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RECORD OF DECISION
SITE 1 GROUNDWATER

OPERABLE UNIT 3 (OU 3)

NAVAL AIR STATION
JOINT RESERVE BASE
Willow Grove, Pennsylvania

Naval Facilities Engineering Command
Mid-Atlantic
Contract Number N62472-03-D-0057
Contract Task Order 003

September 2008

TETRA TECH

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ACRONYMS

AR	Administrative Record
ARARs	Applicable or Relevant and Appropriate Requirements
ARS	Air Reserve Station
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Constituents of Concern
COPCs	Constituents of Potential Concern
CTE	Central Tendency Exposure
FS	Feasibility Study
FFS	Focused Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ILCR	Incremental Lifetime Cancer Risk
LUC	Land Use Control
MCL	Maximum Contaminant Level
NPDES	National Pollution Discharge Elimination System
NCP	National Contingency Plan
NAS JRB	Naval Air Station Joint Reserve Base
NEESA	Naval Energy and Environmental Support Activity
OU	Operable Unit
PA	Preliminary Assessment
PADEP	Pennsylvania Department of Environmental Protection
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PRAP	Proposed Remedial Action Plan
ppm	Part Per Million
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RfD	Reference Dose
RI	Remedial Investigation

RME	Reasonable Maximum Exposure
ROD	Record of Decision
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TRC	Technical Review Committee
ug/l	Micrograms Per Liter
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

RECORD OF DECISION
NAVAL AIR STATION JOINT RESERVE BASE
OPERABLE UNIT 3
SITE 1—PRIVET ROAD COMPOUND GROUNDWATER

PART I—DECLARATION

I. SITE NAME AND LOCATION

Naval Air Station Joint Reserve Base (NAS JRB)
Site 1—Privet Road Compound
Operable Unit 3 (OU 3)
Horsham Township, Montgomery County
Pennsylvania
ID Number: PAD987277837

II. STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents a selected interim remedial action for Operable Unit 3 (OU 3), groundwater contaminated with the Volatile Organic Compounds (VOCs) tetrachloroethene (PCE) and trichloroethene (TCE) at Site 1, the Privet Road Compound, at the Naval Air Station Joint Reserve Base (NAS JRB), located in Horsham Township, Montgomery County, Pennsylvania.

This remedial action decision was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal bases for selecting the interim remedial action and is based on the Administrative Record for OU 3. Reports and other information used in the remedy selection process are part of the Administrative Record file for OU 3. Copies of these reports are available in the information repository at the Horsham Township Library, 435 Babylon Road, Horsham, Pennsylvania.

The Commonwealth of Pennsylvania Department of Environmental Protection (PADEP) concurs with the selected interim remedy for OU 3 at this site. A review of the public response to the OU 3 Proposed Plan is included in the Responsiveness Summary (Part III) of this decision document.

III. ASSESSMENT OF THE SITE

The response actions selected in this ROD are necessary to protect public health, welfare and the environment from actual or threatened releases of hazardous substances into the environment. If not addressed by implementing the response actions selected in the ROD, contaminants from this site may present an imminent and substantial endangerment to public health, welfare or the environment. Unacceptable human health risk could result from unrestricted exposures to groundwater at Site 1.

IV. DESCRIPTION OF THE SELECTED REMEDY

The selected interim remedy for Site 1 Groundwater (OU 3) is a limited action remedy that includes:

- Land use controls (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 constituents of concern (COCs). A Monitoring Plan will be developed as part of the Remedial Design and submitted for regulatory review and concurrence.

- Since contaminants remain on site above levels that allow for unlimited use and unrestricted exposure, a review of site conditions and risks will be conducted every five years, as required by CERCLA.

V. STATUTORY DETERMINATIONS

The interim action for the groundwater at Site 1 is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed. The Navy and USEPA believe that the selected interim remedy complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action and is cost effective. This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for Site 1 Groundwater (OU 3). Because this action does not constitute the final remedy for Site 1 OU 3, the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principle element will be addressed by the final response action. It is anticipated that an action will be taken to address the off-site source of contamination to the groundwater. Once this is accomplished, a final ROD will be issued addressing the groundwater at Site 1.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is an interim action ROD, review of this site and remedy will be ongoing as the Navy and EPA continue to develop final remedial alternatives for Site 1 Groundwater (OU 3).

VI. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Part II - Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

- Constituents of concern (COCs) and their respective concentrations have been identified.

  Table 1 summarizes the occurrence and distribution and selection of potential COCs Table 2 provides a comparison of COCs to regulatory limits, including the MCL where available. Figure 4 shows COCs that exceed screening levels from the human health risk assessment (HHRA). Figures 5 through 8 show the distribution of TCE and PCE in the groundwater aquifer. Concentrations of COCs in groundwater are discussed on pages II-6 and II-7.
- Baseline risk represented by the COCs has been calculated and summarized in this ROD.

  Table 2 summarizes the risk calculation estimation from the HHRA. Human health risks are discussed on pages II-8 and II-9. Ecological risks are discussed on page II-10.
- Cleanup levels have not been established for this interim groundwater remedy.

  The groundwater contamination source is off-Base. It is anticipated that an action will be taken to address the off-site source of contamination to the groundwater. Once this is accomplished, a final ROD will be issued addressing the groundwater at Site 1.
- Source materials constituting principal threats are located off-Base, off of Navy property, outside of Navy control.

  It is anticipated that an action will be taken to address the off-site source of contamination to the groundwater.
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy.

  Section VI on page II-8 discusses the probable future land use scenarios. Groundwater is currently extracted, treated and distributed to the Air Station for all uses.

  A discussion of the assumptions used in HHRA evaluation is included on pages II-8 and II-9.

- Estimated remedy costs over the period projected.

  The estimated total cost for the Selected Remedy is included on Page II-11 and summarized in Table 4. The actual cost will depend on the amount of time needed to investigate the off-site source and prepare a final ROD.

- The key factor in choosing the interim remedy is the off-site source issue.

  Groundwater contamination does not originate on Navy property as discussed on page II-7. A final remedy will be selected after the off-site source area is addressed, as discussed in Section V on page I-2

- Stipulations to ensure adequacy of LUCs to protect potential receptors from contaminated groundwater during the period of this interim remedy.

  The LUC requirements are discussed in Section XI on page II-14.

Authorizing Signatures

Lead Agency:

5 Sept 2008

Robert F. Lewandowski,
BRAC Environmental Coordinator
Naval Air Station Joint Reserve Base, Willow Grove
BRAC Program Management Office, Northeast

Date

Environmental Protection Agency:

9/29/08

James J. Burke, Director
Hazardous Site Cleanup Division
U.S. EPA Region III

Date

RECORD OF DECISION
Naval Air Station Joint Reserve Base (NAS JRB)
Operable Unit 3
Site 1 Groundwater
Willow Grove, Pennsylvania

PART II—DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

NAS JRB Willow Grove is located in Horsham Township, Montgomery County, in southeastern Pennsylvania, approximately 20 miles north of the city of Philadelphia (Figure 1). NAS JRB Willow Grove occupies approximately 1,000 acres of the 1,200 acres maintained by the Department of Defense (DoD) at the Willow Grove Naval Air and Air Reserve Station (Air Station). The National Superfund electronic database identification number is PAD987277837. The Willow Grove Air Reserve Station (ARS) occupies approximately 200 acres of land in the northeastern section of the Air Station and shares common facilities with NAS JRB Willow Grove. The Air Station is comprised of 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 2 shows the location of Site 1 at NAS JRB Willow Grove.

Site 1, the Privet Road Compound, lies within a heavily developed section of the NAS JRB and is located near the eastern boundary of the Base, adjacent to Privet Road (Figure 2). The compound is currently a grass covered lot that is approximately ½ acre in size located northeast of the Base bowling alley. The suspected former waste handling area covered more than 2 acres, including the present location of the bowling alley and the parking area. Storm water drains from the site by way of two drainage swales along the north and east sides of the site to an underground storm water conduit that discharges to a detention basin located north of Site 1 on ARS property. Storm water from the ARS detention basin discharges via a National Pollution Discharge Elimination System (NPDES) outfall to the Little Neshaminy Creek drainage system north of the Air Station.

II. SITE HISTORY AND ENFORCEMENT ACTIVITY

The 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 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, oil and grease emulsion, paint wastes, volatile organic compounds (VOCs), and polychlorinated biphenyl (PCB) fluids from transformers.

Work undertaken pursuant to CERCLA at NAS JRB Willow Grove includes the Preliminary Assessment (PA), also known as the Initial Assessment Study (IAS), (Naval Energy and Environmental Support Activity (NEESA), 1986); Site Inspection (SI) EA Engineering, 1990); the first and second phases of Remedial Investigation (RI) (Halliburton NUS, 1993; Brown & Root Environmental, 1998); a soil removal action (FWENC, 1999); and additional investigations of the groundwater. The PA identified 16 sites requiring further investigation: seven at the Air Reserve Facility in 1984 and nine at the Naval Air Station in 1986 (NEESA, 1986). One additional site was added to the program in 1988 (EA Engineers and Science, 1990). SI work was performed on 12 of the 17 sites, including Site 1 in 1989. Remedial Investigation/Feasibility Study (RI/FS) activities have subsequently been completed or are underway at eight sites, of which four sites are on Air Force property and four sites are on Navy property, including Site 1. Phase I RI activities have been completed for four Navy sites (Halliburton NUS, 1993). The Phase I RI report characterized the physical and chemical nature of these four Navy sites 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 at Site 1 that began in 1996 and have been reported in the Phase II RI report and Addenda RI reports through 2008. A Focused Feasibility Study (FFS) for Site 1 Groundwater was completed in 2008.

The final Site 1 RI report (TtNUS, 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. 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 had been found. Additional groundwater investigations to further quantify the contribution from historical off-Station source areas were considered warranted.

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 Area. Soil excavation was carried out in three stages until post-excavation confirmation sampling and laboratory analysis demonstrated successful cleanup to the residential level of one part per million (1 ppm) PCB. The contaminated soil was transported off-site for proper disposal. 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.

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 (Figure 3). This source creates a mixed TCE and

PCE plume contributing to the deeper (>160 feet) 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 due to an up gradient, off-Base 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 (TtNUS, 2005).

In 2005, the Navy performed an additional investigation to determine the quality of the groundwater migrating onto the Air Station from up gradient, 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 dip 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 up gradient, off-Base location. The full discussion of the results is contained in the Site 1 RI Addendum 5 - Groundwater Continuing Investigation (TtNUS, January 2008).

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Based on the Site 1 - Privet Road Compound Remedial Investigation and the Focused Feasibility Study for Site 1 Groundwater (TtNUS, 2008), the Navy prepared the Proposed Remedial Action Plan (PRAP) for Site 1 Groundwater (OU3), 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 five years, in April 2008 (TtNUS, 2008). On April 16, 2008, a newspaper notification inviting public comment on the Proposed Plan appeared in *The Intelligencer* newspaper. The newspaper public notice identified the time and location of the public meeting to learn about the Navy's Proposed Plan and the preferred alternative. 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. Copies of the Site 1 Groundwater PRAP were distributed to interested community and RAB members, and it was also made available for public review at the public meeting and in the AR for NAS JRB located at the Horsham Township Public Library. 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. More details about the community involvement in this ROD are described in the Responsiveness Summary, which is Part III of this ROD.

