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NAWC WARMINSTER
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Department of the Navy

Record of Decision for OU-9

Naval Air Warfare Center **June 2000**

DECLARATION

SITE NAME AND LOCATION

Naval Air Development Center (8 Waste Areas)
Area A Soils, Surface Water, and Sediment (Operable Unit 9)
Warminster Township
CERCLIS ID No. PA6170024545

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Area A soils, surface water, and sediment (Operable Unit 9 or OU-9), at the Naval Air Development Center (NADC) (the "Site") in Warminster, Pennsylvania. This determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for the Site.

In January 1993, the Site was renamed as the Naval Air Warfare Center (NAWC) Aircraft Division Warminster. NAWC was disestablished on September 30, 1996 and is targeted for transfer to the privat sector.

The Commonwealth of Pennsylvania, as represented by the Pennsylvania Department of Environmental Protection (PADEP), concurs with the selected remedy for OU-9 at the Site (Appendix C).

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect human health, public w lfare, or the environment from actual or threatened rel ases of hazardous substances into the environment.

DESCRIPTION OF THE SELECTED REMEDY

Area A soils, surface water and sediment have been defined as Operable Unit 9 (OU-9) at the Site.

Groundwater underlying and downgradient of Area A has been designated as Area A groundwater and is being addressed separately under Operable Unit 1 (OU-1). An interim remedy ROD for OU-1 was issued in September 1993. A ROD addressing the final remedy for Area A groundwater will be issued in the future.

Soils associated with Area A (OU-9) do not include any source materials constituting a principal threat as defined by the NCP. Therefore, the Selected Remedy does not address such a threat.

The major components of the Selected Remedy for OU-9 are:

1. Erosion controls to ensure that surface soils exceeding concentrations protective of sediment do not migrate to the unnamed tributary of Little Neshaminy Creek.

2. Institutional controls in the form of deed restrictions to ensure permanent maintenance of the erosion controls.

3. Institutional controls in the form of deed restrictions to require prior approval by the Navy and/or EPA of any plans for excavation within specified portions of Area A where subsurface soils exceed concentrations protective of sediment.

4. Institutional controls in the form of deed restrictions prohibiting non-industrial use of the Area A parcel.

5. Periodic monitoring to identify maintenance activities required for erosion controls and to ensure adherence to deed restrictions.

6. Periodic stream monitoring to identify the extent of any contaminant loading to the stream, to assess the ecological effects of any such loading, and to determine the nature of any necessary actions based on these evaluations.

The deed restrictions are to be included in the deed(s) entered into for transfer of property from the Navy to the next property owner.

STATUTORY DETERMINATIONS

The selected remedy for OU-9 is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable.

Based on the nature of contamination at OU-9, the Navy concluded that it was impracticable to treat the chemicals of concern (COCs) associated with Area A sediment in a cost-effective and implementable manner. Thus, the selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances 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, or will be, protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of the ROD. Additional information may be found in the Administrative Record for NAWC Warminster.

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risks represented by the COCs.
- Current and reasonably anticipated future land use assumptions used in the risk assessment.
- Potential land use that will be available at the site as a result of the selected remedy.
- Estimated capital; operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy (i.e., how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)

Thomas C. Ames

Thomas C. Ames
BRAC Environmental Coordinator
Naval Air Warfare Center
Naval Air Warfare Center, Warminster

6/22/00
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
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6/26/00
Date

DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

The former Naval Air Development Center is located in Warminster Township and Ivyland Borough, Bucks County, Pennsylvania. The National Superfund electronic database identification number for the Naval Air Development Center is PA6170024545. The Naval Air Development Center was renamed the Naval Air Warfare Center (NAWC) Aircraft Division in January 1993 and was disestablished on September 30, 1996, in response to the requirements of the Base Realignment and Closure Act (BRAC). The Department of the Navy is the lead agency and EPA is the support agency for CERCLA activities at NAWC. The Department of Defense is the source of cleanup monies for NAWC. Soils in Area A and surface water and sediment downgradient of Area A (hereafter referred to as "Area A soils, surface water, and sediment") have been identified as Operable Unit 9 at NAWC and are addressed by this ROD. Area A includes the locations of three sites reported by the Navy in 1980 to have been used for disposal of wastes which contain CERCLA hazardous substances – Site 1, Site 2, and Site 3. Site 1 and Site 3 were both reportedly burn pits where a variety of wastes were disposed, while Site 2 was reported to be a trench used for the disposal of industrial wastewater treatment sludges. Remedial investigations subsequently identified additional sources of hazardous substance releases in the vicinity of Sites 1, 2, and 3, including the former location of eight impoundments used for storage of wastewater treatment sludges. The area which includes Sites 1, 2, and 3 and these additional potential sources of hazardous substance releases has been defined as Area A. Remedial investigations of groundwater at the Site determined that releases of hazardous substances to groundwater have occurred within Area A. The groundwater contamination of concern has been defined as Area A groundwater and is being addressed under Operable Unit 1.

II. SITE HISTORY

NAWC is an 824-acre facility located in Warminster Township, Northampton Township and Ivyland Borough, Bucks County, Pennsylvania (see Appendix B, Figure 1). Per the Base Realignment and Closure Act (BRAC), NAWC ceased operations on 30 September 1996. The majority of NAWC, including Area A, is being transferred to the private sector.

