency (EPA) and the Pennsylvania Department of Environmental Protection (PADEP), has begun a five-year review of the remedies implemented at the former Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove, Pennsylvania. The purpose of the five-year review is to ensure that the selected remedies are effectively protecting public health and the environment. The five-year review process is mandated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (also known as Superfund) for sites where the selected remedial action results in contaminants remaining above levels that allow for unlimited use and unrestricted exposure. The Navy's Policy for Conducting Five-Year Reviews under the CERCLA Program and EPA's Comprehensive Five-Year Review Guidance will be used in the preparation of this review. This first five-year review for NAS JRB Willow Grove will focus on the Site 1 - Privet Road Compound, where a remedial action has been implemented.

The Navy will conduct interviews, review reports, and assess site conditions to evaluate if the remedies remain protective of human health and the environment. Public participation is encouraged and welcomed. If you are interested in participating in the interview process, please contact the BRAC Environmental Coordinator. Information on environmental restoration activities can be found at the Horsham Library and on the internet at <http://htl.mclinc.org>.

### FOR MORE INFORMATION

If you have any questions, or wish to discuss the project, please contact Mr. Willington Lin, BRAC Environmental Coordinator at 4911 South Broad Street, Philadelphia, PA 19112 or phone (215) 897-4900 or [willie.lin@navy.mil](mailto:willie.lin@navy.mil).

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Unwind with a glass of wine and a gourmet dinner, as Claire Day of the Alzheimer's Association® discusses the latest research and development on dementia.

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**APPENDIX B**  
**SITE INSPECTION CHECKLIST**

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

## Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION													
<b>Site name:</b> Site 1 Groundwater (OU 3)	<b>Date of inspection:</b> 1/31/2013												
<b>Location and Region:</b> NAS JRB Willow Grove, PA	<b>EPA ID:</b> PAD987277837												
<b>Agency, office, or company leading the five-year review:</b> Navy BRAC PMO East	<b>Weather/temperature:</b> Partly Cloudy/ 40's												
<b>Remedy Includes:</b> (Check all that apply) <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Landfill cover/containment</td> <td><input type="checkbox"/> Monitored natural attenuation</td> </tr> <tr> <td><input type="checkbox"/> Access controls</td> <td><input type="checkbox"/> Groundwater containment</td> </tr> <tr> <td><input type="checkbox"/> Institutional controls</td> <td><input type="checkbox"/> Vertical barrier walls</td> </tr> <tr> <td><input type="checkbox"/> Groundwater pump and treatment</td> <td></td> </tr> <tr> <td><input type="checkbox"/> Surface water collection and treatment</td> <td></td> </tr> <tr> <td colspan="2"><input checked="" type="checkbox"/> Other <u>Interim remedy includes land use controls, periodic groundwater monitoring and a review of site conditions and risks every five years.</u></td> </tr> </table>		<input type="checkbox"/> Landfill cover/containment	<input type="checkbox"/> Monitored natural attenuation	<input type="checkbox"/> Access controls	<input type="checkbox"/> Groundwater containment	<input type="checkbox"/> Institutional controls	<input type="checkbox"/> Vertical barrier walls	<input type="checkbox"/> Groundwater pump and treatment		<input type="checkbox"/> Surface water collection and treatment		<input checked="" type="checkbox"/> Other <u>Interim remedy includes land use controls, periodic groundwater monitoring and a review of site conditions and risks every five years.</u>	
<input type="checkbox"/> Landfill cover/containment	<input type="checkbox"/> Monitored natural attenuation												
<input type="checkbox"/> Access controls	<input type="checkbox"/> Groundwater containment												
<input type="checkbox"/> Institutional controls	<input type="checkbox"/> Vertical barrier walls												
<input type="checkbox"/> Groundwater pump and treatment													
<input type="checkbox"/> Surface water collection and treatment													
<input checked="" type="checkbox"/> Other <u>Interim remedy includes land use controls, periodic groundwater monitoring and a review of site conditions and risks every five years.</u>													
<b>Attachments:</b> <input checked="" type="checkbox"/> Inspection team roster attached <input checked="" type="checkbox"/> Site map attached													
II. INTERVIEWS (Check all that apply)													
1. <b>O&amp;M site manager</b> <u>Captain Seth Foulkes</u> <u>Pennsylvania Air National Guard</u> <u>1/31/2013</u> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>Name</span> <span>Title</span> <span>Date</span> </div> Interviewed <input checked="" type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. <u>215-323-8387</u> Problems, suggestions; <input type="checkbox"/> Report attached _____ _____													
2. <b>O&amp;M staff</b> <u>Marty Schy/Jim Rugh</u> <u>Navy BRAC PMO</u> <u>1/31/2013</u> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>Name</span> <span>Title</span> <span>Date</span> </div> Interviewed <input checked="" type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____ Problems, suggestions; <input type="checkbox"/> Report attached _____ _____													



<b>III. ON-SITE DOCUMENTS &amp; RECORDS VERIFIED</b> (Check all that apply)			
1.	<b>O&amp;M Documents</b> <input type="checkbox"/> O&M manual <input type="checkbox"/> As-built drawings <input type="checkbox"/> Maintenance logs Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
2.	<b>Site-Specific Health and Safety Plan</b> <input type="checkbox"/> Contingency plan/emergency response plan Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
3.	<b>O&amp;M and OSHA Training Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
4.	<b>Permits and Service Agreements</b> <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Effluent discharge <input type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Other permits _____ Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
5.	<b>Gas Generation Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
6.	<b>Settlement Monument Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
7.	<b>Groundwater Monitoring Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
8.	<b>Leachate Extraction Records</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A
9.	<b>Discharge Compliance Records</b> <input type="checkbox"/> Air <input type="checkbox"/> Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> N/A
10.	<b>Daily Access/Security Logs</b> Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input checked="" type="checkbox"/> N/A



<b>C. Institutional Controls (ICs)</b>			
1.	<b>Implementation and enforcement</b>		
	Site conditions imply ICs not properly implemented	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Site conditions imply ICs not being fully enforced	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Type of monitoring (e.g., self-reporting, drive by)	Drive by.	
	Frequency	Annually	
	Responsible party/agency	Pennsylvania Air National Guard and Navy	
	Contact	Captain Seth Foulkes	Environmental Manager
		Name	Title
			Date
			Phone no.
	Reporting is up-to-date	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
	Reports are verified by the lead agency	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
	Specific requirements in deed or decision documents have been met	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
	Violations have been reported	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
	Other problems or suggestions:	<input type="checkbox"/> Report attached	
2.	<b>Adequacy</b>	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate <input type="checkbox"/> N/A
	Remarks		
<b>D. General</b>			
1.	<b>Vandalism/trespassing</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No vandalism evident
	Remarks		
2.	<b>Land use changes on site</b>	<input type="checkbox"/> N/A	
	Remarks	In September 2009, the majority of the Site 1 LUC area was transferred to the U.S. Air Force. The land use will remain military use in the future, and no future residential uses are planned.	
3.	<b>Land use changes off site</b>	<input type="checkbox"/> N/A	
	Remarks	The Armed Forces Reserve Center was constructed in 2011. The storm water retention basin and partial of building fully occupy the former Privet Road Compound.	
<b>VI. GENERAL SITE CONDITIONS</b>			
<b>A. Roads</b>	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A	
1.	<b>Roads damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Roads adequate <input type="checkbox"/> N/A
	Remarks		

<b>B. Other Site Conditions</b>		
Remarks _____ _____ _____ _____ _____		
<b>VII. LANDFILL COVERS</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
<b>A. Landfill Surface</b>		
1.	<b>Settlement</b> (Low spots) Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Settlement not evident
2.	<b>Cracks</b> Lengths _____    Widths _____    Depths _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Cracking not evident
3.	<b>Erosion</b> Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Erosion not evident
4.	<b>Holes</b> Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Holes not evident
5.	<b>Vegetative Cover</b> <input type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____ _____	<input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> No signs of stress
6.	<b>Alternative Cover (armored rock, concrete, etc.)</b> Remarks _____ _____	<input type="checkbox"/> N/A
7.	<b>Bulges</b> Areal extent _____ Height _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Bulges not evident

8.	<b>Wet Areas/Water Damage</b> <input type="checkbox"/> Wet areas <input type="checkbox"/> Ponding <input type="checkbox"/> Seeps <input type="checkbox"/> Soft subgrade Remarks _____ _____	<input type="checkbox"/> Wet areas/water damage not evident <input type="checkbox"/> Location shown on site map    Areal extent _____ <input type="checkbox"/> Location shown on site map    Areal extent _____ <input type="checkbox"/> Location shown on site map    Areal extent _____ <input type="checkbox"/> Location shown on site map    Areal extent _____
9.	<b>Slope Instability</b> <input type="checkbox"/> Slides <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of slope instability Areal extent _____ Remarks _____ _____	
<b>B. Benches</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	<b>Flows Bypass Bench</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> N/A or okay Remarks _____ _____	
2.	<b>Bench Breached</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> N/A or okay Remarks _____ _____	
3.	<b>Bench Overtopped</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> N/A or okay Remarks _____ _____	
<b>C. Letdown Channels</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	<b>Settlement</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of settlement Areal extent _____    Depth _____ Remarks _____ _____	
2.	<b>Material Degradation</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of degradation Material type _____    Areal extent _____ Remarks _____ _____	
3.	<b>Erosion</b> <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of erosion Areal extent _____    Depth _____ Remarks _____ _____	

4.	<b>Undercutting</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting
	Areal extent _____	Depth _____	
	Remarks _____ _____		
5.	<b>Obstructions</b>	Type _____	<input type="checkbox"/> No obstructions
	<input type="checkbox"/> Location shown on site map	Areal extent _____	
	Size _____		
	Remarks _____ _____		
6.	<b>Excessive Vegetative Growth</b>	Type _____	
	<input type="checkbox"/> No evidence of excessive growth		
	<input type="checkbox"/> Vegetation in channels does not obstruct flow		
	<input type="checkbox"/> Location shown on site map	Areal extent _____	
	Remarks _____ _____		
<b>D. Cover Penetrations</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1.	<b>Gas Vents</b>	<input type="checkbox"/> Active	<input type="checkbox"/> Passive
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance
	<input type="checkbox"/> N/A		
	Remarks _____ _____		
2.	<b>Gas Monitoring Probes</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A
	Remarks _____ _____		
3.	<b>Monitoring Wells</b> (within surface area of landfill)	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A
	Remarks _____ _____		
4.	<b>Leachate Extraction Wells</b>	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A
	Remarks _____ _____		
5.	<b>Settlement Monuments</b>	<input type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed <input type="checkbox"/> N/A
	Remarks _____ _____		

<b>E. Gas Collection and Treatment</b>			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Gas Treatment Facilities</b>		<input type="checkbox"/> Flaring	<input type="checkbox"/> Thermal destruction
			<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
				<input type="checkbox"/> Collection for reuse
	Remarks	_____		
		_____		
2.	<b>Gas Collection Wells, Manifolds and Piping</b>		<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
	Remarks	_____		
		_____		
3.	<b>Gas Monitoring Facilities</b> (e.g., gas monitoring of adjacent homes or buildings)		<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
				<input type="checkbox"/> N/A
	Remarks	_____		
		_____		
<b>F. Cover Drainage Layer</b>			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Outlet Pipes Inspected</b>		<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks	_____		
		_____		
2.	<b>Outlet Rock Inspected</b>		<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks	_____		
		_____		
<b>G. Detention/Sedimentation Ponds</b>			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Siltation</b> Areal extent _____	Depth _____		<input type="checkbox"/> N/A
	<input type="checkbox"/> Siltation not evident			
	Remarks	_____		
		_____		
2.	<b>Erosion</b> Areal extent _____	Depth _____		
	<input type="checkbox"/> Erosion not evident			
	Remarks	_____		
		_____		
3.	<b>Outlet Works</b>		<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks	_____		
		_____		
4.	<b>Dam</b>		<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks	_____		
		_____		