IV. SCOPE AND ROLE OF SITE 1 GROUNDWATER (OU 3)

As with many Superfund sites, there are multiple sources of contamination at NAS JRB Willow Grove. The PCB contamination in the shallow soil at Site 1 (OU 1) was not related to the chlorinated contaminants in groundwater at Site 1 (OU 3). As a result, the Navy and EPA with agreement from PADEP organized the response at Site 1 into two operable units:

- Operable Unit 1: Contamination of soil
- Operable Unit 3: Contamination of the groundwater

The PCB soil removal action for Site 1 soil (OU 1) was performed in 1999, followed by preparation of the Site 1 soil NFA PRAP in 2006. The ROD for OU 1 (Site 1 soil) was signed in September 2006.

This ROD addresses the selected interim remedy for OU 3. OU 3, contamination of groundwater beneath Site 1, will be resolved in accordance with CERCLA and applicable federal and state guidelines. A limited action will be taken as an interim measure to address risks associated with the Site 1 groundwater (OU 3) while EPA investigates the off-site source of groundwater contamination. It is anticipated that action will be taken to address the off-site source of contamination to the groundwater. Once the off-Station VOC source is addressed, a final ROD will be issued for OU 3. This interim action will neither be inconsistent with, nor preclude, implementation of the final remedy.

Other sites at NAS JRB Willow Grove identified as part of the National Priorities List (NPL) site include:

- Site 2—Antenna Field Landfill (OU 5—Site 2 soil; OU 9—Site 2 groundwater)
- Site 3—Ninth Street Landfill (OU 6—Site 3 soil; OU 10—Site 3 groundwater)
- Site 5—Fire Training Area (OU 2—Site 5 groundwater; OU 4—Site 5 soil)

Sites 2, 3, and 5 are in the RI/FS phase of the CERCLA process. At Site 5, a soil removal action (OU 4) was conducted in 1999, and the ROD for OU 4 was signed in September 2007 stating that no further action was required for Site 5 Soil.

Two other sites at the Air Station have been assigned operable unit designations by EPA (OU 8—Navy Fuel Farm and OU 7—Air Force Site 1 Ponding Basin). For OU 8, PADEP is the lead regulatory agency because the contamination source is petroleum, which is excluded from CERCLA. For OU 7, the Air Force is the lead agency.

V. SUMMARY OF SITE CHARACTERISTICS

A. Hydrology

Although a significant portion of the ground surface in the area is covered by impermeable paving material, much of the precipitation during normal weather conditions is believed to infiltrate the soil, due to the relatively gentle slope, intermittent vegetated areas, and (historically) the rutted and uneven nature of the ground surface in the compound area. Storm drainage swales parallel the northeastern and southeastern sides of the compound and intersect at the northern corner of the site. Runoff is prevented from entering the site from the south by grading and a storm drainage channel located along the southern side of Privet Road. Runoff from the compound that enters the drainage swales discharges to the Air Reserve Station storm water detention basin. Water flow from the storm water detention basin follows an unnamed tributary to Park Creek and enters the Little Neshaminy Creek drainage basin.

B. Geology

The geologic interpretation of the Privet Road Compound is based on the subsurface data (boring logs and geophysical logs) obtained during previous site investigations (TtNUS, 2002). The local geology beneath the site is generally consistent with the regional geology discussed in the Remedial Investigation Report for Site 1—The Privet Road Compound (TtNUS, 2002).

Soil and well borings taken during the RI consistently 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). Gravel-rich fill material was encountered within 2 feet of the surface at most locations within the former compound but was not encountered beyond the limits of the suspected waste area.

The maximum depth of the monitoring well boreholes at Site 1 is 100 feet. The bedrock to this depth typically consisted of alternating sequences of siltstone and fine- to medium-grained sandstone. Thin beds of shale and claystone were inconsistently encountered within the compound and the northern portion of the site area. In general, the bedrock lithology beneath Site 1 was more variable than that seen at the other sites investigated during the multi-site remedial investigation. That is, thin and vertically alternating sequences of sandstone, siltstone, and shale (or claystone) were typically encountered, rather than thick vertical sequences generally consisting of only one dominant lithology.

Driller's boring logs for Navy Supply Well No. 1 (396 feet deep) and Navy Supply Well No. 2 (351 feet deep) and the results of the borehole geophysical logging program (USGS, 2001) indicate that the lithology below the depth of investigation of the monitoring well network also is consistent with the regional geology and is generally similar to the lithology described from the shallower monitoring well boreholes. Overall, the rock becomes somewhat coarser grained with increasing depth, and the thickness of the individual lithologic units generally increases, especially below a subsurface depth of about 200 feet.

C. Hydrogeology

The sandstones, shales, and conglomerates of the Triassic Basin are relatively good water-bearing formations. They generally yield abundant supplies to wells (Hall, 1934). The groundwater ranges from soft to hard, and the average hardness is greater than that of most other formations in southeastern Pennsylvania.

The fractured bedrock of the Stockton Formation is a major source of groundwater in the vicinity of NAS JRB Willow Grove (Earth Data Incorporated, 1985). These rocks form a multi-aquifer system of relatively discrete water-bearing zones separated by less permeable zones. Transmissivity and groundwater movement within water-bearing zones are greater parallel to bedding than across bedding. Groundwater can generally be found between 5 and 25 feet below ground surface (bgs).

The groundwater in the area of the Privet Road Compound exists under both unconfined and confined aquifer conditions. Under non-pumping conditions, the hydraulic head within the confined aquifer is higher and the vertical gradient between the two aquifers is oriented upward. Under pumping conditions, the hydraulic head of the confined aquifer within the vicinity of the compound is eventually lowered to a level below the hydraulic head of the unconfined aquifer, which reverses the hydraulic gradient and may induce groundwater flow into the confined aquifer. This reversal of vertical hydraulic gradient does not occur down gradient (northwest) of the compound.

D. Nature and Extent of Contamination

Twelve monitoring wells and four supply wells were sampled for Target Compound List (TCL) VOCs and Target Analyte (TAL) inorganics during the Phase I RI, and 21 monitoring wells and 2 supply wells were sampled for TCL VOCs during the Phase II RI. Figure 4 shows sample locations and concentrations of compounds that exceed human health risk-based screening levels.

Several VOCs were detected in the groundwater samples obtained during both phases of the RI. The most frequently detected compounds were PCE, ranging from 2 ug/l to 53 ug/l in 11 samples, and TCE, ranging from 1 ug/l to 120 ug/l in 26 samples. Figures 5 and 6 show the distribution of TCE

concentrations in the unconfined and confined aquifers, respectively, and Figures 7 and 8 show the distribution of PCE concentrations in the unconfined and the confined aquifers, respectively.

An investigation of the Base supply wells conducted by the United States Geological Survey concluded that the deeper intervals of both Navy supply wells contained significantly more VOCs than the shallower intervals. The lack of VOCs in the soil and their low concentrations in the shallow groundwater indicate that the Privet Road Compound is not a significant source of the VOCs detected in Site 1 groundwater and in the Navy supply wells.

The Navy searched for the primary source of the VOCs during the RI by installing monitoring wells at various depths throughout Site 1 and adjacent areas, by determining the directions of groundwater flow, by researching the land use history of all Base property in the vicinity of Site 1, and by reviewing the publicly available environmental data for off-Base properties located nearby along Route 611.

The RI concluded that the principal contaminants associated with Site 1 groundwater are the VOCs PCE and TCE. VOC compounds occur chiefly in the deep monitoring wells and 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. None of these isolated detections could account for the levels of contamination detected in the deeper Site 1 monitoring wells or in the Base supply wells.

The RI also concluded that the most significant groundwater contamination detected at Site 1 does not originate on the Navy Base. An off-Base property located east of Route 611 (near the former Kellett Aircraft manufacturing facility) was identified as the probable source area and origination point for the contaminant plume. From there, the plume travels with groundwater and flows onto the Base property through a combination of both natural flow conditions and through the pumping effects of the Navy supply wells, which capture some of the off-Base groundwater and draw it onto the Base property.

EPA considers the Air Force Wash Rack (ARS Site SD-4) as an additional potential source to VOC contamination beneath Site 1. PCE and TCE are detected in SD-4 groundwater monitoring wells. The Air Force is currently conducting additional RI work to determine the full nature and extent of contamination at Site SD-4.

VI. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCES USES

Groundwater in the immediate vicinity of Site 1 is the primary source of water supplies for the Air Station. NAS JRB Willow Grove obtains its potable water from two deep water supply wells that are located east of Site 1, on the opposite side of Privet Road (Figure 4). The water produced from these wells contains VOCs at concentrations above the regulatory-permitted levels. 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 Navy supply wells is treated by air stripping to remove VOCs before use. Specific reuse plans for Site 1 after Base Closure, however, are not known at this time. However, the BRAC law allows for the establishment of an enclave for the Air National Guard. Additionally, it authorized the establishment of an Armed Forces Reserve Center for Army Reserve Units relocated to NAS JRB Willow Grove by other BRAC recommendations. Subsequent legislation authorized the transfer of NAS JRB Willow Grove property to the Air Force for the establishment of a Joint Interagency Installation for use by the Pennsylvania National Guard and other DoD components and government agencies.

VII. SUMMARY OF SITE RISKS

A. Baseline Human Health Risk Assessment

A baseline human health risk assessment (HHRA) was performed in 1997 for the Phase II RI to characterize the potential risks to human receptors under current and potential land uses. A review and limited update of the 1997 HHRA was performed in 2005 and presented in the Site 1 RI Addendum 2 for Groundwater Technical Memorandum of Risk Assessment Evaluation (TtNUS, 2005). The review concentrated on the changes in the methodology for evaluating risks to hypothetical residents since these receptors were identified as the critical receptors in the 1997 HHRA.

Groundwater concentrations were initially compared to EPA MCLs and Region 3 EPA Risk-Based Concentrations (RBCs) for tap water in order to be protective of all receptors exposed to groundwater and to identify the constituents of potential concern (COPCs). Chemicals were eliminated from consideration as a COPC if the maximum detected concentration did not exceed the lesser of the MCL and the RBC screening value determined at a carcinogenic risk level of 1×10^{-6} or a non-carcinogenic Hazard Quotient (HQ) of 0.1, or if site concentrations were not greater than background (inorganics only). The selected COPCs for groundwater are listed in Table 1, and include the VOCs chloroform, carbon tetrachloride, PCE, and TCE, and the metals arsenic, barium, chromium, lead, and manganese. The results of this screening-level assessment indicated that the potential risks associated with the Site 1 groundwater were above acceptable levels.

The potential receptors evaluated in the initial HHRA included current occupational workers (adult full-time worker employed at NAS JRB Willow Grove year round), current adolescent and adult trespassers, future excavation workers, future recreational children, and future residents. The updated HHRA concentrated on the hypothetical residents, since they were identified as the critical receptors in the initial study. The risk evaluation assumed that potential human receptors would be exposed to the COPCs in Site 1 groundwater via ingestion, dermal contact while bathing or showering, and inhalation of airborne vapors while showering.