The facility lies in a populated suburban area surrounded by private homes, various commercial and industrial activities, and a golf course. On-base areas include various buildings and other complexes connected by paved roads, the runway and ramp area, mowed fields, and a small wooded area.

The Navy purchased the western portion of the base, including OU-9, in July 1944. Before the Navy purchase, the property contained an aircraft manufacturing facility operated by the Brewster Aeronautical Corporation. Aircraft manufacturing and modification remained the primary mission at the base until 1949. After 1949, the overall mission of the base underwent a change from a manufacturing operation to a research and development operation. Those activities varied over the years, but they included the development, research, and testing of aircraft components, coatings, electronics, and control devices. Concurrent with these activities, aircraft continued to be used and maintained.

NAWC also conducted studies in anti-submarine warfare systems and software development. Historically, wastes were generated during aircraft maintenance and repair, pest control, fire-fighting training, machine and plating shop operations, spray painting, and various materials research and testing activities in laboratories.

The generated wastes included paints, solvents, sludges from industrial wastewater treatment, and waste oils that were disposed in several pits, trenches, and landfills throughout the facility property. NAWC was listed on the Superfund National Priorities List (NPL) in 1989. This list comprises sites where uncontrolled hazardous substance releases present the most significant potential threats to human health and the environment. Areas reported by the Navy to have been potentially used for disposal of hazardous substances include eight locations covering more than 15 acres. These locations include the following:

- Three waste disposal locations (Sites 1, 3, and 6)
- Two sludge disposal pit locations (Sites 2 and 7)
- Two landfills (Sites 4 and 5)
- One fire training location (Site 8)

These disposal locations have since been grouped within the following areas on NAWC property: Area A (Sites 1, 2, and 3); Area B (Sites 5, 6, and 7); and Area C (Sites 4 and 8). A fourth general area, Area D, primarily includes the main building complex at the base and lies west of Jacksonville Road. Figure 2 provides the location of these areas.

Area A includes Sites 1, 2, and 3, the location of eight (8) former wastewater impoundments, and adjacent areas in the northwest corner of the facility (Figure 3). Area A is bordered by industrial/commercial areas to the north and west. Area A is a flat-lying area approximately 1,200 feet by 270 feet in size and covers approximately 7.4 acres. An unnamed tributary of Little

Neshaminy Creek is located north of Area A, and the NAWC Warminster wastewater treatment facility and parking lots are immediately to the south.

Below is a site history and more detailed description of Sites 1, 2, and 3 and the eight former unlined wastewater impoundments.

A. Site 1

The Navy initially reported Site 1 as a potential location for disposal of hazardous substances in 1980. At the time, Site 1 was reported to be a burn pit, which operated from 1940 to 1955 and was located at the embankment of a ravine formed by erosion action. Waste materials were reportedly dumped over the bank and burned. The waste reportedly disposed included inorganics, solvents, acids, bases and firing range waste. Site 1 was reportedly closed in 1955 by covering the site with excess earth generated by grading an extension of an aircraft runway. The volume of material disposed was reported as unknown. Site 1 was reported to be located along the base property boundary northwest of the NAWC wastewater treatment plant.

To better identify the nature and extent of disposal activities at NAWC, an Aerial Photographic Site Analysis Report for NAWC was prepared by the EPA Environmental Photograph Interpretation Center (EPIC) in 1994. The report evaluated aerial photographs of Area A dating from 1938 to 1990 and identified several features within the reported location of Site 1 which suggested potential disposal activities. The features of interest included an irregularly shaped pit (designated P1 by EPIC) approximately 100 feet by 35 feet in area which was observed in photos dated 1948 and 1950 and a trench (designated TR8 by EPIC) approximately 230 feet by 20 feet in area observed in a photo dated 1981. These and other features of interest such as disturbed ground (EPIC feature DG2) and ground scars (EPIC feature GS4) were all observed located within a 250 feet by 50 feet area (see Figure 4). Aside from mounded material observed in a photo from 1973, the photos provided no information regarding the nature of any materials which may have been disposed in this area. For purposes of the CERCLA RI work, the subject area has been identified as Site 1. Site 1 is located approximately 300 feet from an unnamed tributary of Little Neshaminy Creek and currently includes an extraction well network constructed as part of the interim remedy for Area A groundwater (see OU-1 ROD), a gravel access road and grass.

B. Site 2

In 1980, the Navy reported Site 2 to be the location of a 200 ft. by 12 ft. by 8 ft. trench used for the disposal of approximately 1,400 cubic yards of industrial wastewater treatment sludge. The disposal area was reported to be about 150 feet southwest of Site 2 along the NAWC property boundary and used from 1965 to 1970, when the site was closed with 2 feet of cover and revegetated.