<b>H. Retaining Walls</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Deformations</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident
	Horizontal displacement_____	Vertical displacement_____	
	Rotational displacement_____		
	Remarks_____		
	_____		
2.	<b>Degradation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident
	Remarks_____		
	_____		
<b>I. Perimeter Ditches/Off-Site Discharge</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Siltation</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident
	Areal extent_____	Depth_____	
	Remarks_____		
	_____		
2.	<b>Vegetative Growth</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A
	<input type="checkbox"/> Vegetation does not impede flow		
	Areal extent_____	Type_____	
	Remarks_____		
	_____		
3.	<b>Erosion</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident
	Areal extent_____	Depth_____	
	Remarks_____		
	_____		
4.	<b>Discharge Structure</b>	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks_____		
	_____		
<b>VIII. VERTICAL BARRIER WALLS</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Settlement</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident
	Areal extent_____	Depth_____	
	Remarks_____		
	_____		
2.	<b>Performance Monitoring</b>	Type of monitoring_____	
	<input type="checkbox"/> Performance not monitored		
	Frequency_____	<input type="checkbox"/> Evidence of breaching	
	Head differential_____		
	Remarks_____		
	_____		



<b>C. Treatment System</b>		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	<b>Treatment Train</b> (Check components that apply)		
	<input type="checkbox"/> Metals removal	<input type="checkbox"/> Oil/water separation	<input type="checkbox"/> Bioremediation
	<input type="checkbox"/> Air stripping	<input type="checkbox"/> Carbon adsorbers	
	<input type="checkbox"/> Filters _____		
	<input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____		
	<input type="checkbox"/> Others _____		
	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
	<input type="checkbox"/> Sampling ports properly marked and functional		
	<input type="checkbox"/> Sampling/maintenance log displayed and up to date		
	<input type="checkbox"/> Equipment properly identified		
	<input type="checkbox"/> Quantity of groundwater treated annually _____		
	<input type="checkbox"/> Quantity of surface water treated annually _____		
	Remarks _____		
	_____		
2.	<b>Electrical Enclosures and Panels</b> (properly rated and functional)		
	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
	Remarks _____		
	_____		
3.	<b>Tanks, Vaults, Storage Vessels</b>		
	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition	<input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance
	Remarks _____		
	_____		
4.	<b>Discharge Structure and Appurtenances</b>		
	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance
	Remarks _____		
	_____		
5.	<b>Treatment Building(s)</b>		
	<input type="checkbox"/> N/A	<input type="checkbox"/> Good condition (esp. roof and doorways)	<input type="checkbox"/> Needs repair
	<input type="checkbox"/> Chemicals and equipment properly stored		
	Remarks _____		
	_____		
6.	<b>Monitoring Wells</b> (pump and treatment remedy)		
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> All required wells located	<input type="checkbox"/> Needs Maintenance	<input type="checkbox"/> N/A
	Remarks _____		
	_____		
<b>D. Monitoring Data</b>			
1.	Monitoring Data		
	<input type="checkbox"/> Is routinely submitted on time	<input checked="" type="checkbox"/> Is of acceptable quality	
2.	Monitoring data suggests:		
	<input type="checkbox"/> Groundwater plume is effectively contained	<input checked="" type="checkbox"/> Contaminant concentrations are declining	

<b>D. Monitored Natural Attenuation</b>	
1.	<p><b>Monitoring Wells</b> (natural attenuation remedy)</p> <p> <input checked="" type="checkbox"/> Properly secured/locked                   <input checked="" type="checkbox"/> Functioning                   <input type="checkbox"/> Routinely sampled                   <input checked="" type="checkbox"/> Good condition  <input type="checkbox"/> All required wells located                   <input type="checkbox"/> Needs Maintenance                   <input type="checkbox"/> N/A             </p> <p>Remarks Monitoring wells were accessible and in good condition. During construction, monitoring wells 01MW01 SO and 01MW01S were replaced with two new wells 01MW01SO-R and 01MW01S-R. _____</p>
<b>X. OTHER REMEDIES</b>	
<p>If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.</p>	
<b>XI. OVERALL OBSERVATIONS</b>	
<b>A. Implementation of the Remedy</b>	
<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><u>The implementation of the interim remedy was completed in accordance with the LUC RD and ROD for OU 3. LUCs were implemented to prevent exposure to COCs in groundwater in accordance with the LUCRD. The LUCs are identified in the Base Master Plan (Air National Guard, 2010). The LUCs are in place that prevents the use of untreated groundwater. No new uses of groundwater were observed.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<b>B. Adequacy of O&amp;M</b>	
<p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><u>No active remedy.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

Based on the site inspection, there were no instances of non-compliance with the LUCs placed on Site1 groundwater (OU 3).

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**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Optimization of groundwater sampling should be considered to eliminate monitoring of wells that have consistently had contaminant levels below the remedial goals.

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**APPENDIX C**  
**LUC INSPECTION REPORTS**



TETRA TECH

PHIL-23979

November 9, 2010

Project Number 02014

Base Realignment and Closure  
Program Management Office, Northeast  
4911 South Broad Street  
Philadelphia, Pennsylvania 19112-1303

Attn: Mr. Jeff Dale

Reference: Contract No. N62470-08-D-1001  
Contract Task Order (CTO) No. WE05

Subject: Site 1 Land Use Controls - July 2010 Annual Inspection Report  
NAS JRB Willow Grove, Pennsylvania

Dear Mr. Dale:

Tetra Tech NUS, Inc. (Tetra Tech) is pleased to provide this 2010 Letter Report documenting the status of compliance with the land use controls (LUCs) that have been placed by the Navy on Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania. A description of the LUCs, along with a brief site description and the historical perspective, are contained in the *Draft Remedial Design for Land Use Controls (RDLUC) for Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania*, dated February 2009 (Tetra Tech, 2009).

The RDLUC describes the program agreed to by the Navy, the US Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection (PADEP) to ensure and document compliance with land use controls placed on Site 1 Groundwater (Operable Unit 3). Compliance monitoring includes on-site inspections of Site 1, interviews of property owner and workers, and completion of an Institutional Control Inspection Checklist. After completion of the "Physical On-Site Inspection" and "Interview Property Owner" portions of the checklist, the Navy signed the Annual Certification portion. The signed checklist is included in this RDLUC Annual Letter Report.

The Institutional Control Inspection Checklist provides verification of compliance with the land-use controls that were previously identified in a Record of Decision (ROD), or referenced in the Sampling and Analysis Plan for Groundwater Monitoring, and deed covenants. Site 1 Groundwater is addressed below, documenting the inspection findings, items of noncompliance, if any, and measures taken to correct the items of non-compliance during the year 2010. The Institutional Control Checklist is included as Attachment A.

Tetra Tech NUS, Inc.

234 Mall Boulevard, Suite 260, King of Prussia, PA 19406  
Tel 610.491.9688 Fax 610.491.9645 www.ttrnus.com



The following land use controls have been placed on the designated land or areas while the interim ROD is in force for Site 1 groundwater:

- No new groundwater well(s) may be installed without written consent from EPA and PADEP.
- Access to existing and any additional groundwater monitoring wells, including supply wells, will be limited by the Navy or subsequent land owner to the organization responsible for groundwater monitoring.

Figure 1 identifies the area for land use limitations.

#### On-Site Inspection

In September 2009, a groundwater sampling event of periodic groundwater monitoring for Site 1 was conducted according to the Sampling and Analysis Plan for the Site 1 Groundwater Monitoring (Tetra Tech, July 2009). The annual institutional control on-site inspection of Site 1 was performed on July 20, 2010. No evidence of new groundwater wells was encountered during either site the groundwater monitoring event or the LUC inspection. However, new construction activities at Site 1 were underway by CLAYCO which is a contractor of the Air Force Reserve. Two damaged monitoring wells (01MW01S and 01MW02S) were found due to construction activities. The damage incurred to these wells was limited to the aboveground well riser and protective casing.

#### Interview Property Owner

On July 20, 2010, Bill Heil from the NAS JRB Willow Grove Environmental Division, confirmed that no permits, construction, directives, or other guidance had been issued that would change the use of site groundwater.

#### Other Related Information

An Army Reserve Training Center is under construction at Site 1. The drawing from U.S. Army Corps of Engineers indicates three monitoring wells of 01MW01 cluster would be abandoned and 01MW02 and 01MW03 clusters would be adjusted during construction of the Training Center (Figure 2). Monitoring wells 01MW01S and 01MW01SO are included in the sampling program for Site 1 periodic groundwater monitoring. However, the Navy has reached an agreement with the Air Force Reserve about monitoring wells 01MW01S and 01MW01SO, which must be replaced for Site 1 periodic groundwater monitoring as required by the Interim ROD for Site 1 groundwater.

Based on the data obtained for the RDLUC inspection, there was no non-compliance with the land use controls placed by the Navy on Site 1 groundwater. The Navy has communicated with the current property owner of Site 1 (the US Air Force Reserve) notifying them of current LUCs compliance status, reiterating the need for the replacement of monitoring wells 01MW01S and 01MW01SO, and requesting copies of closure documentation for any wells that have been closed.



**TETRA TECH**

PHIL-23979  
Mr. Jeff Dale  
Base Realignment and Closure, PMO NE  
November 9, 2010 - Page 3

If you have any questions or require revisions regarding this report, please do not hesitate to contact me.