The quantitative HHRA evaluated each potential receptor under a reasonable maximum exposure (RME) scenario. RME incorporates input parameters into the exposure scenarios that are representative of the highest exposure that is reasonably expected to occur at a site.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risks were determined for each receptor by multiplying a daily dose by the chemical-specific cancer slope factor. Cancer slope factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. Pursuant to 40 CFR Section 300.430 (e)(2)(i)(A)(*2*), EPA's maximum acceptable carcinogenic risk range for site-related exposure is $1x\ 10^{-6}$ to $1x\ 10^{-4.}$ This equates to an increased risk over and above the background cancer rate of one in one million to one in ten thousand that a receptor will develop cancer in his or her lifetime as a result of exposure to chemicals present at this site.

Non-carcinogenic risks are presented in the form of HQs, which are determined by dividing the daily dose of a chemical by the published reference dose (RfD). RfDs have been developed by EPA and represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health.

The RME cancer risks and non-cancer hazard indices are summarized in Table 2. The HHRA results indicated that the estimated RME incremental lifetime cancer risks (ILCRs) for the lifetime resident (2×10^{-4}) exceeded the maximum guideline risk range. Arsenic and PCE were the major contributors to the ILCR for the lifetime resident.

The RME non-carcinogenic risk for adult residents (HI = 1.2) was equal to the acceptable value. The HI for child residents (HI = 2.7) exceeded unity, although the HIs for the individual target organs were all less than unity.

B. Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) was performed to characterize the potential risks from site-related contaminants to ecological receptors that inhabit the installation (TtNUS, 2002).

There are no ecological risks associated with the Site 1 groundwater because the groundwater does not discharge to the surface in the vicinity of the site or interact with any surface water bodies. There are no ecological receptors exposed to Site 1 groundwater. Consequently, the potential for ecological impacts from site-related contaminants is negligible.

VIII. REMEDIAL ACTION OBJECTIVES

The HHRA concluded that under a future residential land use scenario, the exposure to contaminated groundwater through ingestion, dermal contact, and inhalation would pose potential carcinogenic risks exceeding EPA's target risk range for the lifetime resident.

The remedial action objective for Site 1 groundwater is to protect the health of future groundwater users by preventing their contact with groundwater that is contaminated with VOCs at concentrations greater than the regulatory benchmark levels, which are listed in Table 3.

IX. DESCRIPTION OF ALTERNATIVES

A Focused Feasibility Study was conducted to identify and evaluate remedial alternatives for contaminated groundwater found in the unconfined and the confined aquifers beneath Site 1. The NCP and the EPA RI/FS guidance present a broad framework for the formulation, evaluation, and selection of remedial alternatives for uncontrolled hazardous waste sites. In this case, since the source of groundwater contamination is known to be off-Base, a focused set of response actions has been developed.

A. Alternative 1: No Action

The no-action alternative was developed as a baseline case, as required by the NCP. The only activity conducted under this alternative is a review of site conditions and risks every five years.

The purpose of the no-action alternative is to evaluate the overall human health and environmental risk

posed by the site in its present state. Under this alternative, no remedial actions would be taken to protect human health or the environment. No measures would be implemented to remove or contain the groundwater VOC plume, to prevent potential human exposure to site groundwater, or to mitigate contaminant migration in the environment. The estimated present worth cost of this alternative is $43,156 over a 30-year period.

Existing Features - Currently, site features offer limited protection of human health and the environment. The primary protective features are that the site is under military control and the groundwater underlying Site 1 is treated to remove contamination prior to its use as a potable water supply. As a result, there is currently no pathway for human exposure to VOC-contaminated groundwater. However, following Base closure, site groundwater could conceivably be used as a potable water supply without being treated, posing a potential excess human health risk.

Five-Year Reviews - Since contaminants remain on the site above levels that allow for unlimited use and unrestricted exposure, a review of site conditions and risks would be conducted every five years, as required by CERCLA.

B. Alternative 2: Limited Action

Alternative 2 involves no treatment but provides protection to human health through the establishment of land use controls to limit human exposure to contaminants. This alternative includes the implementation of land use controls and periodic groundwater monitoring in conjunction with a review of site conditions and risks every five years. The present worth cost of this remedy is $ 248,471 over a 30-year period.

Land Use Controls - Land use restrictions will be identified in a Navy document that identifies the restriction on the use of site groundwater prior to and following the closure of the Base, and transfer of the property.

In the event the affected property is transferred to another federal agency, this land use control will be included in the Department of Defense Form 1354, Transfer and Acceptance of Military Real Property. This agreement transfers care and custody of real property owned by the Department of Defense to other federal agencies. The receiving agency will be bound by the same environmental restrictions as the Navy. These restrictions will be identified in an Environmental Summary Document, which will be incorporated by reference into the transfer agreement.

Land use controls will consist of deed restrictions that prohibit the use of untreated groundwater for drinking if the property is transferred to a non-Federal entity.

Periodic Groundwater Monitoring – periodic groundwater sampling will be conducted to ensure the Navy and regulatory agencies have the data necessary to evaluate and ensure the remedies' protectiveness.

Five-Year Reviews - Since contaminants remain on site above levels that allow for unlimited use and unrestricted exposure, a review of site conditions and risks will be conducted every five years, as required by CERCLA. Upon property transfer, this requirement will be transferred to the property recipient.

X. COMPARATIVE ANALYSIS OF ALTERNATIVES

Comparisons of the remedial alternatives are made to identify differences between the alternatives and how site contaminant threats are addressed. The two alternatives are compared with respect to each of the evaluation criteria, and differences are identified. Table 4 presents summaries of the comparative analysis for each alternative.

Overall Protection of Human Health and the Environment

Alternative 1 would not provide adequate protection of human health or the environment because no actions would be taken to prevent human exposure to groundwater or to mitigate migration of contaminated groundwater. Therefore, the No Action alternative will not be considered further in this analysis, since it does not satisfy this criterion.

Alternative 2 would provide protection of human health through implementation of groundwater use restrictions and periodic groundwater monitoring. The effectiveness of this alternative for interim protection of human health would be dependent on maintenance and enforcement of land use controls.

Compliance with ARARs

Because the remedy selected in this ROD will be an interim action, it is not necessary to achieve 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. Alternative 2 would implement land use controls restricting the use of untreated groundwater from Site 1. The implementation of land use controls does not invoke any ARARs. ARARs requiring the achievement of MCLs in the groundwater will be met by the final remedy.

Because this interim action is limited to land use controls and monitoring, no action-specific ARARs were identified. The site is not in a sensitive location; therefore, no location-specific ARARs apply.

Long-Term Effectiveness and Permanence

Alternative 2 offers long-term protection of human health through the use of land use controls that place limitations on use of contaminated groundwater as drinking water. Periodic groundwater monitoring proposed under Alternative 2 ensures that the Navy and regulatory agencies have the data necessary to evaluate and maintain the protective features of this remedy. The effectiveness of these controls depends on enforcement. If groundwater use restrictions were not enforced, protection of human health would not be achieved.

Five-year reviews would be required to assess changes in site conditions and groundwater use.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2 would not reduce groundwater contamination through treatment. (Until the (off-Base) groundwater contaminant source has been remediated, the reduction of groundwater contamination through natural processes would be expected to continue.)

Short-Term Effectiveness

The implementation of LUCs and groundwater monitoring under Alternative 2 would not adversely impact the surrounding community or the environment.

Implementability

The prohibition on use of untreated groundwater and periodic groundwater monitoring proposed under Alternative 2 would be readily implemented through the design and establishment of LUCs and through subsequent monitoring and enforcement.

Regulatory and technical personnel are available to perform the five-year reviews effectively.

Cost

The costs associated with each alternative are provided in Table 4. Alternative 2 would be more expensive to implement than Alternative 1 because of the land use controls and periodic groundwater monitoring proposed under Alternative 2.

XI. SELECTED REMEDY

The Navy and EPA have selected Alternative 2: Limited Action as the interim remedy for Site 1 groundwater (OU 3) which includes the implementation of land use controls and periodic groundwater monitoring in conjunction with a review of site conditions and risks every five years. Land use controls would be identified in a Navy document that identifies the restriction on the use of site groundwater prior to and following the 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. Figure 9 shows the proposed LUCs, groundwater use restriction area.

Although the Navy may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall remain ultimately responsible for remedy integrity and shall: i) perform CERCLA 121(c) five-year reviews; ii) notify the appropriate regulators and/or local government representatives of any known LUC deficiencies or violations; iii) provide access to the property to conduct any necessary response; iv) retain the ability to change, modify or terminate LUCs and any related deed or lease provisions; and, v) ensure that the LUC objective is met to maintain remedy protectiveness.

As a condition of property transfer or lease, the Navy may require the transferee or lessee in cooperation with other stakeholders to assume responsibility for various implementation actions. Third party LUC responsibility will be incorporated into pertinent contractual, property and remedial documentation, such as a purchase agreement, deed lease, and RD addendum. To the extent permitted by law, 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. If the Navy intends to transfer ownership of a site, the Navy may, if Federal and/or State law allows, upon transfer of fee title grant the State an environmental covenant or easement that would allow the State to enforce LUC terms and conditions against the transferee(s), as well as subsequent property owner(s) or user(s) or their contractors, tenants, lessee or other parties. This covenant will be incorporated by reference in the transfer deed and will run with the land in accordance with State realty law. This state enforcement right would supplement, not replace, the Navy's right and responsibility to enforce the LUCs.

However, in the event that the affected property is transferred to another federal agency, this interim remedy will be included in the Department of Defense Form 1354, Transfer and Acceptance of Military Real Property. This agreement transfers care and custody of real property owned by the Department of Defense to other federal agencies. The receiving agency will be bound by the same environmental restrictions as the Navy. These restrictions will be identified in an Environmental Summary Document, which will be incorporated by reference into the transfer agreement. The receiving federal agency will

assume ultimate responsibility for all implementation, maintenance, reporting and enforcement of the interim remedy.

XII. STATUTORY DETERMINATIONS

Under CERCLA §121(b) and the NCP, the selected remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), be cost effective, use permanent solutions and alternative treatment technologies to the maximum extent practical, and satisfy the preference for active cleanup. The Navy and EPA have selected Alternative 2 as the interim remedy for Site 1 groundwater (OU 3) consistent with CERCLA and the NCP statutory requirements. The following sections discuss how the selected interim remedy meets these statutory requirements.

Protection of Human Health and the Environment

Under the selected interim remedy, LUCs will be implemented to protect human health and the environment by preventing exposure to untreated contaminated groundwater. Because contaminants remain onsite above levels that allow for unlimited use and unrestricted exposure, a review of site conditions and risks will be conducted every five years, as required by the NCP. Additionally, periodic groundwater sampling will be conducted to ensure the Navy and regulatory agencies have the data necessary to evaluate and ensure the protectiveness of the remedy.

Compliance with ARARs

Because the selected remedy is an interim action, it is not necessary to achieve 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.

Cost-Effectiveness

Because Site 1 is not the source of the contamination in the deep aquifer, it is not feasible or appropriate to attempt to clean up this aquifer at this location. EPA is investigating the off-site source of groundwater contamination with the intent of addressing the contamination at the source. Hence, the selected interim remedy is cost-effective and represents a reasonable value for the money to be spent.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

This selected remedy is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for Site 1 Groundwater (OU 3). The interim action is not designed or expected to be final; however, the selected remedy represents the best balance of trade-offs among alternatives with respect to pertinent criteria, given the limited scope of the action.

Five-Year Review Requirements

Because the selected interim remedy will result in groundwater contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is protective of human health and the environment.

XIII. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes from the Proposed Plan appear in this ROD.