A review of aerial photographs of the reported area by EPA EPIC identified several features of interest (see Figure 5). A dump (EPIC feature D1) approximately 300 ft. by 100 ft. in area was observed in a photo dated 1942 and was still in place in 1948 and 1950. Part of the dump extended to the unnamed tributary of Little Neshaminy Creek and appeared to occupy the bank of the stream. At the time, a tributary extended south from the northern end of the Building 2 to the site boundary. Three rectangular ground scars (EPIC feature GS1) and a probable trench (EPIC feature TR1) approximately 225 feet southeast of D1 in an aerial photo dated 1950 and possible trench (EPIC feature TR2) and mounded material were identified about 225 feet southeast of D1 in aerial photo dated 1958. By 1958, the dump D1, as well as the former tributary extending to the site boundary, were no longer evident and had been apparently covered with fill material. The former stream had been replaced by a stormsewer with an outfall designated as Outfall 01. The subject outfall currently drains the majority of NAWC property west of Jacksonville Road. An area of piled earthen material (EPIC feature MM3) was observed just south of DG1 in 1965, while an area of disturbed ground (EPIC feature DG3) was observed over part of the former area of DG1 and MM3 in 1973.

An evaluation of the above information suggests that D1, as described above, appears to fit the description of "Site 1" as reported by the Navy in 1980. In addition, the results of remedial investigations and response actions (to be discussed below) suggest that pit P1 and trench TR8 may be the reported "Site 2". For purposes of the RI, the general area of pit P1 and trench TR8 has been considered Site 1, while the general area of dump D1 is considered to be part of Site 2.

Remedial investigations of groundwater underlying the area of Sites 1 and 2 have been performed under OU-1. These investigations determined that groundwater contamination underlying this area may have been attributable to releases in the area of Site 1 and/or Site 2 or possibly at upgradient locations. Soils in the upgradient locations of interest have also been investigated under the RI and are considered part of Site 2. These soils are located within an area between D1 and a series of former underground jet fuel storage tanks (see Figure 3).

Investigation and remediation of the former jet fuel tanks and associated soils were performed as part of activities addressing RCRA requirements.

The area of Site 2 currently includes paved and gravel roads, a paved parking lot, an extraction well network for Area A groundwater (see OU-1 ROD) and maintained lawn.

C. Site 3

Site 3 is immediately southeast of Site 2 along the NAWC property boundary and was reportedly used from 1955 to 1965 as a burn pit for solvents, paints, acids, bases, mixed municipal waste, and other unspecified chemicals. The pit was reported to be approximately 20 feet wide by 30 feet long by 10 feet deep and covered by a large metal screen enclosure. Residue from the pit was reportedly removed periodically and deposited at an unspecified, on-base "sanitary landfill." Upon closure in 1965, Site 3 was reportedly backfilled with on-base soil and regraded.

An aerial photo evaluation by EPIC found that the reported area of Site 3 was wooded in 1950. By 1958, the area had been cleared and vehicular traffic over the area was evident. In addition, an unspecified, relatively small area of disturbed ground (EPIC feature DG1) was observed at the center of the area of vehicular traffic (Figure 6). The area dimensions of DG1 were similar to the reported dimensions of the burn pit (20 ft. by 30 ft.). By 1965, DG1 was no longer present and in 1971 and 1973, an open storage area (EPIC feature OS1) for a variety of materials, including a tank, mounded material and/or equipment, was evident. The aerial photo review did not reveal any other features that may suggest disposal activity. The stream bank of the current unnamed tributary of Little Neshaminy Creek lies directly adjacent to the former open storage area (OS1) and approximately 75 feet from the former location of DG1. At this time, an asphalt access road lies within 10 to 20 feet of the estimated location of DG1 and covers a substantial portion of the former open storage area (see Figure 6). The balance of the area of Site 3 is currently a sparsely vegetated lot.

D. Impoundment Area

The Navy formerly operated eight unlined impoundments or lagoons for storage of wastewater treatment sludges generated by the industrial wastewater treatment plant just north of Area A. These lagoons were located immediately south of Site 1 (see Figure 4). Each lagoon had approximate dimensions of 60 feet wide by 75 feet long, with depths of approximately 8 to 10 feet. The first impoundments were installed as early as 1940 and reportedly closed in 1973. There is no known information regarding the nature of the closure of these impoundments. The area of the

the former impoundments currently includes level ground, two concrete-lined basins which were in place by 1977, and a groundwater treatment plant which has been constructed as part of the remedy for contaminated groundwater at the Site (see OU-1 ROD).

The former unlined impoundments received sludge generated by the treatment of industrial wastewaters generated by NAWC. The subject wastewater included liquids from electroplating operations, photographic operations, aircraft maintenance and washing activities, and a wide variety of laboratories. The industrial wastewater was treated in Buildings 20 and 259 through neutralization and metals precipitation. No treatment for organic compounds was performed. Apparently, the solid phase of the sludges stored in these impoundments was periodically removed and disposed at other locations at NAWC (e.g., see reported disposal at Site 1). At least one aerial photo (dated March 1965) suggests that the impoundments occasionally may have been breached and their contents released to adjacent soils.

III. ENFORCEMENT ACTIVITIES

No enforcement actions have been taken at Area A. The Navy has owned the property since 1944 and is the lead agency for CERCLA work at NAWC Warminster.