Sincerely,

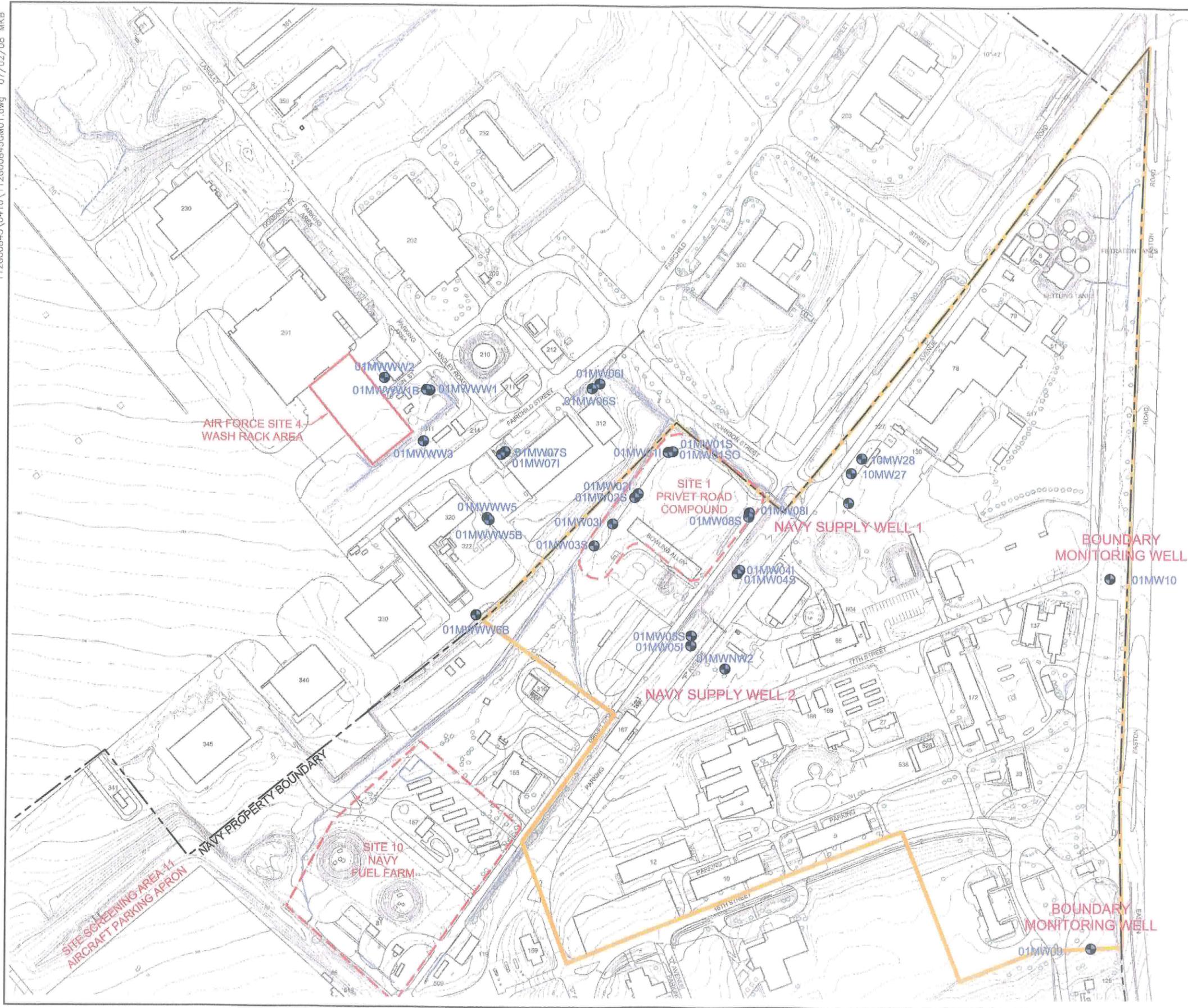
Russell E. Turner, P.E.  
Project Manager

RT/nfs

Enclosure

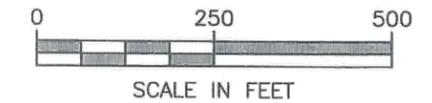
c: Lisa Cunningham (EPA Region 3)  
Kathleen Patnode (EPA Region 3 BTAG)  
Charles Clark (PADEP)  
Bill Heil (NAS JRB Willow Grove)  
Executive Officer (NAS JRB Willow Grove)  
Horsham Township Library  
NAVFAC Mid-Atlantic Librarian  
Garth Glenn (Tetra Tech) (without enclosures)  
File

## FIGURES



LEGEND

-  MONITORING WELL LOCATION
-  BOUNDARY OF INSTITUTIONAL CONTROLS



TETRA TECHNUS, INC.

PROPOSED INSTITUTIONAL CONTROLS AREA  
 SITE 1 - PRIVET ROAD  
 NAS JRB WILLOW GROVE  
 WILLOW GROVE, PENNSYLVANIA

FILE  
 112G00845GM01

SCALE  
 AS NOTED

FIGURE NUMBER  
 FIGURE 1

REV DATE  
 0 07/02/08



**ATTACHMENT A**  
**INSTITUTIONAL CONTROL INSPECTION CHECKLIST**

**INSTITUTIONAL CONTROL INSPECTION CHECKLIST**  
**FOR LAND USE CONTROLS**  
**SITE 1-PRIVET ROAD COMPOUND GROUNDWATER (OU 3)**  
**NAS JRB WILLOW GROVE, HORSHAM TOWNSHIP, PENNSYLVANIA**

**A. Annual certification**

Name: ROBERT F. LEWANDOWSKI  
Affiliation: BRAC ENVIRONMENTAL COORDINATOR  
NAVY BRAC PROGRAM MANAGEMENT OFFICE  
Signature: *Robert F. Lewandowski*  
Date: 11/8/2010

**B. Interview Property Owner**

Person interviewed: Bill Heil (NAS JRB Willow Grove)  
Date: 7/20/2010

**Check as appropriate:**

- No permits, construction, directives, or other guidance has been issued that would change the use of site groundwater.  
Comments: Proposed Army Reserve Training Center will be constructed at Site 1. O1MW015 and O1MW025 were damaged due to construction activities. The new construction plan will interfere with the LLCs and Site 1 groundwater monitoring.
- Changes have been made that may change the use of site groundwater

Comments: \_\_\_\_\_  
\_\_\_\_\_

**C. Physical On-Site Inspection**

Name: XUEJUN CHEN  
Affiliation: Tetra Tech NYS, Inc  
Signature: *Xuejun Chen*  
Date: 7/20/2010

In accordance with the Land Use Controls of Site 1 Groundwater (OU 3), the following numbered and checked items are being inspected to ensure compliance.

Item	Check one	Comments *
1. Land Use Condition: Uses of treated/untreated groundwater?  If yes, is there evidence of use of untreated groundwater in violation of the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<i>NAS JRB Willow Grove obtains its portable water from two Navy supply wells located east of Site 1. VOCs are removed by Base's Water treatment facility.</i>
2. Any groundwater supply wells found?  If yes, is there evidence of damage to the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
3. Weather Conditions		<i>86 °F, Partly Cloudy.</i>

\* If the answer to a question is 'yes', use the Comments column to list type(s) and name(s) of notices, permits, variances, or notices of intent found: Describe the type and location where the non-conforming groundwater use was observed or reported.



TETRA TECH

PHIL-24455

September 8, 2011

Project Number 02014

Base Realignment and Closure  
Program Management Office, Northeast  
4911 South Broad Street  
Philadelphia, Pennsylvania 19112-1303

Attn: Mr. Jeff Dale

Reference: Contract No. N62470-08-D-1001  
Contract Task Order (CTO) No. WE05

Subject: Site 1 Land Use Controls - 2011 Annual Inspection Report  
NAS JRB Willow Grove, Pennsylvania

Dear Mr. Dale:

Tetra Tech NUS, Inc. (Tetra Tech) is pleased to provide this Annual Letter Report documenting the status of compliance with the land use controls (LUCs) that have been placed by the Navy on Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania. A description of the LUCs, along with a brief site description and the historical perspective, are contained in the *Remedial Design for Land Use Controls (RDLUC) for Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania*, dated August 2010 (Tetra Tech, 2010).

The RDLUC describes the program agreed to by the Navy, the United States Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection (PADEP) to ensure and document compliance with land use controls placed on Site 1 Groundwater (Operable Unit 3). Compliance monitoring includes on-site inspections of Site 1, interviews of property owner and workers, and completion of an Institutional Control Inspection Checklist. After completion of the "Physical On-Site Inspection" and "Interview Property Owner" sections of the checklist, the "Annual Certification" section is signed by the Navy.

The Institutional Control Inspection Checklist provides verification of compliance with the land-use controls that were previously identified in the Interim Record of Decision (ROD) for Site 1 Groundwater (Tetra Tech, 2008), or referenced in the Sampling and Analysis Plan for Groundwater Monitoring (Tetra Tech, 2011), and deed covenants. Site 1 Groundwater is addressed below, documenting the inspection findings, items of non-compliance, if any, and measures taken to correct the items of non-compliance during the year 2011. The signed Institutional Control Checklist is included as Attachment A.

The following land use controls have been placed on the designated land or areas while the Interim ROD is in force for Site 1 groundwater:



- No new groundwater well(s) may be installed without written consent from EPA and PADEP.
- Access to existing and any additional groundwater monitoring wells, including supply wells, will be limited by the Navy or subsequent land owner to the organization responsible for groundwater monitoring.

Figure 1 identifies the area for land use limitations.

#### On-Site Inspection

The annual institutional control on-site inspection of Site 1 was performed on August 15, 2011. The construction of the Army Reserve Training Center, which was in progress during the previous inspection, has been completed by the Air Force Reserve contractor, Clayco. Monitoring well cluster 01MW01, consisting of monitoring wells 01MW01SO, 01MW01S, and 01MW01I, has been abandoned to allow for the installation of a storm water retention basin. Monitoring wells 01MW01SO and 01MW01S have been replaced with two new wells, 01MW01SO-R and 01MW01S-R, located along Johnson Street near the corner with Griffiss Street (Figure 1). These two wells are included in the groundwater monitoring program required by the Interim ROD for Site 1 Groundwater. Both wells are fitted with locked caps. The completion reports for the two wells are included as Attachment B. Other than these two replacement monitoring wells, no evidence of new groundwater wells was encountered during the LUC inspection.

As noted in the previous inspection report, monitoring well 01MW02S was damaged during construction activities. The steel protective casing was observed to be dented at ground level, and the inner PVC casing was obstructed by soil or sand at a depth of approximately 3.5 feet below the top of casing. If the damage to the well is irreparable, the well should be properly abandoned and, if necessary, replaced.

As a result of the landscaping for the new building, monitoring wells 01MW02S, 01MW02I, 01MW03S, and 01MW03I are located in a drainage swale that drains into the newly constructed storm water retention basin.

#### Interview with Property Owner

On August 15, 2011, Bill Heil from the NAS JRB Willow Grove Environmental Division, confirmed that no permits, construction, directives, or other guidance had been issued that would change the use of site groundwater.

The operation of the two supply wells and the responsibility for compliance with the drinking water permit associated with their use have been transferred to the Pennsylvania Air National Guard (PaANG).

Mr. Heil said that the Air Force Reserve is in the process of confirming that the stick-up heights of the four monitoring wells located within the newly constructed drainage swale are high enough to prevent their submersion when the swale fills with storm water. The stick-ups were previously extended by a drilling subcontractor to Clayco, however, they have not been surveyed. Clayco plans to have a surveyor confirm that the stick-ups are high enough, and if not, they will be extended further.

#### Summary

Based on the data obtained for the RDLUC inspection, there was no non-compliance with the land use controls placed by the Navy on Site 1 groundwater. The Navy has communicated with the current property owner of Site 1 (the Air Force Reserve) notifying them of current LUCs compliance status.



TETRA TECH

PHIL-24455  
Mr. Jeffrey Dale  
Base Realignment and Closure, PMO NE  
September 8, 2011 - Page 3

Monitoring wells 01MW01S and 01MW01SO have been replaced, allowing groundwater monitoring to continue.

If you have any questions or require revisions regarding this report, please do not hesitate to contact me.