RECORD OF DECISION
Naval Air Station Joint Reserve Base (NAS JRB)
Operable Unit 3
Site 1 Groundwater
Willow Grove, Pennsylvania

PART III - RESPONSIVENESS SUMMARY

The purpose of this Responsiveness Summary is to review public response to the Proposed Plan for Site 1 groundwater. It also documents the consideration of comments during the decision-making process and provides answers to any comments raised during the public comment period.

The Responsiveness Summary for Site 1 groundwater is divided into the following sections:

- **Overview** - This section briefly describes the remedial alternative recommended in the Proposed Plan and any impacts on the Proposed Plan due to public comment.

- **Background on Community Involvement** - This section describes community relations activities conducted with respect to the area of concern.

- **Summary of Major Questions and Comments** - This section summarizes oral and written comments received during the public meeting and the public comment period.

I. OVERVIEW

This Responsiveness Summary addresses public response to the Limited Action Proposed Plan for Site 1 groundwater. The Proposed Plan and other supporting information are maintained for public review in the Administrative Record file for Site 1, which is maintained at the Horsham Township Public Library, 435 Babylon Road, Horsham, Pennsylvania.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

This section provides a brief history of community participation in the investigation and interim remedial planning activities conducted for Site 1. Throughout the investigation period, USEPA and PADEP reviewed work plans and reports and provided comments and recommendations, which were incorporated into appropriate documents. A Technical Review Committee (TRC), consisting of representatives from the Navy, USEPA, the PADEP, and other agencies and local groups surrounding NAS JRB Willow Grove, was formed. The TRC later was transformed into the Restoration Advisory Board (RAB) to include community

members, as well as the original officials from the TRC. The RAB has been holding periodic meetings to maintain open lines of communication with the community and to inform all parties of current activities.

On April 16, 2008, a newspaper notification inviting public comment on the Proposed Plan appeared in *The Intelligencer* newspaper. The newspaper public notice identified the time and location of the public meeting to learn about the Navy's Proposed Plan and the preferred alternative. At the public meeting, the Navy announced the time frame for the public comment period as well as the address to which written comments could be sent. The public comment period ran from April 16, 2008 to May 30, 2008. No written comments were received. At the public meeting, the Navy explained that a copy of the Proposed Plan, along with the entire Administrative Record (AR) file, was available for public review at the Navy's Information Repository. The Information Repository had been housed at the Horsham Township Public Library, 435 Babylon Road, Horsham, Pennsylvania.

The public meeting was held on April 30, 2008 at 6:00 PM at the Horsham Township Public Library, 435 Babylon Road, Willow Grove, Pennsylvania. At this meeting, representatives from the Navy, USEPA and PADEP were available to answer questions concerning Site 1 Groundwater and the preferred alternative.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS

A. Written Comments

During the public comment period from April 16, 2008 to May 30, 2008, no written comments were received from the public pertaining to Site 1.

B. Public Meeting Comments

Questions or comments concerning Site 1 Groundwater received from the public at the April 30, 2008 public meeting are presented with the government response:

1. Mr. Lindhult asked if the soil removal had gone down to the bedrock.

   Response: Mr. Frye said he didn't think that the soil removal reached bedrock which is at an approximate depth of 15 feet.

2. Mr. Lindhult asked at what depth the water table was found.

   Response: Mr. Turner answered that the depth to the water table was about 20 feet.

3. Mr. Lindhult asked if there were any down gradient receptors past the Site 1 wells, in the down gradient groundwater flow direction to the north.

Response: Mr. Turner answered that, historically, the Air Force had a couple of wells in the area, but the wells stopped pumping when the Air Force realized that they were contaminated.

4. Mr. Lindhult commented that was likely how the contamination got past the two wells, because the wells were deep and the pumps were set deep. The ground water beneath Site 1 was being drawn back due to the pumping wells and drawing water from off site.

Response: Mr. Kilmartin answered that the contaminant plume was being pulled onto the Base by the pumping of the supply wells.

5. Mr., Myers asked if there had been any change in the water quality in the two perimeter wells.

Response: Mr. Kilmartin answered that the wells were new and did not have an extensive sampling history.

6. Mr. Myers asked if the 1,200 tons of soil removed were replaced, and with what.

Response: Mr. Frye answered yes and that the area of the soil removal action was near the bowling alley. Mr. Turner answered that the contaminated soil was replaced with certified clean fill.

7. Ms. Cunningham, with US EPA, gave an update of EPA's progress in conducting site assessment of a potential source in the vicinity of the former Kellet Aircraft Corporation. The site assessment is in its early stages and they are still reviewing existing information and obtaining site access.

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TABLES

TABLE 1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
SITE 1 - PRIVET ROAD COMPOUND
NASJRB WILLOW GROVE, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Nondects[2]	Concentration Used for Screening[3]	Above Background Concentration[4]	EPA Region 3 RBCs for Tap Water[5]	MCL[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
Site 1	**Volatile Organic Compounds**													
	71-55-6	1,1,1-Trichloroethane	0.5 J	6	ug/L	10MW27	2/25	10	6	NA	320 N	200	No	BSL
	75-34-3	1,1-Dichloroethane	0.2 J	0.8 J	ug/L	10MW27-D	2/25	10	0.8	NA	90 N	NA	No	BSL
	75-35-4	1,1-Dichloroethene	0.1 J	4	ug/L	10MW27	2/25	10	4	NA	35 N	7	No	BSL
	56-23-5	**Carbon Tetrachloride**	0.2 J	0.2 J	ug/L	10MW27-D	1/25	1 - 10	0.2	NA	**0.16 C**	5	**Yes**	ASL
	67-66-3	**Chloroform**	0.1 J	0.2 J	ug/L	10MW27, 10MW28	2/25	10	0.2	NA	**0.15 C**	80	**Yes**	ASL
	127-18-4	**Tetrachloroethene**	2 J	36	ug/L	01MWNW1_19970708	8/25	1 - 10	36	NA	**0.1 C**	**5**	**Yes**	ASL
	540-59-0	Total 1,2-Dichloroethene	0.2 J	5 J	ug/L	01MW07I_19970627	3/25	1 - 10	5	NA	5.5 N	NA	No	BSL
	79-01-6	**Trichloroethene**	0.1 J	37	ug/L	01MW07I_19970627	16/25	10	37	NA	**0.026 C**	**5**	**Yes**	ASL
	Semi-Volatile Organic Compounds													
	117-81-7	Bis(2-Ethylhexyl)Phthalate	2 J	2 J	ug/L	10MW28	1/2	6 - 9	2	NA	4.8 C	6	No	BSL
	Inorganics													
	7429-90-5	Aluminum	19.1	3430	ug/L	01MW05S_19910923-F	6/18	8.6 - 135	3430	NA	3700 N	NA	No	BSL
	7440-36-0	Antimony	0.81 K	0.98	ug/L	10MW27	2/18	45	0.98	NA	1.5 N	6	No	BSL
	7440-38-2	**Arsenic**	3.6	4.2	ug/L	01MWNW1B_19911007	2/18	0.85 - 3.2	4.2	NA	**0.045 C**	10	**Yes**	ASL
	7440-39-3	**Barium**	15	474	ug/L	10MW28	15/18	20 - 155	474	NA	**260 N**	2000	**Yes**	ASL
	7440-41-7	Beryllium	0.16	4	ug/L	5 SAMPLES	7/18	0.05 - 9	4	NA	7.3 N	4	No	BSL
	7440-70-2	Calcium	12300	56500	ug/L	10MW28	18/18	---	56500	NA	NA	NA	No	NUT
	7440-47-3	**Chromium**	1.3	18	ug/L	01MW05I_19910923-F	3/18	7 - 11	18	NA	**11 N[8]**	100[9]	**Yes**	ASL
	7440-48-4	Cobalt	10	17	ug/L	01MW05S_19910923-F	2/18	0.15 - 10	17	NA	73 N	NA	No	BSL
	7440-50-8	Copper	0.49	37	ug/L	01MW05S_19910923-F	3/18	6 - 35	37	NA	150 N	1300[10]	No	BSL
	7439-89-6	Iron	23.6	576 J	ug/L	01MW02I_19910924	4/18	14.6 - 177	576	NA	1100 N	NA	No	BSL
	7439-92-1	**Lead**	1	18	ug/L	01MW04I_19910923	11/18	0.5 - 1	18	NA	**15 [11]**	MCL[10]	**Yes**	ASL
	7439-95-4	Magnesium	3780	27500	ug/L	01MWNW1A_19911007-D	18/18	---	27500	NA	NA	NA	No	NUT
	7439-96-5	**Manganese**	2.3	981	ug/L	01MW05S_19910923-F	14/18	1 - 2	981	NA	**73 N[12]**	NA	**Yes**	ASL
	7440-02-0	Nickel	3.1	26	ug/L	01MW04S_19910923-F	4/18	12 - 26	26	NA	73 N	NA	No	BSL
	7440-09-7	Potassium	1490 J	38700	ug/L	01MW05I_19910923-F	11/18	2140	38700	NA	NA	NA	No	NUT
	7782-49-2	Selenium	1.1	1.2	ug/L	10MW27-D	2/16	0.85 - 20	1.2	NA	18 N	50	No	BSL
	7440-23-5	Sodium	9840	28500	ug/L	01MW06S_19910924-F	18/18	---	28500	NA	NA	NA	No	NUT
	7440-62-2	Vanadium	0.58	0.58	ug/L	10MW28	1/9	0.12 - 4	0.58	NA	3.7 N	NA	No	BSL
	7440-66-6	Zinc	2	187	ug/L	10MW27	7/18	2 - 47	187	NA	1100 N	NA	No	BSL

Footnotes

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - No background data are available for groundwater.
5 - The EPA Region 3 tap water screening level is presented. Value represents the risk based tap water screening level divided by 10 to correspond to a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag), or an incremental cancer risk of 1.0E-6 for carcinogens (denoted with a "C" flag) (USEPA Region III, April 2005).
6 - USEPA Primary Drinking Water Standard (USEPA, Winter 2004). The values presented are based on MCLs or SMCLs and are presented for reference purposes only.
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level. Chemicals selected as COPCs are indicated by shaded chemical names.
8 - The RBC for tap water for hexavalent chromium is presented. The RBC for trivalent chromium is 55,000 ug/L.
9 - Value presented is for total chromium.
10 - The MCL for this parameter is actually a treatment technique. The SDWA action level (at the tap) has been presented.
11 - No RBC is available. The Action Level promulgated under the Safe Drinking Water Act is used for screening purposes.
12 - The RBC for tap water calculated using the RfD-oral for manganese nonfood is presented.

Definitions:
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value
K = Value estimated with a high bias
MCL = Maximum Contaminant Level
N = Noncarcinogen
NA = Not Applicable/Not Available
RBC = Risk Based Concentration

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level and site background.