IV. SITE INVESTIGATIONS AND REMOVAL ACTIONS

Remedial investigations of Area A soils and downgradient surface water and sediment were conducted between 1989 and 1999 in three phases – Phase I, Phase II, and Phase III. The field work focused on characterizing known and potential sources of contamination within Area A. The results of previous investigations and analysis of historical aerial photographs identified these sources. Field work included soil gas sampling, geophysical surveys, surface soil sampling and analysis, subsurface soil sampling and analysis, and a wetlands assessment. The subsurface studies consisted of drilling soil borings and excavating test pits to better determine the nature and extent of subsurface contamination. In addition, a surface water and sediment sampling and analysis program was conducted to evaluate the impacts of the base on the nearby stream.

From 1989 through 1991, the Phase I RI work was conducted (SMC Martin, 1991). These investigation activities included mapping of VOCs in soil gas and detecting magnetic and conductive anomalies through electromagnetic surveys. Approximate site boundaries were identified and confirmation of site contamination was made through soil borings, monitoring well installation, and sampling and analysis of groundwater.

Known investigations addressing OU-9 prior to CERCLA remedial investigation work were minimal. In response to the identification of on-base groundwater contamination with volatile organic compounds (VOCs), in February 1980, two soil borings were conducted in the vicinity of one of the two concrete basins to identify potential sources of VOCs. Analysis of soil samples from these two borings reportedly detected TCE concentrations of up to 78 ug/kg and 17 ug/kg, respectively.

No additional investigation of OU-9 was conducted until October 1988, when a Phase I RI was initiated. Phase I RI work within Area A included a geophysical survey, a soil gas survey and exploratory borings to identify potential wastes. No soil or waste samples were collected for analysis. Surface water and sediment samples were collected during Phase I from the unnamed tributary draining Area A and a biological characterization of the tributary was performed.

Phase II RI work addressing OU-9 was performed in 1993 and was limited to the collection and analysis of four soil samples and additional sampling of the unnamed tributary.

The majority of RI work addressing OU-9 was performed under Phase III between 1995 and 1999. Initially, geophysical and soil gas surveys were performed throughout areas where available information suggested potential hazardous substance disposal and/or the potential release of hazardous substances to groundwater. Primary sources of information included disposal information reported by the Navy, potential disposal areas identified by EPIC and information regarding the nature and extent of groundwater contamination underlying or in the vicinity of Area A. Based on the results of the geophysical and soil gas surveys and a review of other information, extensive surface and subsurface soil sampling was performed during Phase III. Subsurface soil samples were collected via soil borings and test pits. In addition, two rounds of surface water and sediment sampling were conducted and a wetlands assessment was performed.

During the course of the Phase III RI, several removal actions were performed in response to the detection of hazardous substances that presented a risk to human health and the environment.

During the construction of the groundwater treatment plant adjacent to and within the former Impoundment Area, elevated levels of metals were encountered. A removal action was conducted in 1996 to remove soils at two locations beneath the footprint of the treatment plant building and surrounding property.

In a separate removal action, based on preliminary RI results, about 6,700 tons of nonhazardous Area A surface and subsurface soils were excavated, transported, and disposed in an off-base landfill in 1998. A small amount (about 100 pounds) of flammable solids or corrosive liquids was also disposed. Soils were excavated from two separate locations within Site 1, three locations within Site 2, and one location near Site 3 (Figure 7). Post-removal soil sampling was performed to confirm that clean-up goals established for the protection of groundwater and human health were attained with the designated removal action areas.

The results of all RI work addressing soils, sediment, and surface water associated with Area A are described or summarized in the OU-9 RI/FS Report for Area A issued by the Navy in April 2000 (Tetra Tech NUS, 2000). This report characterizes Area A prior to and after the removal actions and contains an assessment of any risk posed by OU-9 to human health and the environment after the removal actions.

While the April 2000 RI report assesses the potential impact of soils at Area A on groundwater quality, the report does not address underlying and downgradient groundwater, which has been identified as Area A groundwater. Area A groundwater is being addressed under OU-1. An interim RI/FS report for OU-1 was completed in 1993 and supported the interim remedy ROD for Area A Groundwater issued September 1993. The interim remedy was operational in 1999 and consists of a groundwater pump and treat system with monitoring. A final Area A Groundwater RI/FS Report will be issued and support a final remedy ROD for OU-1.

V. HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with Sections 113 and 117 of CERCLA, 42 U.S.C. Sections 9613 and 9617, the Navy, in conjunction with EPA, issued a Proposed Plan on May 1, 2000, presenting the preferred remedy for Operable Unit 9. The Proposed Plan and RI/FS report for OU-9 became available for review at the time and are among the documents that comprise the Administrative Record for NAWC Warminster. The Administrative Record is available for review by the public at the following information repositories:

- Caretaker Site Office
  Jacksonville Road (building located on west side)
  P.O. Box 2609
  Warminster, Pennsylvania 18974-0061

- Bucks County Library
  150 South Pine Street
  Doylestown, Pennsylvania 18901

An announcement of the public meeting, the comment period, and the availability of the Administrative Record for the proposed remedy for OU-6 was issued on May 1, 2000 in the Philadelphia Inquirer, Intelligencer, and Courier Times. Additionally, the Proposed Plan and the Notice of Availability were mailed to local municipal and government agencies and residents in the vicinity of the site. A public meeting was held on May 11, 2000. Additional community involvement, including Restoration Advisory Board (RAB) activities, is detailed in Section XVI.