Sincerely,

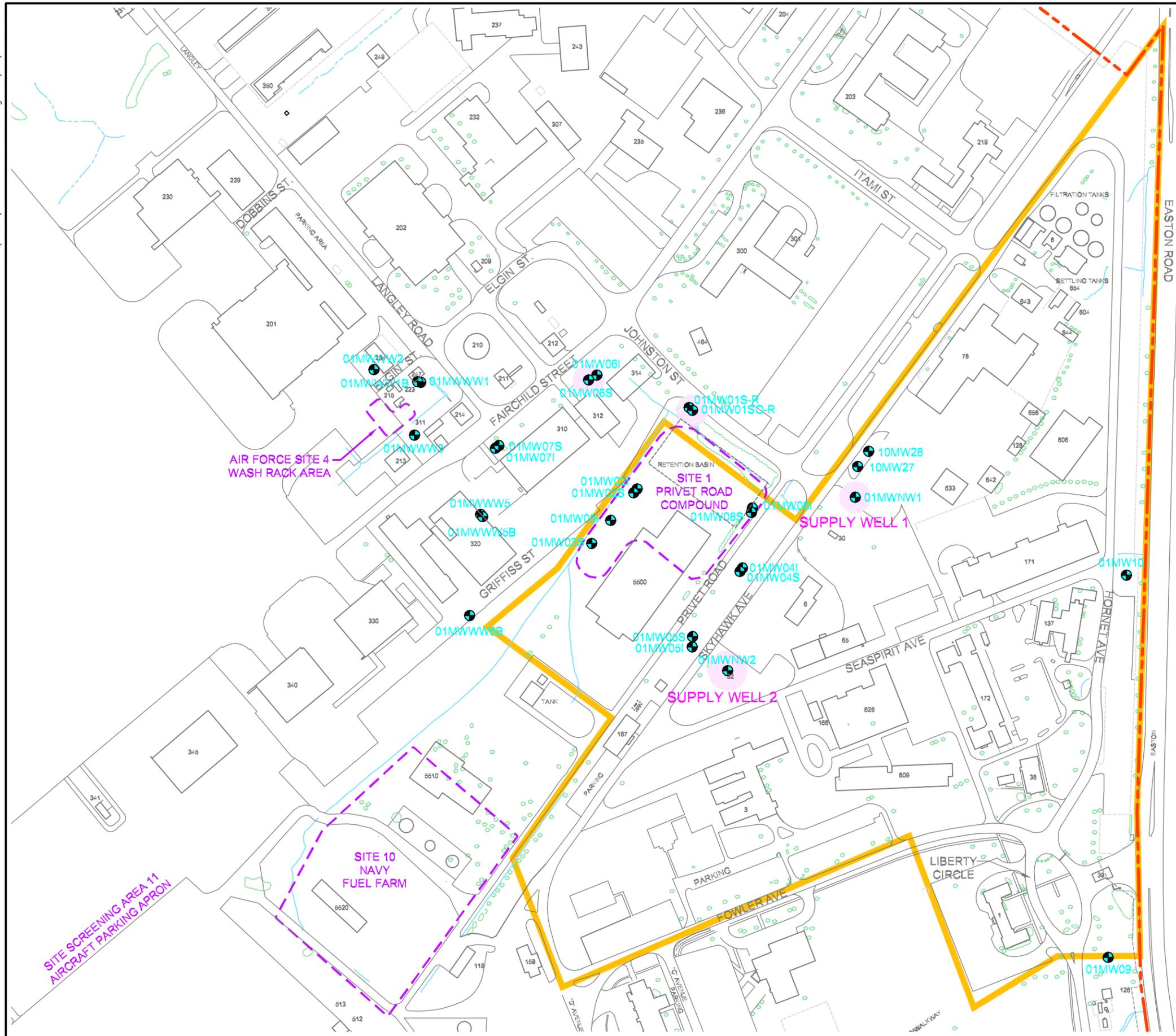
Andrew Frebowitz  
Project Manager

AF/nfs

Enclosure

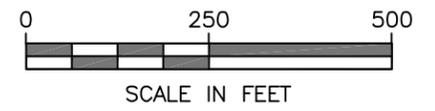
c: Lisa Cunningham (EPA Region 3)  
Kathleen Patnode (EPA Region 3 BTAG)  
Tim Sheehan (PADEP)  
Marty Schy (Navy Caretaker Office)  
Horsham Township Library  
Glenn Wagner (Tetra Tech)  
Garth Glenn (Tetra Tech) (without enclosures)  
File

## FIGURES



**LEGEND**

-  MONITORING WELL LOCATION
-  PERIODIC GROUNDWATER MONITORING WELL LOCATION
-  BOUNDARY OF INSTITUTIONAL CONTROLS



**SITE LAYOUT AND  
PROPOSED LAND USE CONTROL AREA  
SITE 1 - PRIVET ROAD  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA**

FILE 112G02014GM01-2	SCALE AS NOTED
FIGURE NUMBER FIGURE 1	REV DATE 0 08/22/11

**ATTACHMENT A**  
**INSTITUTIONAL CONTROL INSPECTION CHECKLIST**

**INSTITUTIONAL CONTROL INSPECTION CHECKLIST**  
**FOR LAND USE CONTROLS**  
**SITE 1-PRIVET ROAD COMPOUND GROUNDWATER (OU 3)**  
**NAS JRB WILLOW GROVE, HORSHAM TOWNSHIP, PENNSYLVANIA**

**A. Annual certification**

Name: Robert Lewandowski  
Affiliation: NAVY BRAC ENVIRONMENTAL COORDINATOR  
Signature: *Robert Lewandowski*  
Date: 8/29/11

**B. Interview Property Owner**

Person interviewed: Bill Heil (NAS JRB Willow Grove)  
Date: 8/15/11

**Check as appropriate:**

No permits, construction, directives, or other guidance has been issued that would change the use of site groundwater.  
Comments: Monitoring Wells O1MW01\$ , O1MW01\$0, and O1MW01\$F have been abandoned due to construction activities. O1MW01\$ and O1MW01\$0 have been replaced.

Changes have been made that may change the use of site groundwater  
Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**C. Physical On-Site Inspection**

Name: Donald Whalen  
Affiliation: Tetra Tech  
Signature: *Donald Whalen*  
Date: 8/15/11

In accordance with the Land Use Controls of Site 1 Groundwater (OU 3), the following numbered and checked items are being inspected to ensure compliance.

Item	Check one	Comments *
1. Land Use Condition: Uses of treated/untreated groundwater?  If yes, is there evidence of use of untreated groundwater in violation of the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<i>The Base obtains its potable water from two supply wells located east of Site 1. The water is treated to remove VOCs prior to distribution.</i>
2. Any groundwater supply wells found?  If yes, is there evidence of damage to the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<i>see above.</i>
3. Weather Conditions		<i>80°F, cloudy</i>

\* If the answer to a question is 'yes', use the Comments column to list type(s) and name(s) of notices, permits, variances, or notices of intent found: Describe the type and location where the non-conforming groundwater use was observed or reported.

**ATTACHMENT B**

**REPLACEMENT MONITORING WELL COMPLETION REPORTS**

DEPARTMENT OF CONSERVATION & NATURAL RESOURCES  
 BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY  
 WATER WELL LICENSING/WATER WELL INVENTORY SECTION  
 3240 Schoolhouse Rd  
 Middletown, PA 17057  
 717-702-2017

<b>WATER WELL COMPLETION REPORT</b>		
Well Driller: <b>EICHELBERGERS INC.</b>	Driller Well ID: <b>DS10050-MW015</b>	
Driller License: <b>0198</b>	Local Permit #:	
Type of Activity: <b>New Well</b>	Original Well By: <b>Current Driller</b>	
Date Drilled: <b>4/20/2011</b>	Drilling Method: <b>AIR ROTARY</b>	
Owner: <b>USACE</b> Address of Well: <b>1301 EASTON RD</b> <span style="float: right;">Zipcode: <b>19090</b></span> County: <b>MONTGOMERY</b> Municipality: <b>HORSHAM</b> <span style="float: right;">Municipality Type: <b>T</b></span> Coordinate Method: <b>Commercial Street Atlas Program</b> Quadrangle: <span style="margin-left: 100px;">Latitude: <b>40.15848</b></span> <span style="float: right;">Longitude: <b>-75.12258</b></span>		
Well Depth (ft): <b>40</b>	Well Finish: <b>SCREEN</b>	
Depth to Bedrock (ft): <b>24</b>	Did Not Encounter Bedrock:	
Well Yield (gpm):	Yield Measure Method:	
Static Water Level: (ft below land surface)	Water level after yield test: (ft below land surface)	
Length of Yield Test: (minutes)	Saltwater Zone (ft):	
Use of Well: <b>OBSERVATION</b>	Use of Water: <b>UNUSED</b>	

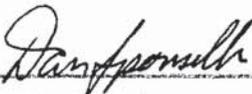
<b>DRILLER'S LOG</b>		
<u>UNIT TOP</u>	<u>UNIT BOTTOM</u>	<u>DESCRIPTION OF UNITS PENETRATED</u>
Unit Top 1: <b>0</b>	Unit Bottom 1: <b>15</b>	Unit 1: <b>OVERBURDEN</b>
Unit Top 2: <b>15</b>	Unit Bottom 2: <b>24</b>	Unit 2: <b>WEATHERED RED SILTSTONE</b>
Unit Top 3: <b>24</b>	Unit Bottom 3: <b>40</b>	Unit 3: <b>RED SILTSTONE AND SANDSTONE</b>

<b>BOREHOLE</b>			
Section 1:	Top: <b>0</b>	Bottom: <b>40</b>	Diameter: <b>6</b>

<b>CASING</b>
Casing 1:

Top: 0	Bottom: 32	Diameter: 2	Material: PVC OR OTHER PLASTIC
<b>Seal(Grout) 1:</b>			
Top: 0	Bottom: 30	Type: BENTONITE CHIPS/PELLETS	

<b>SCREEN/SLOT</b>			
<b>Screen 1:</b>	Top: 32	Bottom: 40	Diameter: 2
	Type: SCREEN		
	Material: PLASTIC		Slot Size: 20
	Packing: Screened Sand		

I hereby certify that the above information is true and complete to the best of my knowledge and belief.	
	