For elimination as a COPC:
BSL = Below Screening Level
NUT = Essential Nutrient

TABLE 2

SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 1 - PRIVET ROAD COMPOUND
NASJRB WILLOW GROVE, PENNSYLVANIA

Receptor	Media	Exposure Route	Cancer Risk	Individual Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Individual Chemicals Contributing to a Target Organ HI > 1
Child Residents	Groundwater	Ingestion	6E-05	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Trichloroethene	2	Target Organs HI < 1
		Dermal Contact	1E-05	- -	- -	Tetrachloroethene	0.2	- -
		Total	7E-05	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Trichloroethene	2	Target Organs HI < 1
Adult Residents	Groundwater	Ingestion	1E-04	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Trichloroethene	1	- -
		Dermal Contact	3E-05	- -	Tetrachloroethene	- -	0.09	- -
		Inhalation	3E-06	- -	- -	- -	0.005	- -
		Total	1E-04	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Trichloroethene	1	- -
Lifetime Residents (Child and Adult)	Groundwater	Ingestion	2E-04	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Trichloroethene	NA	- -
		Dermal Contact	4E-05	- -	Tetrachloroethene	Carbon Tetrachloride	NA	- -
		Inhalation	3E-06	- -	- -	Chloroform	NA	- -
		Total	2E-04	- -	Tetrachloroethene, Arsenic	Carbon Tetrachloride, Chloroform, Trichloroethene	NA	- -

TABLE 3
COMPARISON OF GROUNDWATER CONCENTRATIONS TO REGULATORY CRITERIA
SITE 1- PRIVET ROAD COMPOUND
NASJRB WILLOW GROVE, PENNSYLVANIA

COC	MAXIMUM DETECTION (ug/l)	LOCATION OF MAX. DETECTION	FEDERAL SDWA (ug/l)[1]	PADEP MSC (ug/l)[2]	RBC VALUE (ug/l)[3]
Arsenic	4.2	01MWNW1B	10 (MCL)	50 (MCL)	0.045
Barium	474	10MW28	2000 (S)	2000 (S)	260
Chromium	18	01MW05I	100 (MCL)	100(MCL)	11
Lead	18	01MW04I	15 (AL)	5	15[4]
Manganese	981	01MW05S	--	--	73
Carbon Tetrachloride	0.2J	10MW27-D	5 (MCL)	5	0.16
Chloroform	0.2J	10MW27, 10MW28	--	100	0.15
PCE	36	10MWNW1	5 (MCL)	5 (MCL)	0.1
TCE	37	01MW07I	5 (MCL)	5 (MCL)	0.026

[1] Federal Maximum Contaminant Levels (MCLs). Source: National Primary Drinking Water Regulations, 40 CFR Parts 141.61 and 141.62. SDWA = Safe Drinking Water Act; S = Secondary MCL; AL = Action Level.

[2] Pennsylvania Department of Environmental Protection (PADEP) Medium-specific concentrations (MSCs), November 24, 2001 for used or currently planned for use aquifers, residential land use, and total dissolved solids (TDS) less than 2,500 ug/l. MCL = Maximum Contaminant Level; H = Lifetime Health Advisory Level; G = Ingestion; N = Inhalation; S = Aqueous solubility cap. With Periodic Updates and Changes.

[3] EPA Region 3 Risk-Based Concentrations for Tap Water. Source: EPA Region 3 RBC Table, April 2006. The RBC values for tap water are based on maximum carcinogenic risk of 1E-6 or Hazard Quotient of 1.0.

[4] No RBC is available. The action Level promulgated under the Safe Drinking Water Act is used for screening purposes.

Bold = Risk-based Constituent of Concern for site-related groundwater.
ug/l = microgram per liter.

TABLE 4
SITE 1 GROUNDWATER (OU 3) COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
NAS JRB WILLOW GROVE, PENNSYLVANIA

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTION
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Prevent Human Exposure to Contaminated Groundwater	Would not provide adequate protection against human exposure to contaminated groundwater. CERCLA five-year review would provide the Navy and regulatory bodies the opportunity to review site conditions and perform additional remedial actions if they become warranted.	LUCs would minimize potential exposure to site groundwater by prohibiting the use of untreated groundwater from the designated LUC area. CERCLA five-year review and periodic groundwater monitoring would provide the Navy and regulatory bodies the opportunity to review site conditions and perform additional remedial actions if they become warranted.
Mitigate Migration of VOC Contaminated Groundwater	No actions taken to reduce migration of contaminated groundwater.	Same as Alternative 1.
COMPLIANCE WITH ARARS*		
Chemical-Specific ARARs	Would not comply with MCLs.	Would not comply with MCLs.
Location-Specific ARARs	Not applicable.	Not applicable.
Action-Specific ARARs	Not applicable.	Not applicable.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Existing risks would remain.	Implementation and enforcement of LUCs would reduce risks from exposure to site groundwater to acceptable levels.
Adequacy and Reliability of Controls	No new controls implemented.	Long-term enforcement of LUCs would be required to ensure their effectiveness for preventing use of contaminated groundwater.
Need for Five-Year Review	Review would be required since groundwater contaminants would be left in place.	Review would be required since groundwater contaminants would be left in place.

TABLE 4
SITE 1 GROUNDWATER (OU 3) COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
NAS JRB WILLOW GROVE, PENNSYLVANIA

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTION
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT		
Treatment Process Used	None.	None.
Amount Treated or Destroyed	None.	None.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction, since no treatment would be employed.	Same as Alternative 1.
Irreversible Treatment	Not applicable.	Not applicable.
Statutory Preference for Treatment	No.	No.
SHORT-TERM EFFECTIVENESS		
Community Protection	No risk to community anticipated.	Same as Alternative 1.
Worker Protection.	Not applicable.	Same as Alternative 1.
Environmental Impacts	No adverse impacts to the environment anticipated.	Same as Alternative 1.
Time Until Action is Complete	Not applicable.	Six months.
IMPLEMENTABILITY		
Ability to Construct and Operate	No construction or operation involved.	Same as Alternative 1.
Ease of Doing More Action if Needed	Additional actions would be easily implemented if required.	Same as Alternative 1.
Ability to Monitor Effectiveness	Five-year reviews would provide assessment of changes in site conditions.	Periodic groundwater monitoring and five-year reviews would provide assessment of contaminant presence, migration, and changes in site conditions.
Ability to Obtain Approvals and Coordinate with Other Agencies	None required.	Same as Alternative 1.
Availability of Treatment, Storage Capacities, and Disposal Services	None required.	Same as Alternative 1.
Availability of Equipment, Specialists, and Materials	Personnel and equipment available for implementation of five-year reviews.	Personnel and equipment available for placement of LUCs, periodic monitoring and implementation of five-year reviews.
Availability of Technology	Not required.	Not required.

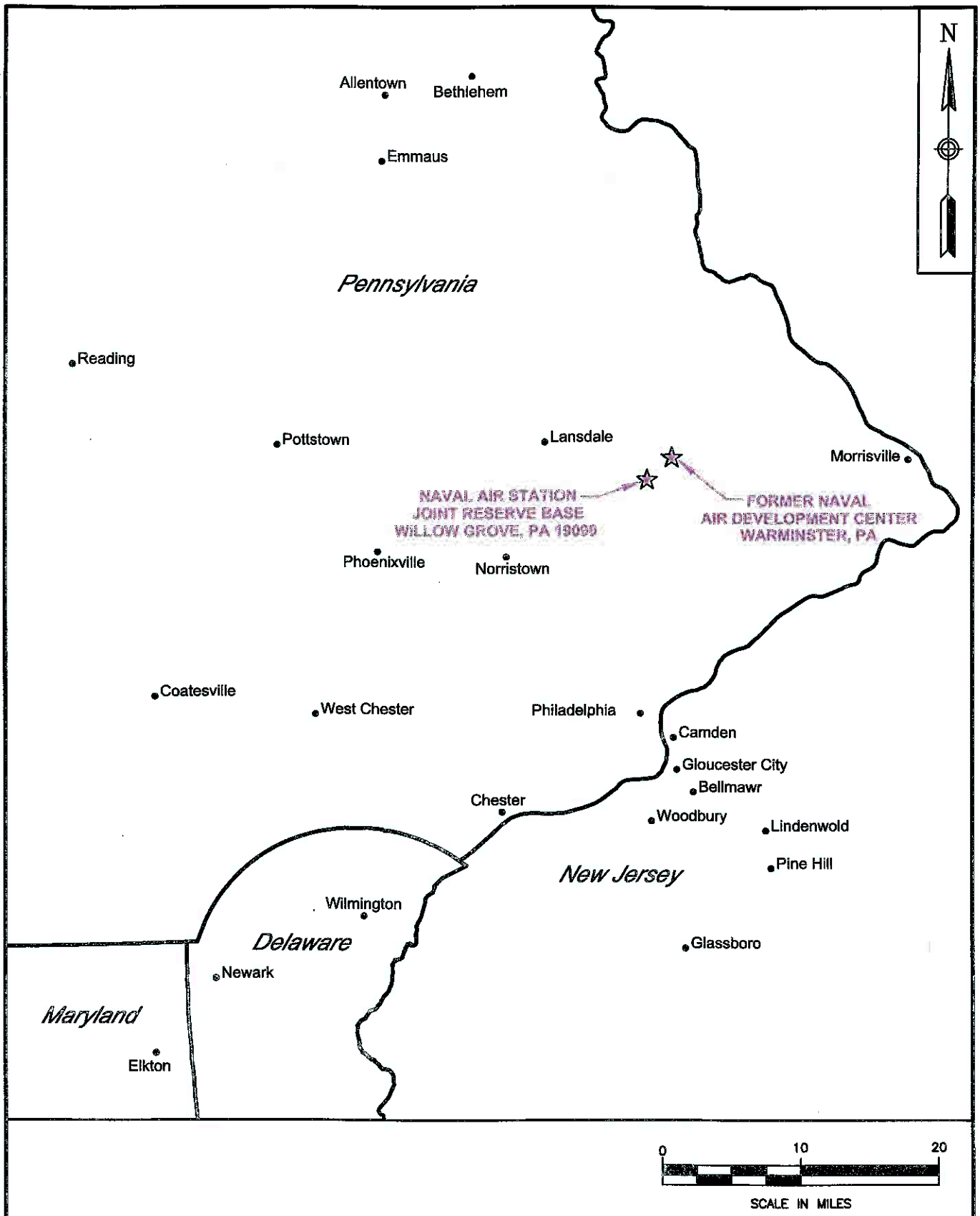
TABLE 4
SITE 1 GROUNDWATER (OU 3) COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
NAS JRB WILLOW GROVE, PENNSYLVANIA

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTION
COST		
Capital Cost	0	$56,790
Annual LUCs Inspection & Report	0	$5,000
Periodic Groundwater Monitoring	0	$13,482
Five-Year Reviews	$20,000	$20,000
Present Worth Cost**	$43,156	$248,471

*Interim remedy is not required to meet ARARs
**Present worth cost is based on discount rate of 7%