VI. SCOPE AND ROLE OF OPERABLE UNIT

Section 300.430 (a) (1) (ii) (A) of the NCP, 40 C.F.R. Section 300.340 (a) (1) (ii) (A) provides that CERCLA NPL sites "should generally be remediated in operable units when early actions are necessary or appropriate to achieve significant risk reduction quickly, when phase analysis or response is necessary or appropriate given the size or complexity of the site, or to expedite the completion of a total cleanup." In the case of NAWC Warminster, the Navy has organized work to date into nine operable units (OUs). These OUs are as follows:

- OU-1: Contaminated shallow groundwater attributable to Areas A and B.
- OU-2: Contamination of domestic well water for residences near the base.
- OU-3: Contaminated groundwater attributable to Area C.
- OU-4: Contaminated groundwater attributable to Area D.
- OU-5: Soils, sediment, and surface water associated with Site 8 at Area C.
- OU-6: Soils, sediment, and surface water associated with Site 4 at Area C.
- OU-7: Soils and wastes associated with Sites 6 and 7 at Area B.
- OU-8: Soils associated with Area D.
- OU-9: Soils, sediment, and surface water associated with Area A.

The interim remedy ROD for OU-1 was signed on September 30, 1993, and addressed contaminated groundwater attributable to Areas A and Area B. Subsequent to the issuance of the OU-1 ROD, the Navy and EPA conducted a removal action, providing water treatment system and public water connections to residences in the vicinity of the base. This removal action was designated as OU-2. Due to the time-critical nature of the removal action, a ROD was not issued for OU-2.

The ROD for OU-3 (Area C groundwater) was signed on March 10, 1995, while the interim remedy ROD for OU-4 (Area D groundwater) was signed on September 29, 1997. Since the issuance of the RODs for OU-1, OU-3, and OU-4, a groundwater treatment plant was constructed within Area A and the cleanup of contaminated groundwater attributable to Area A, Area C, and Area D has begun.

The ROD for OU-5, which addressed soils, sediment, and surface water associated with Site 8, called for no further action at the site. It was signed on September 30, 1999. A no further action ROD for OU-6 (Site 4 media other than groundwater), the ROD for OU-7 (Sites 6 and 7 soils and wastes), and the ROD for OU-8 (Area D soils) were signed on June 20, 2000. The final remedy ROD for OU-4 (Area D groundwater) is forthcoming.

The ninth operable unit (OU-9), the subject of this ROD, consists of Area A soils and downgradient surface water and sediment. This ROD determines that potential ingestion and dermal contact with soils in Area A may pose potential unacceptable risks to human health, and that stream sediment downgradient of Area A may pose potential risks to ecological receptors. The ROD presents a remedial action to address these unacceptable risks.

Groundwater underlying and downgradient of Area A is being addressed under OU-1.

VII. SITE CHARACTERISTICS

A substantial portion of soils within Area A consists of fill materials. The topography of the area of Sites 2 and 3 has been significantly altered since the Navy occupied the property. As noted previously, a former tributary of Little Neshaminy Creek, an associated ravine and surface drainage pathways in the area of Site 2 were filled in and leveled in the 1950's. This area is now underlain by a storm sewer that drains the majority of NAWC property west of Jacksonville Road. A relatively steep slope now descends from the leveled area of Site 2 down to the subject tributary. Similarly, while the area of Site 3 formerly consisted of a more gradual slope to a tributary of Little Neshaminy Creek, this area was also regraded by placement of fill in the 1950's. As with the area of Site 2, a steep slope now descends from the area of Site 3 down to the remaining tributary. While the topography of Site 1 does not appear to have been altered substantially since Brewster and Navy ownership of the property, the area of Site 1 also appears to contain a substantial amount of fill material. As noted earlier, the location of the eight former impoundments now consists of fill material. The fill material generally consists of a soils native to the area mixed with miscellaneous debris. Native soils for the area consist of variable quantities of clay, silts and loams with slow to moderate permeabilities. Soil boring and well logs indicate

that the depth of these soils within Area A ranges from 8 to 10 feet, where weathered bedrock begins. Bedrock consists of alternating layers of siltstone, shale and sandstone. The water table aquifer occurs at a depth of 10 to 15 feet in Area A. Perched water has been observed in Area A above the water table aquifer over localized areas of low permeability soils.

An unnamed tributary of Little Neshaminy Creek currently flows in a northwest direction immediately adjacent to Area A (see Figure 3). This stream originates from a stormwater culvert under Jacksonville Road and flows from the southeast to the northwest before turning north, away from the base. The current stormwater outfall (OF1) within Area A and along the base boundary may represent the original discharge point of a former stream on base property. The outfall lies in the area of Site 2. Several additional outfalls between Jacksonville Road and outfall OF1 drain stormwater from the parking lot south of Site 2 and Site 3.

A small forested wetland dominated by mature red maple and arrowwood was identified just north of outfall OF1 and beyond the base property boundary during a wetland assessment conducted as part of the Phase III RI work. This assessment concluded that the stream and wetlands provide good ecological habitat within an urbanized landscape. There are no known critical habitats of endangered species located within 1 mile of Area A.