Driller's Signature (required)	Date

DEPARTMENT OF CONSERVATION & NATURAL RESOURCES  
 BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY  
 WATER WELL LICENSING/WATER WELL INVENTORY SECTION  
 3240 Schoolhouse Rd  
 Middletown, PA 17057  
 717-702-2017

<b>WATER WELL COMPLETION REPORT</b>		
Well Driller: <b>EICHELBERGERS INC.</b>	Driller Well ID: <b>DS10050-MW0150</b>	
Driller License: <b>0198</b>	Local Permit #:	
Type of Activity: <b>New Well</b>	Original Well By: <b>Current Driller</b>	
Date Drilled: <b>4/20/2011</b>	Drilling Method: <b>AIR ROTARY</b>	
Owner: <b>USACE</b>		
Address of Well: <b>1301 EASTON RD</b>	Zipcode: <b>19090</b>	
County: <b>MONTGOMERY</b>		
Municipality: <b>HORSHAM</b>	Municipality Type: <b>T</b>	
Coordinate Method: <b>Commercial Street Atlas Program</b>		
Quadrangle:	Latitude: <b>40.15864</b>	Longitude: <b>-75.12262</b>
Well Depth (ft): <b>24</b>	Well Finish: <b>SCREEN</b>	
Depth to Bedrock (ft):	Did Not Encounter Bedrock: <b>X</b>	
Well Yield (gpm):	Yield Measure Method:	
Static Water Level: (ft below land surface)	Water level after yield test: (ft below land surface)	
Length of Yield Test: (minutes)	Saltwater Zone (ft):	
Use of Well: <b>OBSERVATION</b>	Use of Water: <b>UNUSED</b>	

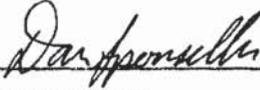
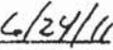
<b>DRILLER'S LOG</b>		
<u>UNIT TOP</u>	<u>UNIT BOTTOM</u>	<u>DESCRIPTION OF UNITS PENETRATED</u>
Unit Top 1: <b>0</b>	Unit Bottom 1: <b>13</b>	Unit 1: <b>OVERBURDEN</b>
Unit Top 2: <b>13</b>	Unit Bottom 2: <b>24</b>	Unit 2: <b>WEATHERED RED SILTSTONE</b>

<b>BOREHOLE</b>			
Section 1:	Top: <b>0</b>	Bottom: <b>24</b>	Diameter: <b>6</b>

<b>CASING</b>			
Casing 1:			
Top: <b>0</b>	Bottom: <b>11</b>	Diameter: <b>2</b>	Material: <b>PVC OR OTHER PLASTIC</b>

<b>Seal(Grout) 1:</b>		
Top: <b>0</b>	Bottom: <b>9</b>	Type: <b>BENTONITE CHIPS/PELLETS</b>

<b>SCREEN/SLOT</b>			
<b>Screen 1:</b>	Top: <b>11</b>	Bottom: <b>24</b>	Diameter: <b>2</b>
	Type: <b>SCREEN</b>		
	Material: <b>PLASTIC</b>		Slot Size: <b>20</b>
	Packing: <b>Screened Sand</b>		

I hereby certify that the above information is true and complete to the best of my knowledge and belief	
	
Driller's Signature (required)	Date



DEPARTMENT OF THE NAVY  
BASE REALIGNMENT AND CLOSURE  
PROGRAM MANAGEMENT OFFICE, NORTHEAST  
4911 SOUTH BROAD STREET  
PHILADELPHIA, PA 19112-1303

5090  
BPMP NE/WL  
Ser 12-121  
September 18, 2012

Ms. Lisa Cunningham  
Remedial Project Manager  
U.S. Environmental Protection Agency  
Region III (3HS11)  
1650 Arch Street  
Philadelphia, PA 19103-2029

Ms. Margaret Pollich  
Project Officer  
Environmental Cleanup Program  
PA Department of Environmental Protection  
2 East Main Street  
Norristown, PA 19401-4915

Dear Ms. Cunningham and Ms. Pollich:

Enclosed is the Institutional Control Inspection Report for Site 1 - Privet Road Compound Groundwater (OU-3) at Naval Air Station Joint Reserve Base Willow Grove. This inspection was performed on August 15, 2012.

Should you require any further information, please contact me at (215) 897-4904 or e-mail [willie.lin@navy.mil](mailto:willie.lin@navy.mil).

Sincerely,

A handwritten signature in black ink, appearing to read "Willington Lin", with a horizontal line extending to the right.

WILLINGTON LIN, P.E.  
BRAC Environmental Coordinator  
By direction of BRAC PMO

Enclosure:

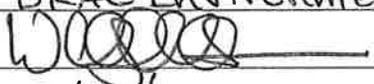
Institutional Control Inspection Report for Site 1 - Privet Road Compound Groundwater (OU-3)

Copy to:

Horsham Township Authority (T. Ames)  
Pennsylvania Air National Guard (Capt Foulkes)  
Administrative Record  
✓ Horsham Township Library

**INSTITUTIONAL CONTROL INSPECTION CHECKLIST**  
**FOR LAND USE CONTROLS**  
**SITE 1-PRIVET ROAD COMPOUND GROUNDWATER (OU 3)**  
**NAS JRB WILLOW GROVE, HORSHAM TOWNSHIP, PENNSYLVANIA**

**A. Annual certification**

Name: Willington Lin  
Affiliation: Navy BRAC Environmental Coordinator  
Signature:   
Date: 8/15/12

**B. Interview Property Owner**

Person interviewed: Lt Col Richard Frattarelli, Pa ANG  
Date: 8/15/12

**Check as appropriate:**

No permits, construction, directives, or other guidance has been issued that would change the use of site groundwater.  
Comments: MWS 10MW27 and 10MW28 have been properly abandoned due to construction activities.

Changes have been made that may change the use of site groundwater  
Comments: \_\_\_\_\_  
\_\_\_\_\_

**C. Physical On-Site Inspection**

Name: Brian Helland  
Affiliation: Navy Remedial Project Manager  
Signature: B. Helland  
Date: 8/15/12

In accordance with the Land Use Controls of Site 1 Groundwater (OU 3), the following numbered and checked items are being inspected to ensure compliance.

Item	Check one	Comments *
1. Land Use Condition: Uses of treated/untreated groundwater?  If yes, is there evidence of use of untreated groundwater in violation of the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	PaANC obtains potable water from two supply wells located east of site 1. The water is treated under permit to remove VOCs prior to distribution.
2. Any groundwater supply wells found?  If yes, is there evidence of damage to the remedy?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	See above and Attachments A and B.
3. Weather Conditions	90° F, Sunny	

\* If the answer to a question is 'yes', use the Comments column to list type(s) and name(s) of notices, permits, variances, or notices of intent found: Describe the type and location where the non-conforming groundwater use was observed or reported.

**ATTACHMENT A**

**MEMORANDUM FOR THE RECORD**

**2012 SITE 1 PRIVET ROAD COMPOUND GROUNDWATER  
(OU-3) LAND USE CONTROLS INSPECTION NAS-JRB  
WILLOW GROVE, PA**

17 SEP 2012

MEMORANDUM FOR THE RECORD

Subj: 2012 SITE 1 PRIVET ROAD COMPOUND GROUNDWATER (OU-3)  
LAND USE CONTROLS INSPECTION NAS-JRB WILLOW GROVE, PA

1. This memorandum details the 2012 annual inspection of compliance with the land use controls (LUCs) that have been placed by the Navy on Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania. A description of the site and the LUCs are provided in the Remedial Design of Land Use Controls (RDLUC) for Site 1 Groundwater at the NAS JRB Willow Grove, Pennsylvania, dated August 2010 (Tetra Tech, 2010).

2. The RDLUC describes the program agreed to by the Navy, the United States Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection (PADEP) to ensure and document compliance with land use controls placed on Site 1 Groundwater (Operable Unit 3). Compliance monitoring includes on-site inspections of Site 1, interviews of property owner and workers, and completion of an Institutional control Inspection Checklist. After completion of the "Physical On-Site Inspection" and "Interview Property Owner" section of the checklist, the "Annual Certification" section is signed by the Navy.

3. The institutional Control Inspection checklist provides verification of compliance with the land-use controls that were previously identified in the Interim Record of Decision (ROD) for Site 1 Groundwater (Tetra Tech, 2008), or referenced in the Sampling and Analysis Plan for Groundwater Monitoring (Tetra Tech, 2011), and deed covenants. Site 1 groundwater is addressed below, documenting the inspection findings, items of noncompliance, if any, and measures taken to correct the items of non-compliance during the year 2012.

4. The following land use controls have been placed on the designated land or areas while the Interim ROD is in force for Site 1 groundwater:

- No new groundwater well(s) may be installed without written consent from EPA and PADEP
- Access to existing and any additional groundwater wells, including supply wells, will be limited by the Navy or subsequent land owner to the organization responsible for groundwater monitoring.

Subj: 2012 SITE 1 PRIVET ROAD COMPOUND GROUNDWATER (OU-3)  
LAND USE CONTROLS INSPECTION NAS JRB WILLOW GROVE, PA

The RDLUC, Figure 1, identifies the area of land use limitations.

5. The majority of the Site 1 LUC area has been transferred to the Air Force Reserve and is managed by the Pennsylvania Air National Guard (PaANG). The Armed Forces Reserve Center constructed in 2010-2011 is now fully occupied. The operation of the two supply wells and the responsibility for compliance with the drinking water permit associated with their use have been transferred to the PaANG.

6. Due to construction of a new entrance gate, it was necessary to abandon two monitoring wells located in the Privet Rd Compound. These wells (10MW27 and 10MW28) were located on a traffic island in the PaANG compound. The abandonment included sealing the well with cement grout, cutting the well casing below grade and placing topsoil to grade. A memo documenting the abandonment of these wells is provided as Attachment B.

7. The approved Sampling and Analysis Plan (SAP, Tetra Tech Jul 2011) calls for three rounds of bi-annual groundwater monitoring of select wells. The second monitoring round was completed in August 2011, and is discussed in detail in the Final Groundwater Monitoring Report (Tetra Tech, Apr 2012).

8. The annual institutional control on-site inspection of Site 1 was performed on 15 August 2012. No evidence of new groundwater wells was found during the LUC inspection. All other wells associated with Site 1 were located during the inspection and were intact. No instances of non-compliance with the current LUCs were observed.

9. On 15 August 2012, LtCol Richard Frattarelli of the PaANG, was interviewed and confirmed that no permits, directives, or other guidance had been issued that would change the use of the site groundwater, and no new wells have been installed. As noted in previous inspection reports, monitoring wells 01MW02S, 01MW02I, 01MW03S, and 01MW03I are located in the newly constructed stormwater basin. LtCol Frattarelli stated that surveyors have confirmed that the stick-ups are higher than the elevation of the outlet from the stormwater basin. This issue is now closed.

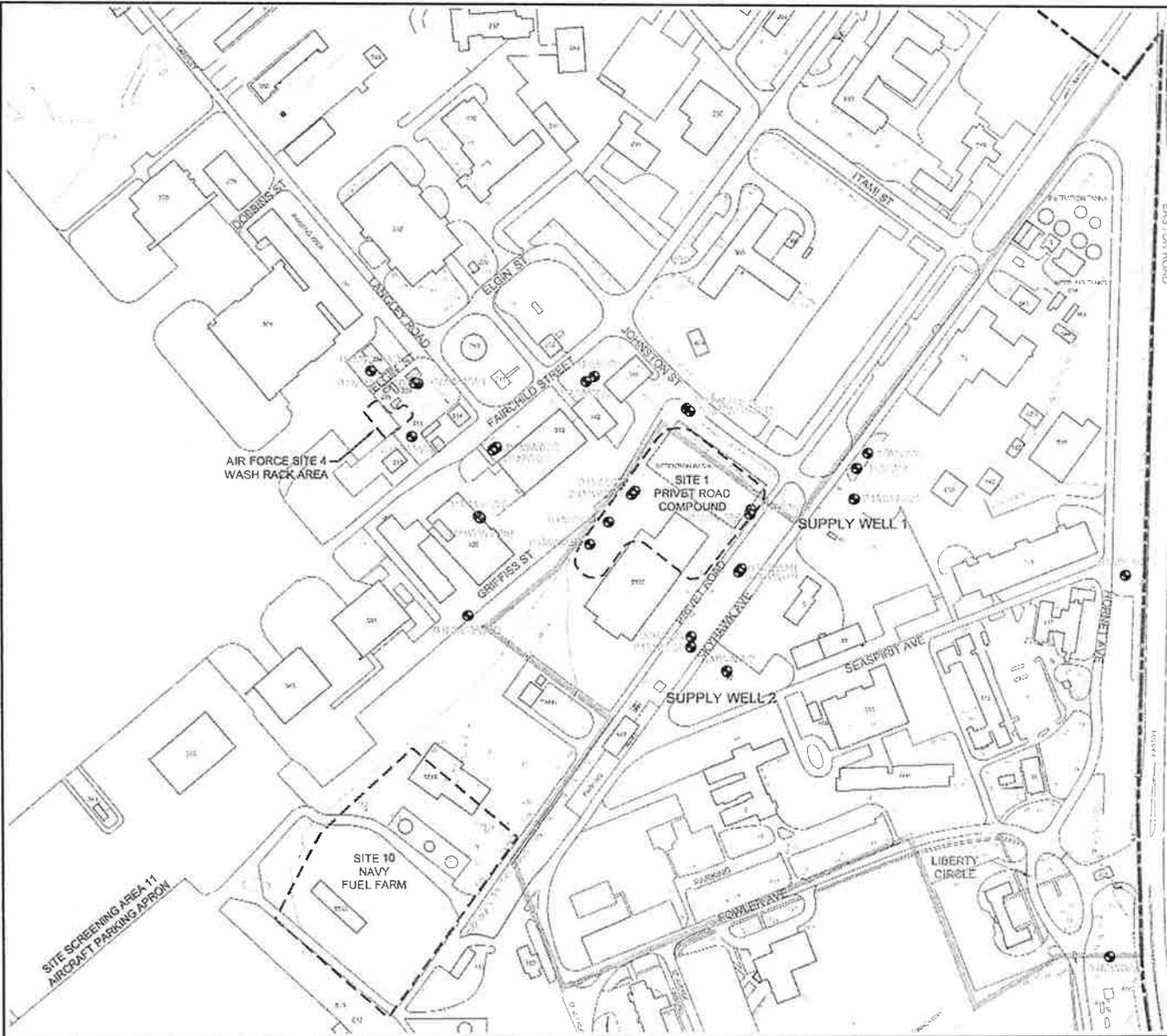
10. In summary, based on the data obtained during this LUC inspection, there were no instances of non-compliance with the