FIGURES

2192 WillowGrove\1226\2192CM01.DWG 08/18/08 MKB



0 10 20

SCALE IN MILES

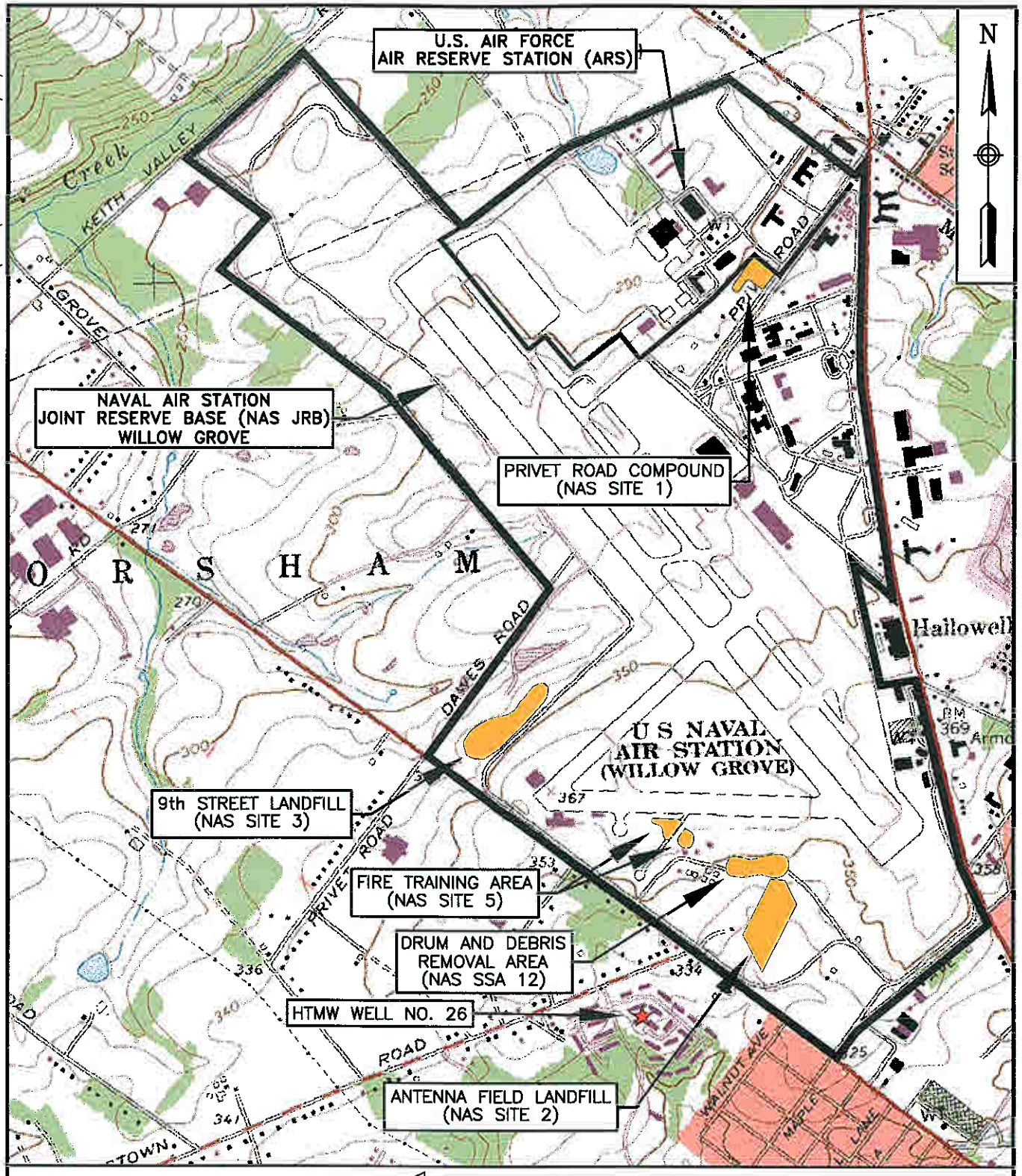
TETRA TECHNUS, INC.

LOCATION OF NAS JRB WILLOW GROVE

WILLOW GROVE, PENNSYLVANIA

SCALE	AS NOTED
FILE	2192CM01.DWG
REV	0
DATE	06/13/08
FIGURE NUMBER	FIGURE 1

2192 WillowGrove\1226\2192CM01.DWG 08/18/08 MKB



BASE MAP IS A PORTION OF THE AMBLER, PA U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 1963, PHOTOREVISED IN 1983.

QUADRANGLE LOCATION

0 1500 3000

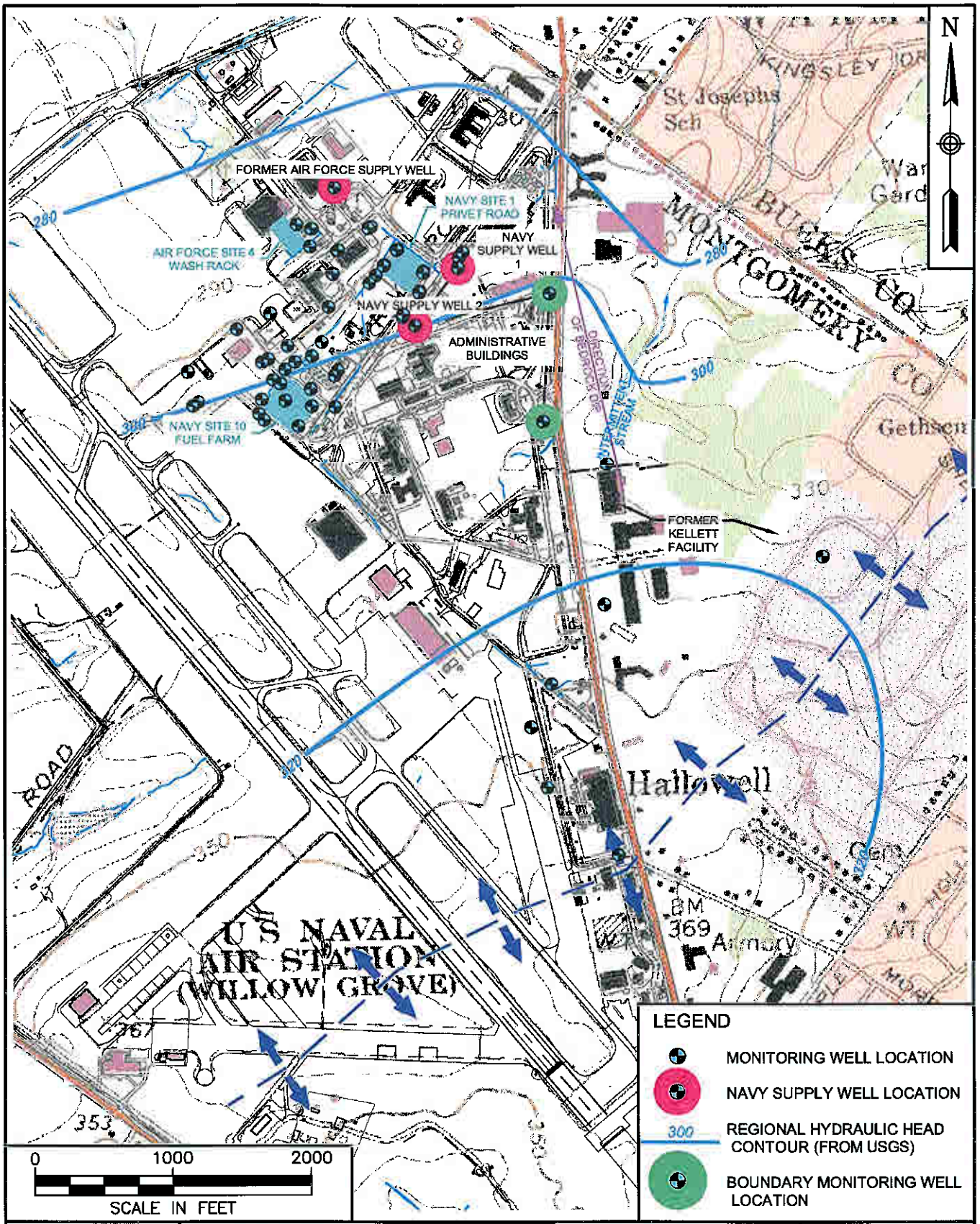
SCALE IN FEET

TETRA TECHNUS, INC.

LOCATION OF RI SITES
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

SCALE	AS NOTED
FILE	2192CM01.DWG
REV	0
DATE	06/13/08
FIGURE NUMBER	FIGURE 2

2192 WillowGrove\1226\2192GM01.DWG 08/18/08 MKB



LEGEND

- MONITORING WELL LOCATION
- NAVY SUPPLY WELL LOCATION
- 300 REGIONAL HYDRAULIC HEAD CONTOUR (FROM USGS)
- BOUNDARY MONITORING WELL LOCATION

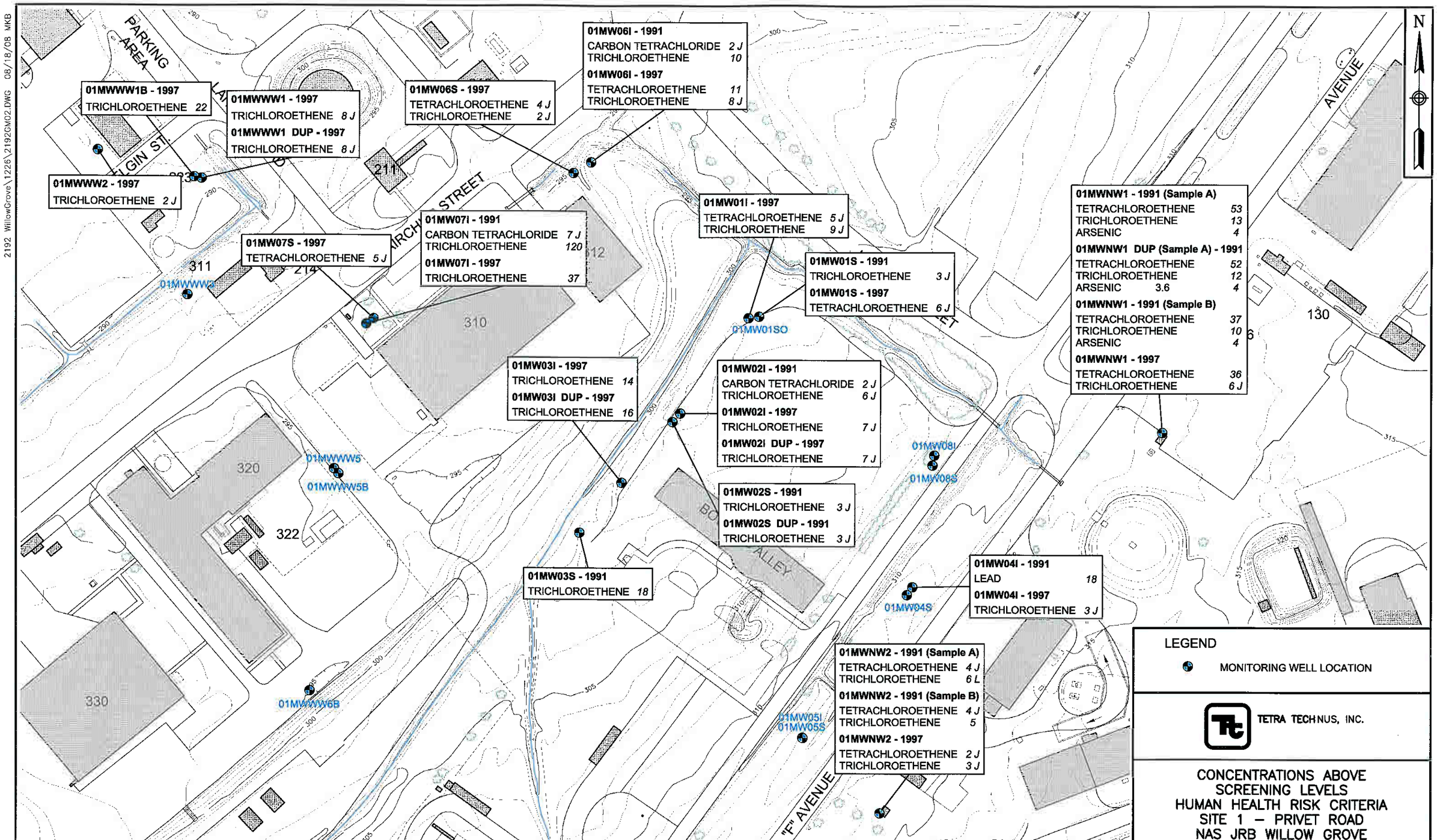
0 1000 2000
SCALE IN FEET

TETRA TECHNUS, INC.