The climate of the area is humid continental and is modified by the Atlantic Ocean. Temperatures average 76°F (24.4°C) in July and 32°F (0°C) in January. The average daily temperature for the NAWC location is 53.3°F (11.8°C). Precipitation averages 42.5 inches per year (106.25 cm per year), and snowfall averages 22 inches per year (55 cm per year). The distribution of precipitation is fairly even throughout the year. The relative humidity for the Site averages 70 percent. The mean wind speed for this area is 9.6 mph, with a prevailing direction of west-southwest.

VIII. NATURE AND EXTENT OF CONTAMINATION

Potential sources of CERCLA hazardous substances within Area A include various pits, trenches, dumps, and miscellaneous disposal features associated with Sites 1, 2, and 3 as well as the former unlined impoundments (see Section II, Site History). Surface and subsurface soil sample locations were based on a review of soil gas sample results, geophysical survey results, historical aerial photography, and other supporting information (e.g., record reviews, interviews with current or former employees). Background samples were also obtained to compare the resultant analytical data to site-related analytical results. Analytical results were compared to

federal and state non-residential (industrial) and residential risk-based soil screening criteria (RBCs).

A. Site 1

A total of seven surface soil and 79 subsurface soil locations were sampled in the area of Site 1 as part of the RI (see Figure 8 for surface soil locations and Figure 9 for subsurface soil locations). Test pits and soil borings conducted as part of subsurface investigations encountered non-native materials such as wood, fabric, blankets, cinders, charred material, and fill material. In addition, an area of multicolored silty clay material was observed in the subsurface at the projected locations of former pit P1 and former trench TR8. This material covered an area of about 0.25 acres and was observed to be present from approximately 2 feet below ground surface down to about 8 feet below ground surface. Sampling of the multicolored clay material consistently identified elevated levels of cadmium and antimony (see Figure 10 for initial sampling results for the area of interest). The detected levels of cadmium and antimony were determined to present an unacceptable risk to industrial receptors exposed via dermal contact. The location of the subject area, the presence of elevated levels of cadmium and the appearance of the subject material suggest this may be the reported location of industrial wastewater sludge disposal in Area A. In response to these findings, in 1998, the Navy performed a removal action to excavate the subject material.

Removal clean-up goals were established for each contaminant based on the potential risks identified through the RI work. Additional sampling and analysis were performed until the removal clean-up goals were met for all soils of concern. Samples were collected from the base and sidewalls of each excavation to verify the completeness of the response actions. The sample analysis results were compared to target clean-up concentrations protective of industrial land use, ecological receptors, and groundwater quality. The removal target clean-up goals are shown in Appendix A, Table 1. For all samples, any exceedances of the target clean-up concentrations were followed by additional excavation of the area where the sample was collected. Where soils remained after the additional excavation, supplemental verification samples were obtained and analyzed for the compounds that initially exceeded the target concentration, to verify that sufficient excavation had been performed. As a result, there were no exceedances of any target clean-up concentration for the final samples from each excavation location sampled.

Approximately 3,600 cubic yards of material was removed from Excavations 1A and 1B. The OU-9 RI/FS Report provides data regarding the quality of soils left in place in the area of Site 1 after the removal action and in place at this time. Table 2 provides the occurrence and distribution of

post-removal Site 1 surface soil sample results. Figure 11 indicates the locations of samples which characterize subsurface soils which remain in place at this time, while Table 3 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics. A human health risk assessment (see Section X) has determined that none of the remaining substances in subsurface soils pose an unacceptable risk to human health under reasonably anticipated land uses, while an ecological risk assessment has determined that these soils do not pose an unacceptable risk to environmental receptors. As a result, there are no contaminants of concern (COCs) in Site 1 subsurface soils under reasonably anticipated land uses. In addition, all surface soils have been replaced by clean fill and/or clean soil as part of the removal action. As a result, there are no contaminants of concern in Site 1 surface soils.

B. Site 2

A total of 71 surface soil locations and 107 subsurface soil locations were sampled in the area of Site 2 as part of the RI (see Figure 12 for surface soil locations and Figure 13 for subsurface soil locations). Test pits and soil borings conducted as part of subsurface investigations encountered non-native materials such as cinders, glass fragments, ceramic pieces, brick fragments, metal fragments, charred debris, and fill material. In addition, a blue-green crystalline material was observed in surface (0 to 2 feet below ground surface) and subsurface soils in part of the area of dump D1 and an area northwest of D1. Sampling of soils containing this blue-green material identified elevated levels of lead, antimony, copper, and zinc. (Removal Site Evaluation for Area A Soils, Brown & Root Environmental, April 1988) The detected levels of lead and antimony were determined to present an unacceptable risk to industrial receptors. In response to these findings, in 1998, the Navy performed a removal action to excavate the soils of concern. Soils within the excavation area (Excavation 2A) were removed from the surface to a depth of either 2 feet or 4 feet below ground surface. Soils were removed until contaminant levels were below cleanup levels identified in a Verification Sampling and Analysis Plan (Tetra Tech NUS, August 1998). This was verified by analytical data contained in a series of letter reports subsequently included in the Post-Removal Summary Report for Area A Soils (Tetra Tech NUS, May 1999). These data confirmed that all soils within this excavation area with contaminant levels above the identified cleanup levels were removed (see Figures 7 and 14 for location of Excavation 2A). Approximately 800 cubic yards of soil were removed from Excavation 2A. The cleanup levels are shown in Table 1.