Subj: 2012 SITE 1 PRIVET ROAD COMPOUND GROUNDWATER (OU-3)  
LAND USE CONTROLS INSPECTION NAS JRB WILLOW GROVE, PA

current land use controls for Site 1 groundwater. A third round of bi-annual groundwater monitoring is scheduled for 2013, as specified in the SAP.

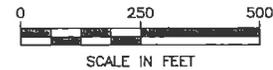
A handwritten signature in black ink that reads "B. Helland". The signature is written in a cursive style with a large, looped initial "B".

B. HELLAND  
Remedial Project Manager  
NAVFAC Mid-Atlantic



**LEGEND**

- MONITORING WELL LOCATION
- PERIODIC GROUNDWATER MONITORING WELL LOCATION
- BOUNDARY OF INSTITUTIONAL CONTROLS



TETRA TECHNUS, INC.

**SITE LAYOUT AND  
PROPOSED LAND USE CONTROL AREA  
SITE 1 - PRIVET ROAD  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA**

FILE 112602014GM01-2	SCALE AS NOTED
FIGURE NUMBER FIGURE 1	REV DATE 0 08/22/11

## **ATTACHMENT B**

### **Monitoring Well Abandonment Forms**



**TETRA TECH**

PHIL-24713

March 9, 2012

Project Number 02014

Water-Well Drillers Licensing Service  
Pennsylvania Geological Society  
3420 Schoolhouse Road  
Middletown, Pennsylvania 17057-3534

Subject:           Monitoring Well Abandonment Forms  
                      Site 1 -- Privet Road Compound  
                      Naval Air Station Joint Reserve Base (NASJRB) - Willow Grove  
                      Horsham, Pennsylvania

Tetra Tech is pleased to submit, on behalf of the United States Navy Base Realignment and Closure Program Management Office Northeast, abandonment forms for two groundwater monitoring wells located at the former NASJRB Willow Grove, Pennsylvania.

Please do not hesitate to contact me if you need more copies or have any questions.

Sincerely,

Andrew Frebowitz  
Project Manager

AF/pg

Enclosure

c:       Brian Helland (Navy BRAC PMO)  
          File

WELL ABANDONMENT FORM

CONTRACTOR/AGENT: TETRA TECH, INC. REGISTRATION NO. 10MW27  
DATE: 2/22/12 TYPE OF SITE OR PROGRAM: GROUNDWATER MONITORING

1. WELL LOCATION: (Show sketch of location on back of this form.)  
Municipality: HORSHAM TOWNSHIP County: MONTGOMERY  
Quadrangle: AMBIER SITE 1, PRIVATE ROAD  
(Road, community, subdivision, lot number)  
Latitude: 40° 12' 30.48" N Longitude: 75° 08' 31.94" W

2. OWNER AND ADDRESS: U.S. NAVY

3. TOPOGRAPHY: (Circle) hilltop, slope, stream terrace, valley, stream channel, draw, local depression, flat

4. USE OF WELL: MONITORING WELL DIAGRAM: sketch a diagram showing depths of well, casing (if present), grouting materials, perforations, etc.

5. DEPTH OF WELL: 42"  
DIAMETER OF WELL: 6"

6. AMOUNT OF CASING REMOVED: 3'  
DIAMETER: 6"

7. SEALING MATERIAL

	Neat cement	Sand cement
Bags (94 lbs.):	<u>10</u>	_____
gals of water:	<u>~55</u>	_____
yds of sand:	_____	_____

OTHER MATERIAL GRANULAR BENTONITE amount: 1 52LB BAG

8. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL:  
GROUT PLACED BY TREMS METHOD

9. CERTIFICATION: We hereby certify that this well abandonment record is true and exact, and was accomplished on 22 ND day of the month of FEBRUARY, 2012 with our active participation and that we are qualified to participate in such abandonment actions.

Joseph J Tomalanga Signature of Participant: \_\_\_\_\_ Signature of Participant: \_\_\_\_\_  
Address: 234 MAIN BLVD, SUITE 260 Address: \_\_\_\_\_  
KING OF PRUSSIA, PA 19406

Date: 2/29/12 Date: \_\_\_\_\_



Tetra Tech

**BEDROCK  
MONITORING WELL SHEET  
OPEN HOLE WELL**

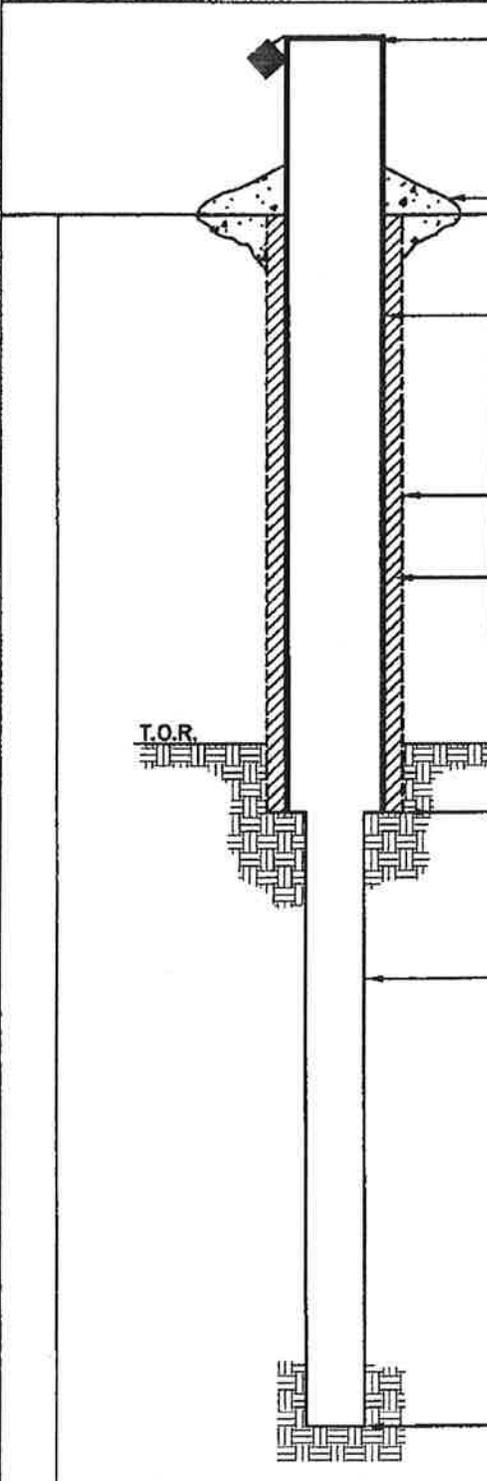
WELL NO.: 10M4'27

WELL ABANDONMENT

PROJECT NAS JRB Willow Grove LOCATION SITE 1, PRIVET Rd  
 PROJECT NO. \_\_\_\_\_ BORING \_\_\_\_\_  
 DATE BEGUN 2/22/12 DATE COMPLETED 2/22/12  
 FIELD GEOLOGIST JT TOMMIAVAO  
 GROUND ELEVATION \_\_\_\_\_ DATUM GROUND SURFACE

DRILLER EICHE/BERGERS  
 DRILLING METHOD AIR ROTARY  
 DEVELOPMENT METHOD \_\_\_\_\_

ACAD:FORM\_MWCHW.dwg 07/28/99 INL



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: 13

TYPE OF SURFACE SEAL: CONCRETE

I.D. OF CASING: 6"  
TYPE OF CASING: STEEL

TEMP./PERM.: PERMANENT

DIAMETER OF HOLE: ~10

TYPE OF CASING SEAL: CEMENT

DEPTH TO TOP OF ROCK: \_\_\_\_\_

DEPTH TO BOTTOM CASING: \_\_\_\_\_

DIAMETER OF HOLE IN BEDROCK: 6"

DESCRIBE IF CORE/REAMED WITH BIT:  
AIR HAMMER

DESCRIBE JOINTS IN BEDROCK AND DEPTH:  
\_\_\_\_\_  
\_\_\_\_\_

ELEVATION/DEPTH OF HOLE: 142

WELL ABANDONMENT FORM

CONTRACTOR/AGENT: TETRA TECH, INC REGISTRATION NO. 10M.W.28  
DATE: 2/22/12 TYPE OF SITE OR PROGRAM: GROUND WATER MONITORING

1. WELL LOCATION: (Show sketch of location on back of this form.)  
Municipality: HORSHAM TOWNSHIP County: MONTGOMERY  
Quadrangle: AMBLER SITE L, PRIVET ROAD  
(Road, community, subdivision, lot number)  
Latitude: 40° 12' 30.98" N Longitude: 75° 08' 31.16" W

2. OWNER AND ADDRESS: US NAVY

3. TOPOGRAPHY: (Circle) hilltop, slope, stream terrace, valley, stream channel, draw, local depression, (flat)

4. USE OF WELL: MONITORING WELL DIAGRAM: sketch a diagram showing depths of well, casing (if present), grouting materials, perforations, etc.

5. DEPTH OF WELL: 108'  
DIAMETER OF WELL: 4"

6. AMOUNT OF CASING REMOVED: 3'  
DIAMETER: 4" & 10"

7. SEALING MATERIAL	Neat cement	Sand cement
	Bags (94 lbs.): <u>12</u>	<u>                    </u>
	gals of water: <u>70</u>	<u>                    </u>
	yds of sand: <u>                    </u>	<u>                    </u>

OTHER MATERIAL GRANULAR BENTONITE amount: 2 - 50 LB BAGS

8. EXPLAIN METHOD OF EMPLACEMENT OF MATERIAL: GROUT PLACED BY TREMG METHOD

9. CERTIFICATION: We hereby certify that this well abandonment record is true and exact, and was accomplished on 22nd day of the month of FEBRUARY 2012 with our active participation and that we are qualified to participate in such abandonment actions.