NAS JRB SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

SCALE	AS NOTED
FILE	2192GM01
REV	0
DATE	08/18/08
FIGURE NUMBER	FIGURE 3

2192 WillowGrove\1226\2192GM02.DWG 08/18/08 MKB



LEGEND

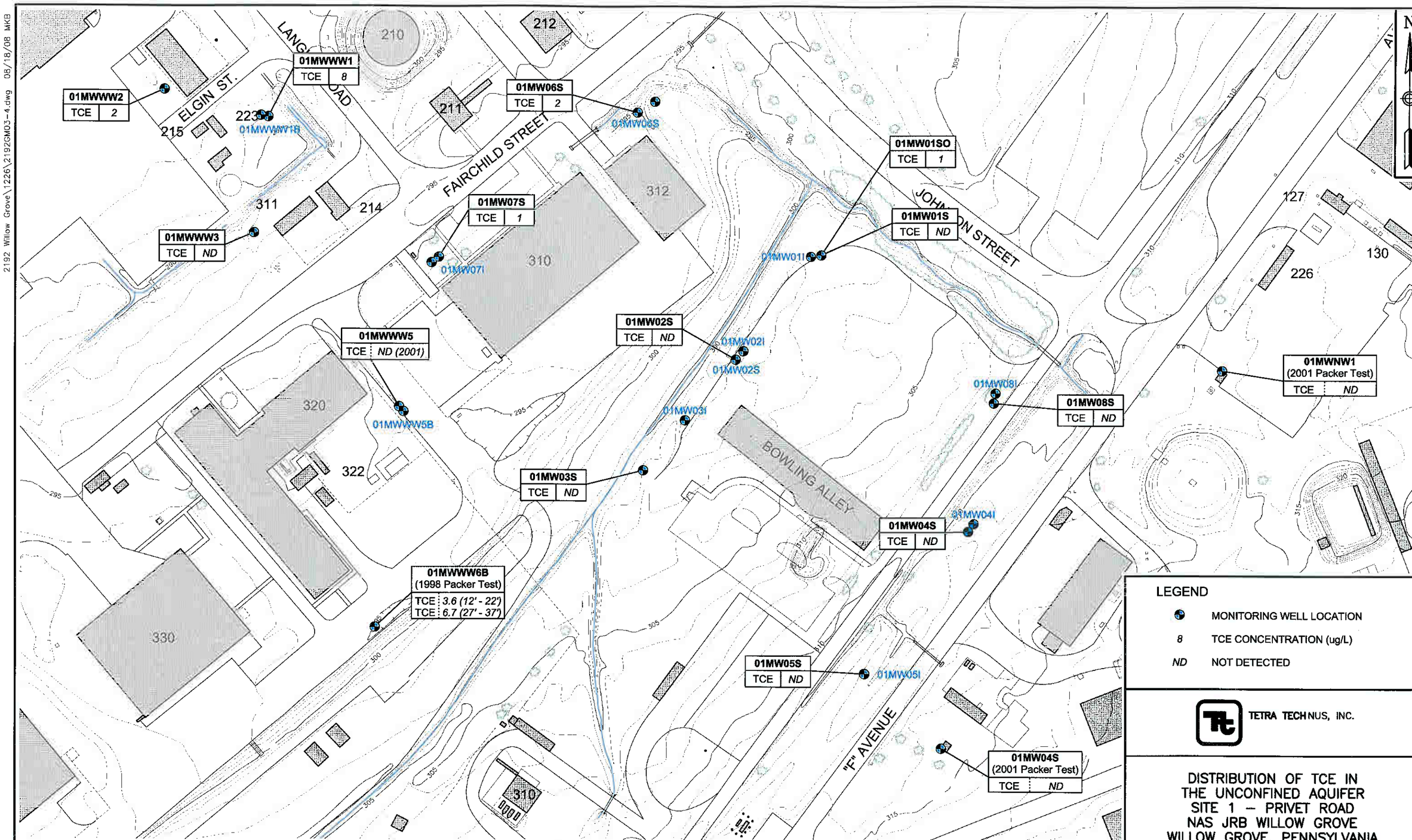
MONITORING WELL LOCATION

TETRA TECHNUS, INC.

CONCENTRATIONS ABOVE SCREENING LEVELS
HUMAN HEALTH RISK CRITERIA
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE	SCALE
2192GM02.DWG	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 4	0 / 08/18/08

2192 Willow Grove\1226\2192GM03-4.dwg 08/18/08 MKB



LEGEND

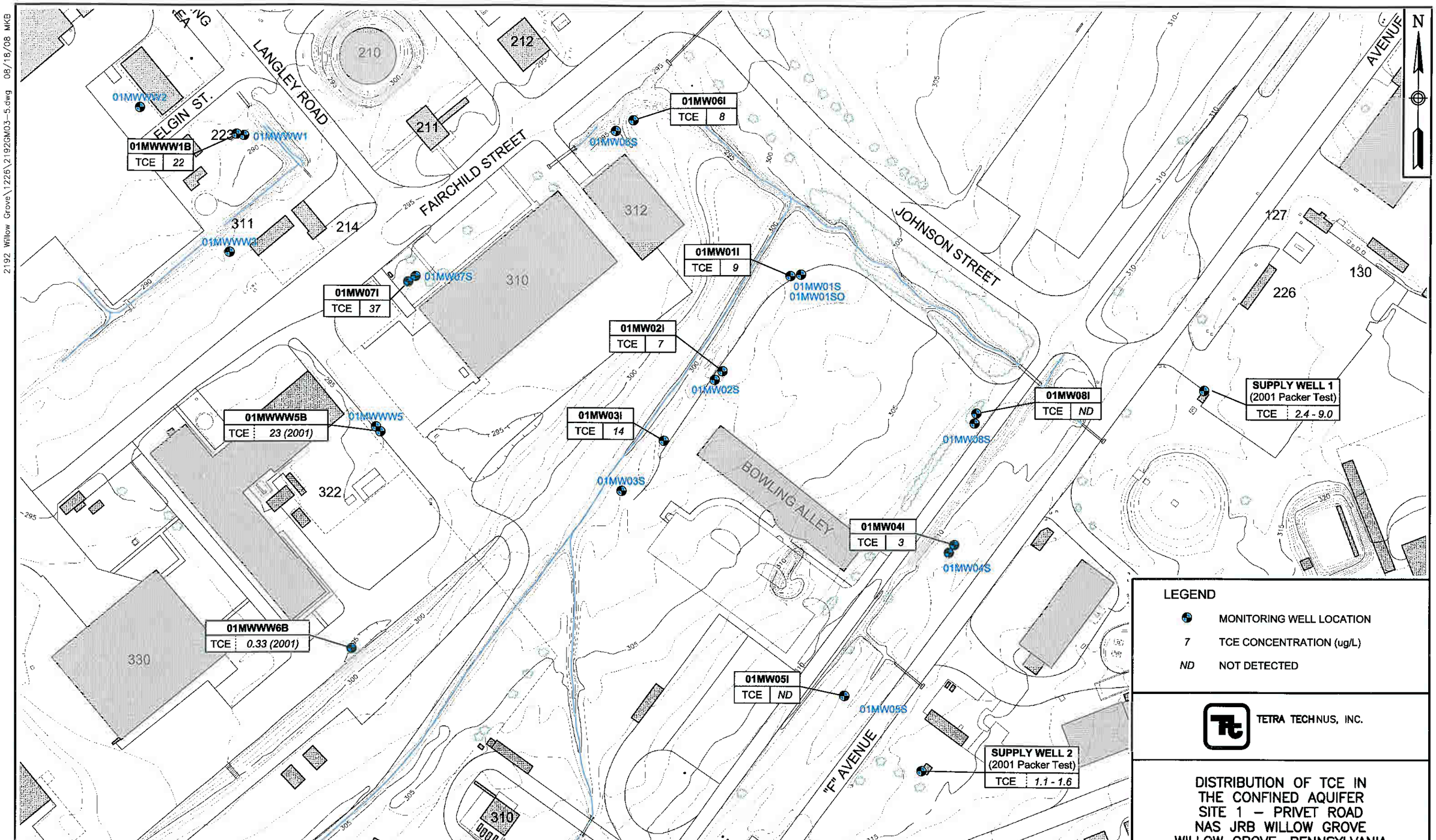
●	MONITORING WELL LOCATION
8	TCE CONCENTRATION (ug/L)
ND	NOT DETECTED

TETRA TECH NUS, INC.

DISTRIBUTION OF TCE IN
THE UNCONFINED AQUIFER
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE 2192GM03-4.DWG	SCALE AS NOTED
FIGURE NUMBER FIGURE 5	REV 0 DATE 08/18/08