Soils were also removed from two other areas at Site 2 - Excavation 2B and Excavation 2C (see (Figure 7 and 14). Soils in Excavation 2B were removed based on the observation and detection of petroleum products. This removal was not considered a CERCLA action and the occurrence of

petroleum products in soils in Area A is not addressed by this ROD. However, it is notable that petroleum products were also observed and detected in subsurface soil adjacent to Excavation 2B under the paved access road during RI work for Site 2. (Information regarding the observation and detection of petroleum products in this area of Site 2 is contained in the final RI report for OU-8.) Soils within Excavation 2C were removed down to a depth of 2 feet based on the detection of elevated levels of benzo(a)pyrene, which were determined to present an unacceptable risk to receptor sediment quality. Soils within Excavation 2C were removed until contaminant levels were below cleanup levels identified in a Verification Sampling and Analysis Plan (Tetra Tech NUS, August 1998; September 1998; and November 1998). This was verified by analytical data contained in a letter report subsequently included in the Post-Removal Summary Report for Area A Soils (Tetra Tech NUS, May 1999). These data confirmed that all soils within Excavation 2C with contaminant levels above the identified cleanup levels were removed. A total of 30 cubic yards of soil was removed from Excavation 2C.

The final RI report provides data regarding the quality of soils left in place in the area of Site 2 after the removal action and in place at this time. Figure 15 indicates the locations of samples which characterize surface soils which remain in place at this time (as well as exceedances of screening criteria protective of industrial use), while Table 4 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics. Figure 16 indicates the locations of samples which characterize subsurface soils that remain in place at this time (as well as exceedances of screening criteria protective of industrial use), while Table 5 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics (as well as exceedances of screening criteria protective of industrial use). A human health risk assessment (see Section X) has determined that none of the remaining substances in surface or subsurface soils pose an unacceptable risk to human health under reasonably anticipated land uses. However, an ecological risk assessment has determined that Site 2 surface and subsurface soils present a potential threat to ecological receptors if allowed to migrate to the unnamed tributary of Little Neshaminy Creek. The contaminants of concern for Site 2 soils in this case include:

CONTAMINANT OF CONCERN	SURFACE SOIL	SUBSURFACE SOIL
Cadmium	X	X
Chromium		X
Copper	X	X
Lead	X	X

CONTAMINANT OF CONCERN	SURFACE SOIL	SUBSURFACE SOIL
Nickel		X
Selenium		X
Silver	X	
Zinc	X	
Acenaphthene		X
Anthracene	X	X
Benzo(a)anthracene	X	X
Benzo(a)pyrene	X	X
Benzo(b)fluoranthene		
Benzo(g,h,i)perylene	X	X
Chrysene		X
Dibenz(a,h)anthracene	X	
Fluoranthene	X	
Fluorene		X
Indeno(cd-1,2,3)pyrene	X	X
Naphthalene		X
Pyrene		X
4,4'-DDD		X
2-Methylnaphthalene		X

C. Site 3

A total of 17 surface soil locations and 35 subsurface soil locations were sampled in the area of Site 3 as part of the RI (see Figure 17 for surface soil locations and Figure 18 for subsurface soil locations). Test pits and soil borings conducted as part of subsurface investigations again encountered non-native materials such as cinders, glass fragments, ceramic pieces, brick fragments, metal fragments, charred debris, and fill material. A layer of charred material was encountered several feet below ground surface in the vicinity of feature DG2, the location of disturbed ground identified by EPIC. However, no evidence of the presence of the reported two-foot deep burn pit was encountered during the RI. Elevated levels of organic vapors were detected in the charred layer with a photoionization detector (PID) and petroleum odors were evident. Similar observations were noted for several soil borings advanced in the paved access road in the area of Site 3. Elevated levels of polynuclear aromatic hydrocarbons such as benzo(a)pyrene were detected in surface soil samples at Site 3. The detected levels of these

compounds were determined to present an unacceptable risk to sediment quality. In response to these findings, in 1998, the Navy performed a removal action to excavate the soils of concern. Soils within the excavation area (Excavation 3) were removed from the surface to a depth of 2 to 3 feet below ground surface. Surface soils were removed until contaminant levels on the sidewalls of the excavation area were below cleanup levels identified in a Verification Sampling and Analysis Plan (Tetra Tech NUS, August 1998). This was verified by analytical data contained in a series of letter reports subsequently included in the Post-Removal Summary Report for Area A Soils (Tetra Tech NUS, May 1999). These data confirmed that all soils within 2 feet of ground surface within the excavation area with contaminant levels above the identified cleanup levels were removed (see Figure 7 for location of Excavation 3). Approximately 380 cubic yards of soil were removed from Excavation 3. The cleanup levels were as shown in Table 1.