Joseph Tomaszewski Signature of Participant: \_\_\_\_\_ Signature of Participant: \_\_\_\_\_

Address: 234 MAIL BLVD, SUITE 260 Address: \_\_\_\_\_  
KING OF PRUSSIA, PA 19406 \_\_\_\_\_

Date: 2/29/12 Date: \_\_\_\_\_



Tetra Tech

WELL NO.: 10MW28

# BEDROCK MONITORING WELL SHEET WELL INSTALLED IN BEDROCK

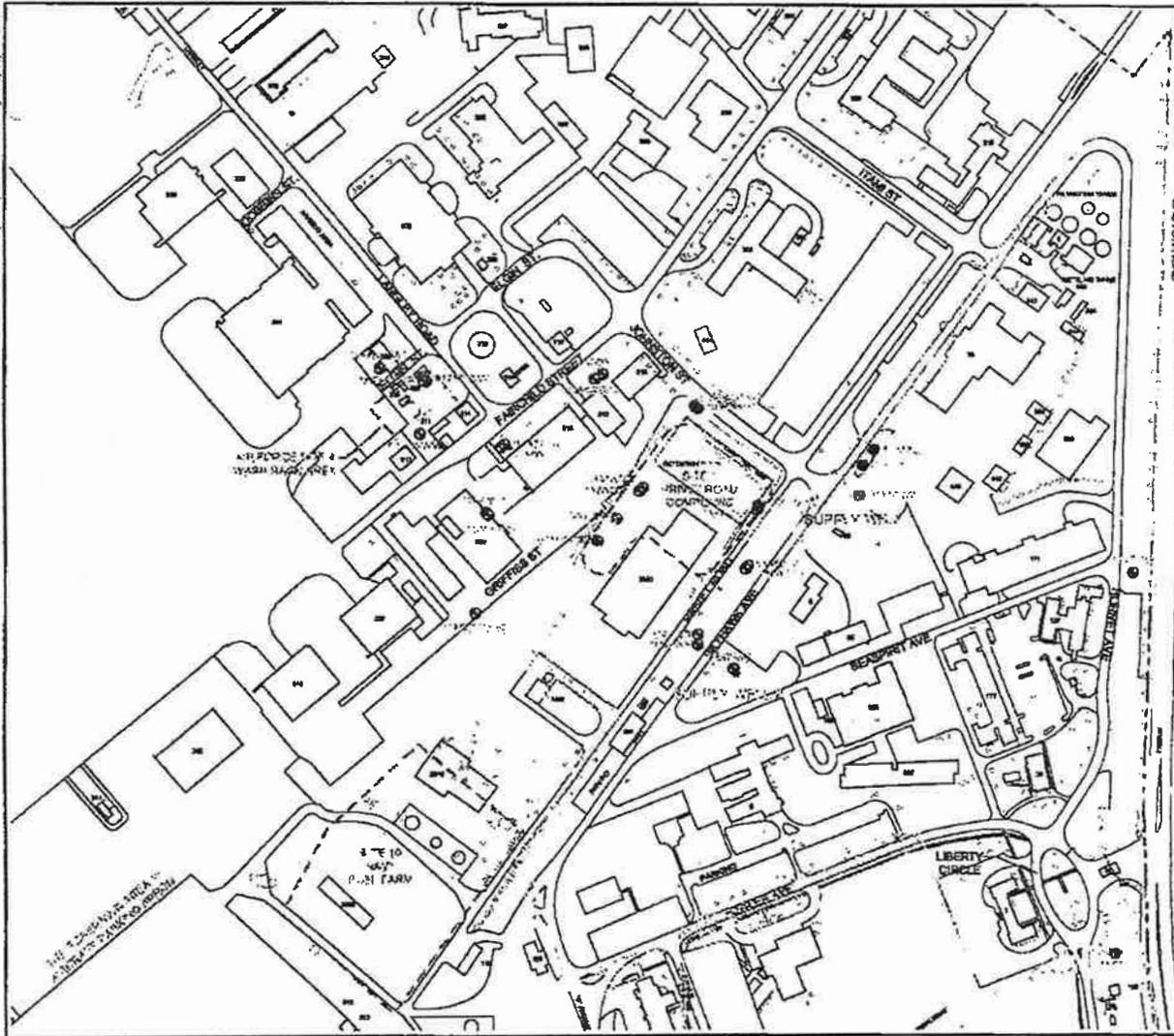
WELL ABANDONMENT

PROJECT <u>NAJRB WILLOW GROVE</u>	LOCATION <u>SITE, PRIVET RD</u>	DRILLER <u>ELITE DRILLERS</u>
PROJECT NO. _____	BORING _____	DRILLING METHOD <u>AIR ROTARY</u>
DATE BEGUN <u>2/22/12</u>	DATE COMPLETED <u>2/22/12</u>	DEVELOPMENT METHOD _____
FIELD GEOLOGIST <u>J.S. TOMALVA</u>	DATUM <u>GROUND SURFACE</u>	
GROUND ELEVATION _____		

ACAD:FORM\_MWDR.dwg 07/28/98 INL

ELEVATION/HEIGHT OF TOP OF SURFACE CASING:	<u>13</u>
ELEVATION/HEIGHT TOP OF RISER:	<u>12.6</u>
TYPE OF SURFACE SEAL:	<u>CONCRETE</u>
I.D. OF SURFACE CASING:	<u>10"</u>
DIAMETER OF HOLE:	<u>10"</u>
RISER PIPE I.D.:	<u>4"</u>
TYPE OF RISER PIPE:	<u>SCH. 40 PVC</u>
TYPE OF BACKFILL:	<u>CEMENT</u>
ELEVATION/DEPTH TOP OF SEAL:	<u>1</u>
ELEVATION/DEPTH TOP OF BEDROCK:	_____
TYPE OF SEAL:	<u>LIKELY BENTONITE</u>
ELEVATION/DEPTH TOP OF SAND:	<u>1</u>
ELEVATION/DEPTH TOP OF SCREEN:	<u>198</u>
TYPE OF SCREEN:	<u>SCH. 40 PVC</u>
SLOT SIZE x LENGTH:	<u>0.070" x 10'</u>
I.D. SCREEN:	<u>4"</u>
TYPE OF SAND PACK:	_____
DIAMETER OF HOLE IN BEDROCK:	<u>10"</u>
CORE/REAM:	<u>AIR ROTARY</u>
ELEVATION/DEPTH BOTTOM SCREEN:	<u>1108</u>
ELEVATION/DEPTH BOTTOM OF SAND:	<u>1108</u>
ELEVATION/DEPTH BOTTOM OF HOLE:	<u>1108</u>
BACKFILL MATERIAL BELOW SAND:	<u>N/A</u>

112G02D14Q001.dwg 10/10/11 MWG



EASTON ROAD

**LEGEND**

- MONITORING WELL LOCATION
- PERIODIC GROUNDWATER MONITORING WELL LOCATION
- BOUNDARY OF INSTITUTIONAL CONTROLS

0 250 500  
SCALE IN FEET



**MONITORING WELL SAMPLE LOCATION MAP**  
**SITE 1 - PRIVET ROAD**  
**NAS JRB WILLOW GROVE**  
**WILLOW GROVE, PENNSYLVANIA**

FILE 112G02D14Q002	SCALE AS NOTED
FIGURE NUMBER FIGURE 1	REV DATE 0 10/10/11



**APPENDIX D**

**VAPOR INTRUSION PATHWAY EVALUATION SUPPORTING DOCUMENTATION**

OSWER VAPOR INTRUSION ASSESSMENT  
 Vapor Intrusion Screening Level (VISL) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Soil Source?	Is Chemical Sufficiently Volatile and Toxic to Pose Inhalation Risk Via Vapor Intrusion from Groundwater Source?	Target Indoor Air Conc. @ TCR = 1E-06 or THQ = 1	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Conc. @ TCR = 1E-06 or THQ = 1	Target Ground Water Conc. @ TCR = 1E-06 or THQ = 1	Is Target Ground Water Conc. < MCL?	Temperature for Groundwater Vapor Conc.	Lower Explosive Limit**	LEL Source	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator	Target Indoor Air Conc. for Carcinogens @ TCR = 1E-06	Target Indoor Air Conc. for Non-Carcinogens @ THQ = 1
		Cvp > Cia.target/AFss?	Cvp > Cia.target/AFgw?	MIN(Cia.c,Cia.nc)		Csq	Cgw	Cqw<MCL?	Tgw or 25	LEL			IUR	RfC	i	Cia,c	Cia,nc	
		Yes/No	Yes/No	(ug/m³)	C/N/C	(ug/m³)	(ug/L)	Yes/No	C	(% by vol)		(ug/m³)⁻¹		(mg/m³)			(ug/m³)	(ug/m³)
x 127-18-4	Tetrachloroethylene	Yes	Yes	9.4E+00	C	9.4E+01	1.3E+01	No (5)	25	8		2.60E-07	I	4.00E-02	I		9.4E+00	4.2E+01
x 79-01-6	Trichloroethylene	Yes	Yes	4.3E-01	C	4.3E+00	1.1E+00	Yes (5)	25		N	see note	I	2.00E-03	I	TCE	4.3E-01	2.1E+00

**OSWER VAPOR INTRUSION ASSESSMENT**

Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cgw (ug/L)	Cia (ug/m <sup>3</sup> )	CR	HQ
127-18-4	Tetrachloroethylene	6.0E+00	4.34E+00	4.6E-07	1.0E-01
79-01-6	Trichloroethylene	1.0E+00	4.03E-01	9.3E-07	1.9E-01

x  
x  
x

Symbol

Value

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
IUR (ug/m <sup>3</sup> ) <sup>-1</sup>		RfC (mg/m <sup>3</sup> )		i
2.60E-07	I	4.00E-02	I	
see note	I	2.00E-03	I	TCE

Symbol

Value

Symbol

Value

**OSWER VAPOR INTRUSION ASSESSMENT**

Indoor Air Concentration to Risk (IAC-Risk) Calculator Version 2.0, May 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column E)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column F)

CAS	Chemical Name	Site Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cia (ug/m <sup>3</sup> )	CR	HQ
x 127-18-4	Tetrachloroethylene		--	--
x 79-01-6	Trichloroethylene		--	--
x	Trichloroethylene			Symbol

Inhalation Unit Risk	IUR Source*	Reference Concentration	RfC Source*	Mutagenic Indicator
(ug/m <sup>3</sup> ) <sup>-1</sup>		(mg/m <sup>3</sup> )		i
2.60E-07	I	4.00E-02	I	
see note	I	2.00E-03	I	TCE
Value	Symbol	Value	Symbol	Value