2192 Willow Grove\1226\2192GM03-5.dwg 08/18/08 MKB



LEGEND

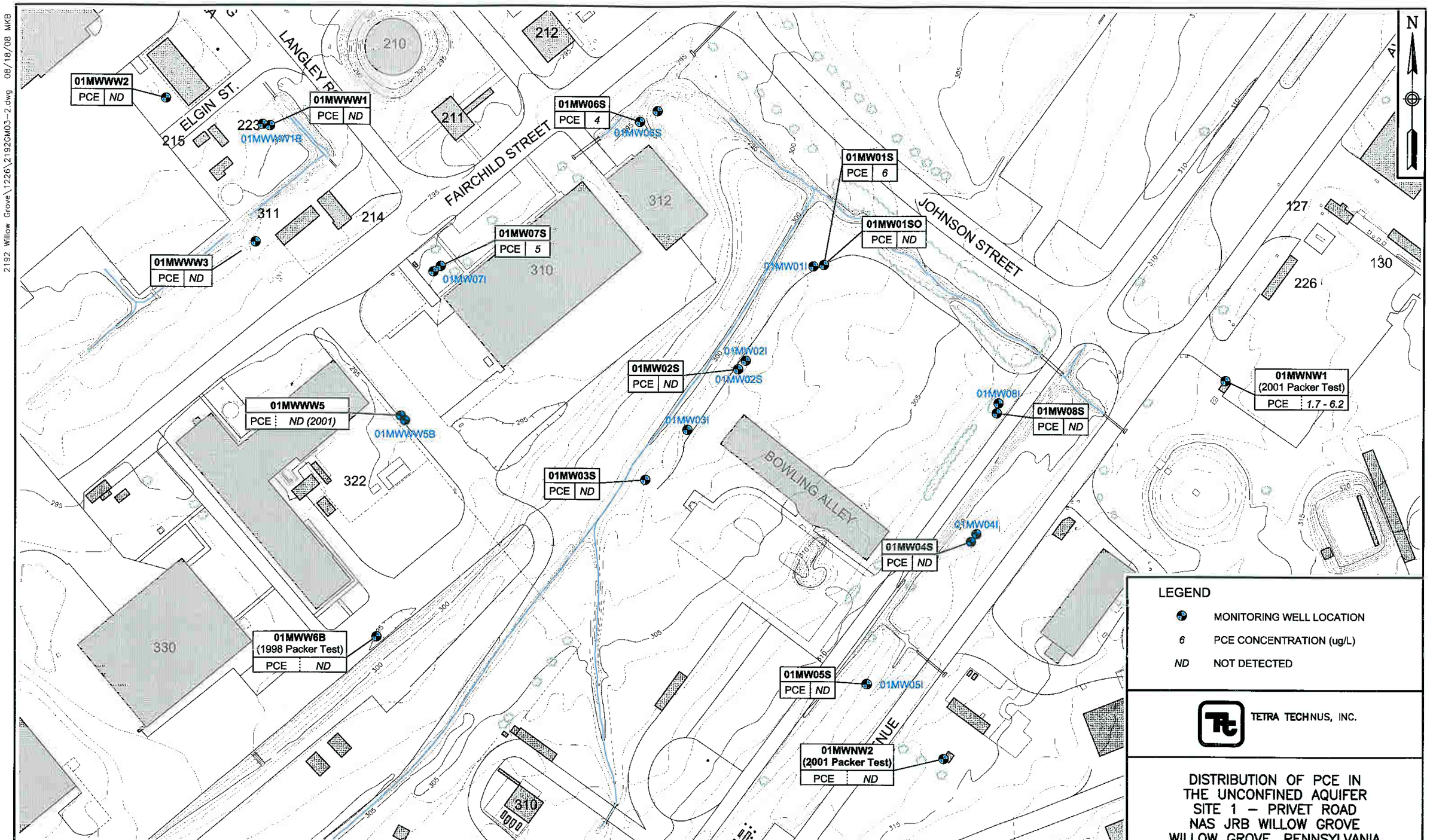
- MONITORING WELL LOCATION
- 7 TCE CONCENTRATION (ug/L)
- ND NOT DETECTED

TETRA TECHNUS, INC.

DISTRIBUTION OF TCE IN
THE CONFINED AQUIFER
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE	SCALE
2192GM03-5.DWG	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 6	0 / 08/18/08

2192 Willow Grove\1226\2192GM03-2.dwg 08/18/08 MKB



LEGEND

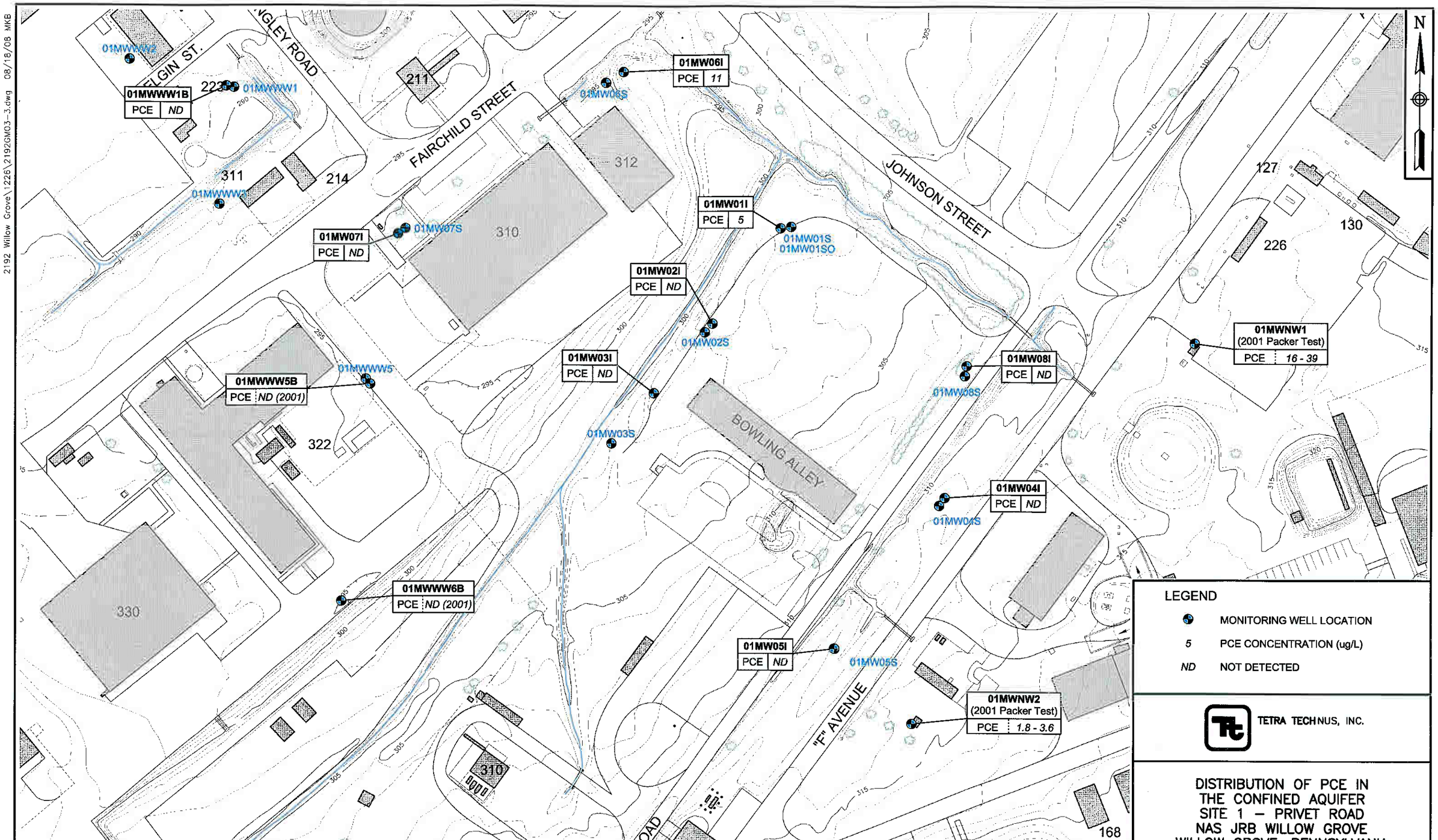
●	MONITORING WELL LOCATION
6	PCE CONCENTRATION (ug/L)
ND	NOT DETECTED

TETRA TECH NUS, INC.

DISTRIBUTION OF PCE IN
THE UNCONFINED AQUIFER
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE	SCALE
2192GM03-2.DWG	AS NOTED
FIGURE NUMBER: FIGURE 7	REV: 0 / DATE: 08/18/08

2192 Willow Grove\1226\2192GM03-3.dwg 08/18/08 MKB



LEGEND

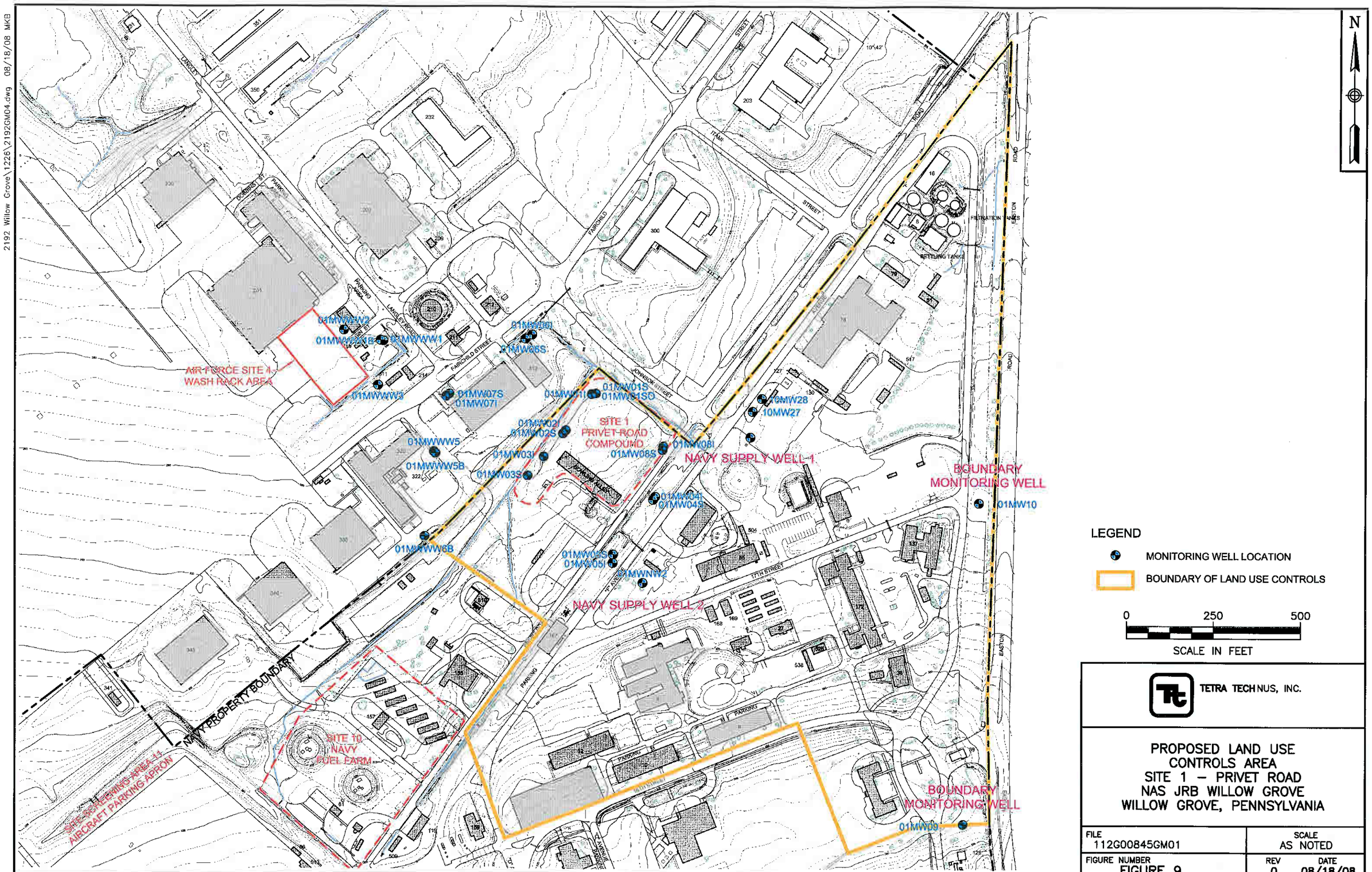
- MONITORING WELL LOCATION
- 5 PCE CONCENTRATION (ug/L)
- ND NOT DETECTED

TETRA TECH NUS, INC.

DISTRIBUTION OF PCE IN
THE CONFINED AQUIFER
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE	SCALE
2192GM03-3.DWG	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 8	0 / 08/18/08

2192 Willow Grove\1226\2192GM04.dwg 08/18/08 MKB



LEGEND

MONITORING WELL LOCATION

BOUNDARY OF LAND USE CONTROLS

0 250 500

SCALE IN FEET

TETRA TECH NUS, INC.

PROPOSED LAND USE CONTROLS AREA
SITE 1 – PRIVET ROAD
NAS JRB WILLOW GROVE
WILLOW GROVE, PENNSYLVANIA

FILE	SCALE
112G00845GM01	AS NOTED
FIGURE NUMBER: FIGURE 9	REV 0 / DATE 08/18/08