Chemical Properties for Supporting the VISL

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
			Molecular Weight Mw	source	Vapor Pressure VP	source	Pure Component Water Solubility S	source	MCL (ug/L)	Henry's Law Constant @25°C Hc25	source	Henry's Law Constant @25°C <sup>9</sup> H'25	Henry's Law Constant @ Tgw <sup>9</sup> H'Tgw	Henry's Law Constant Used in Calcs HLC	Henry's Law Constant @ Tgw_GW <sup>9</sup> H'Tgw_GW
3															
4															
5	CAS	Alphabetized List of Compounds	(g/mole)		(mm Hg)		(mg/L)			(atm-m <sup>3</sup> /mol)		(unitless)	(unitless)	(unitless)	(unitless)
140	127-18-4	Tetrachloroethylene	165.83	a	1.85E+01	b	2.06E+02	a	5	1.77E-02	a	7.23E-01	7.23E-01	7.23E-01	7.23E-01
150	79-01-6	Trichloroethylene	131.39	a	6.90E+01	b	1.28E+03	a	5	9.85E-03	a	4.03E-01	4.03E-01	4.03E-01	4.03E-01
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NOTE: Values not currently included in the chemical parameter Regional screening table (see footnote a) were derived following the hierarchy outlined in the Regional Screening Tables User's Guide.  
Available online at: [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/usersguide.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm)

a Based on values reported in the U.S. EPA Regional Screening Tables. May 2012.  
Available online at: [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/Generic\\_Tables/xls/params\\_sl\\_table\\_bwrun\\_MAY2012.xls](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/xls/params_sl_table_bwrun_MAY2012.xls)

b Experimental values. USEPA 2009. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.00. United States Environmental Protection Agency, Washington, DC, USA.  
Available online at: <http://www.epa.gov/opptintr/exposure/pubs/episuite.htm>

c USEPA 1996. Soil Screening Guidance. Attachment C: Chemical Properties for SSL Development. EPA540/R-96/018. July, 1996.

d USEPA 2001. USEPA WATERS, Version 2.0. United States Environmental Protection Agency, Research Triangle Park, NC, USA.  
Available online at: <http://www.epa.gov/tri-chat/software/water/index.html>

e Syracuse Research Corporation (SRC). 2005. PHYSPROP Database. SRC. Syracuse, NY. Available online at: <http://www.syrres.com/what-we-do/databaseforms.aspx?id=386>

f CRC Handbook of Chemistry and Physics, 76th Edition

g National Institute of Standards and Technology (NIST). Chemistry WebBook. Available online at: <http://webbook.nist.gov/chemistry/>

h USEPA, 2001. FACT SHEET Correcting the Henry's Law Constant for Soil Temperature. Attachment.

j Weast, Robert C. CRC Handbook of Chemistry and Physics 1984-1985, 65th edition. Pages F-62 through F-64.

k McKay, D., et al. Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. Second Edition.

kk Chemical-specific MSDS

m These properties are not used for any calculations in the spreadsheet, but are included to maintain consistency with other spreadsheet tools that do use these properties.

mm The Merck Index, 10th Edition

n United States National Library of Medicine. National Institutes of Health. TOXNET Toxicology Data Network. Available online <http://toxnet.nlm.nih.gov/>

nn Weiss, G. Hazardous Chemicals Data Book, Second Edition, Noyes Data Corporation, 1986.

p DECHEMA Web Database, March 2003.

q No chemical property information available for this chemical, although toxicity data are available.

r California Environmental Protection Agency. Consumer Products Solvents Database. Entry for "Aromatic 150". 2004. Available online a <http://www.arb.ca.gov/db/solvents/solvents.htm>

s Calculated as average of m-xylene, o-xylene, and p-xylene isomers.

v Approximated using T<sub>crit</sub> = 1.5 x T<sub>boil</sub>.

Note the "c" at the end of some sources indicates that the value presented in the table is converted from the value included in the reference source.

Chemical Properties for Supporting the VISL

	A	B	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
			Henry's Law Constant Used in Calcs for GW-IA_calc	Vapor Pressure @ Tgw <sup>a</sup>	Diffusivity in air <sup>m</sup>		Diffusivity in water <sup>m</sup>		Normal Boiling Point		Critical Temperature		Enthalpy of vaporization at the normal boiling point		Organic Carbon Partition Coefficient <sup>m</sup>		Lower Explosive Limit			
	CAS	Alphabetized List of Compounds	HLC_GW (unitless)	VPTgw (ug/m3)	Da (cm <sup>2</sup> /s)	source	Dw (cm <sup>2</sup> /s)	source	Tboil (°K)	source	Tcrit (°K)	source	ΔH <sub>v,b</sub> (cal/mol)	source	Koc (cm <sup>3</sup> /g)	source	LEL (% by vol)	source		Alternative Chemical Name 1
140	127-18-4	Tetrachloroethylene	7.23E-01	1.65E+08	5.05E-02	a	9.46E-06	a	3.94E+02	b	6.20E+02	h	8.29E+03	h	9.49E+01	a				
150	79-01-6	Trichloroethylene	4.03E-01	4.88E+08	6.87E-02	a	1.02E-05	a	3.60E+02	b	5.44E+02	h	7.51E+03	h	6.07E+01	a	8	N		
166																				
167			NOTE:																	
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169																				
170			a																	
171																				
172			b																	
173																				
174			c																	
175			d																	
176																				
177			e																	
178			f																	
179			g																	
180			h																	
181			j																	
182			k																	
183			kk																	
184			m																	
185			mm																	
186			n																	
187			nn																	
188			p																	
189			q																	
190			r																	
191			s																	
192			v																	
193																				

**Table 2 Groundwater Screening "Criteria" (ug/L) for Protection of Indoor Air - Residential**

		Pennsylvania GW MSC Used Aquifer	Pennsylvania GW MSC Unused Aquifer	PA Defaults Residential Volatilization to <u>Indoor Air Criteria (a)</u>
	<u>Chemical</u>			
000067-64-1	Acetone	3,700	37,000	NOC
000107-13-1	Acrylonitrile	0.63	63	NA
000078-93-3	2-Butanone (MEK)	2,800	280,000	NA
000071-43-2	Benzene	5	500	3,500
000075-25-2	Bromoform	100	10,000	182,000
000056-23-5	Carbon Tetrachloride	5	50	1,400
000108-90-7	Chlorobenzene	55	5,500	27,400
000067-66-3	Chloroform	100	1,000	414
000124-48-1	Dibromochloromethane	100	10,000	3,750
000095-50-1	1,2-Dichlorobenzene	600	60,000	NOC
000541-73-1	1,3-Dichlorobenzene	600	60,000	NA
000106-46-7	1,4-Dichlorobenzene	75	7,500	8090
000075-34-3	1,1-Dichloroethane	27	270	15600
000107-06-2	1,2-Dichloroethane	5	50	2,770
000075-35-4	1,1-Dichloroethene	7	70	362
000156-59-2	cis-1,2-Dichloroethene	70	700	42100
000156-60-5	trans-1,2-Dichloroethene	100	1,000	59300
000078-87-5	1,2-Dichloropropane	5	50	3850
000100-41-4	Ethyl benzene	700	70,000	NOC
000106-93-4	Ethylene dibromide	0.05	5	NA
000075-09-2	Methylene chloride	5	500	77,000
000108-10-1	Methyl isobutyl ketone	220	22,000	NA
001634-04-4	Methyl-tert-butyl-ether	20	200	228000
000100-42-5	Styrene	100	10,000	NOC
000127-18-4	Tetrachloroethene	5	50	42400
000079-34-5	1,1,2,2-Tetrachloroethane	0.74	74	3680
000108-88-3	Toluene	1,000	100,000	491000
000079-01-6	Trichloroethylene	5	50	14300
000071-55-6	1,1,1-Trichloroethane	200	2,000	NOC
000079-00-5	1,1,2-Trichloroethane	5	50	5350
000075-01-4	Vinyl chloride	2	20	1,780
001330-20-7	Xylenes	10,000	180,000	57400

a/PA defaults using GWSCREEN.XLS version 2.3 03/01 PA Soils parameters; 15 cm to bottom of enclosed space; 150 cm to water table; RL = 10-5; HQ = 1

NOC - Not of concern

NA - Not available

**Note:** Bold face values indicate a COPIAC

**Table 3 Groundwater Criteria/Screen (ug/L) for Protection of Indoor Air: Non-Residential (Commercial/Industrial)**

		Pennsylvania GW MSC Used Aquifer	Pennsylvania GW MSC Unused Aquifer	USEPA-PA Defaults Non-residential Volatilization to Indoor Air Criteria (a)	USEPA-PA Defaults Non-residential PELs Volatilization to Indoor Air Screen (b)
	<u>Chemical</u>				
000067-64-1	Acetone	3,700	37,000	2,300,000,000 (NOC)	NOC
000107-13-1	Acrylonitrile	0.63	63	NA	NA
000078-93-3	2-Butanone (MEK)	2,800	280,000	NA	NA
000071-43-2	Benzene	5	500	9,600	NOC
000075-25-2	Bromoform	100	10,000	310,000	NOC
000056-23-5	Carbon Tetrachloride	5	50	2,400	NOC
000108-90-7	Chlorobenzene	55	5,500	44,000	NOC
000067-66-3	Chloroform	100	1,000	610	NOC
000124-48-1	Dibromochloromethane	100	10,000	6,300	NC
000095-50-1	1,2-Dichlorobenzene	600	60,000	720,000 (NOC)	NOC
000541-73-1	1,3-Dichlorobenzene	600	60,000	NA	NA
000106-46-7	1,4-Dichlorobenzene	75	7,500	2,400,000 (NOC)	NOC
000075-34-3	1,1-Dichloroethane	27	270	760,000	NOC
000107-06-2	1,2-Dichloroethane	5	50	4,600	NOC
000075-35-4	1,1-Dichloroethene	7	70	610	NOC
000156-59-2	cis-1,2-Dichloroethene	70	700	59,000	NOC
000156-60-5	trans-1,2-Dichloroethene	100	1,000	83,000	NOC
000078-87-5	1,2-Dichloropropane	5	50	9,500	NOC
000100-41-4	Ethyl benzene	700	70,000	1,800,000 (NOC)	NOC
000106-93-4	Ethylene dibromide	0.05	5	NA	NA
000075-09-2	Methylene chloride	5	500	130,000	NOC
000108-10-1	Methyl isobutyl ketone	220	22,000	NA	NA
001634-04-4	Methyl-tert-butyl-ether	20	200	NA	NA
000100-42-5	Styrene	100	10,000	2,700,000 (NOC)	NOC
000127-18-4	Tetrachloroethene	5	50	71,000	NOC
000079-34-5	1,1,2,2-Tetrachloroethane	0.74	74	6,200	NOC
000108-88-3	Toluene	1,000	100,000	690,000 (NOC)	NOC
000079-01-6	Trichloroethylene	5	50	24,000	NOC
000071-55-6	1,1,1-Trichloroethane	200	2,000	1,300,000 (NOC)	NOC
000079-00-5	1,1,2-Trichloroethane	5	50	9,000	NOC
000075-01-4	Vinyl chloride	2	20	5,800	2,300,000
001330-20-7	Xylenes	10,000	180,000	740,000 (NOC)	NOC

a/ "PA" defaults using USEPA J&E Version 2.3; 03/01 (Multichemical), Non-Residential receptor, RL = 10-5, HQ = 1

b/ "PA" defaults using USEPA J&E Version 2.3; 03/01 (Multichemical), Non-Residential receptor, PEL

>value indicates that risk-based target greater than constituent water solubility

NA Not available

NC Not calculated

NOC Not of concern, value above constituent water solubility

**Note:** Bold face values indicate a COPIAC