The OU-9 RI/FS Report for Area A provides data regarding the quality of soils left in place in the area of Site 3 after the removal action. Figure 19 indicates the locations of samples which characterize surface soils which remain in place at this time (as well as exceedances of screening criteria protective of industrial use), while Table 6 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics. Figure 20 indicates the locations of samples which characterize subsurface soils which remain in place at this time (as well as exceedances of screening criteria protective of industrial use), while Table 7 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics (as well as exceedances of screening criteria protective of industrial use). A human health risk assessment (see Section X) has determined that none of the remaining substances in surface or subsurface soils pose an unacceptable risk to human health under reasonably anticipated land uses. However, an ecological risk assessment has determined that Site 3 subsurface soils present a potential threat to ecological receptors if allowed to migrate to the unnamed tributary of Little Neshaminy Creek. The contaminants of concern for Site 3 subsurface soil in this case include:

CONTAMINANT OF CONCERN	SUBSURFACE SOIL
Cadmium	X
Copper	X

CONTAMINANT OF CONCERN	SUBSURFACE SOIL
Lead	X
Mercury	X
Nickel	X
Silver	X
Acenaphthene	X
Acenaphthylene	X
Anthracene	X
Benzo(a)anthracene	X
Benzo(a)pyrene	X
Benzo(b)fluoranthene	X
Benzo(g,h,I)perylene	X
Benzo(k)fluoranthene	X
Chrysene	X
Dibenz(a,h)anthracene	X
Fluoranthene	X
Fluorene	X
Indeno(cd-1,2,3)pyrene	X
Naphthalene	X
Pyrene	X
4,4'-DDD	X
2-Methylnaphthalene	X

D. Impoundment Area

A total of 78 subsurface soil locations within the impoundment area were sampled as part of the RI for the impoundment area (see Figure 21). The primary objective of the sampling was to characterize the quality of soil below the fill material reportedly placed in the former impoundments as part of the closure process. As a result, surface soil samples were not collected. Soil borings encountered non-native materials such as rock, cinders, roots, concrete and brick at certain locations. Elevated levels of several metals (including beryllium, chromium, and manganese) and Aroclor-1260 (a polychlorinated biphenyl or PCB) were detected in samples above risk-based soil screening concentrations collected at the location of former impoundment IM8. The detected levels were determined to present an unacceptable risk to human health. In response to these findings, in 1995, the Navy performed a removal action to excavate the soils of

concern. Approximately 430 cubic yards of soil were removed from within the excavation area (see Figure 22 for locations of excavation). Soils were removed until contaminant levels within the excavation area were either within the range established for background soil concentrations or less than the risk-based soil screening concentrations for industrial use (Halliburton NUS, June 1994; U.S. Navy, August 1995). This was verified by analytical data contained in a letter report (U.S. Navy, August 1995). These data confirmed that all soils within the excavation area with unacceptable contaminant levels were removed. The cleanup levels were as follows:

- Beryllium: 1.7 mg/kg
- Chromium: 1,000 mg/kg
- Manganese: 400 mg/kg
- Aroclor-1260: 370 ug/kg

The OU-9 RI/FS Report provides data regarding the quality of subsurface soils in the impoundment area at this time. Figure 22 indicates the locations of samples which characterize these soils, while Table 8 tabulates the data for these locations and provides the occurrence and distribution of organics and inorganics. A human health risk assessment (see Section X) has determined that the subject soils do not pose an unacceptable risk to human health under reasonably anticipated land uses or to ecological receptors. Therefore, there are no contaminants of concern in the impoundment area soils.

E. Surface Water

Surface water sample locations are indicated in Figures 23 and 24. OF3 is the location of an outfall that discharges surface runoff from both Jacksonville Road and NAWC property west of Jacksonville Road. Outfall OF1 discharges surface runoff from the majority of NAWC property west of Jacksonville Road, while outfall OF2 discharges runoff from the parking lot south of Sites 2 and 3. Tables 9 and 10 summarize the occurrence and distribution of total inorganics and organics in the samples collected during the RI, while Figure 25 indicates sample results which exceeded Ambient Water Quality Criteria (AWQCs) protective of aquatic life developed pursuant to the Federal Clean Water Act. Notably, exceedances for lead, copper, zinc and iron, contaminants detected at elevated concentrations in Site 2 soils, occurred only in samples collected downstream of outfall OF1 and/or Site 2.

F. Sediment

Sediment sample locations are indicated in Figures 23 and 24. Tables 11 and 12 summarize the occurrence and distribution of inorganics and organics in the samples collected during the RI. The RI determined that many of the detected concentrations of organics and inorganics exceeded available screening criteria indicative of a potential risk of concern to ecological receptors. These exceedances are indicated in Figure 26. Polynuclear aromatic hydrocarbons (PAHs), a class of compounds that exceeded the screening criteria in most of the samples collected, were detected at the highest levels next to outfall OF3, a location that is upgradient of the majority of Area A and is the entrance point of surface drainage from Jacksonville Road. Lead was also detected above screening levels at this location. PAHs and numerous metals were also notably elevated at sample locations immediately downstream of outfall OF1 and Site 2.

IX. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Area A is located in the western portion of NAWC, west of Jacksonville Road and north of Street Road. The area consists of a groundwater treatment plant and related extraction wells, parking lots, paved roadways, two concrete-lined basins and maintained lawn. Area A is part of property which is designated for transfer to the Federal Land Reuse Authority (FLRA) and local municipalities under either an economic development conveyance (EDC) or public benefit conveyance (PBC).

The re-use plan for the former NAWC, as prepared by the FLRA and approved by the local municipalities, identifies industrial use as the planned use for Area A.

X. SUMMARY OF SITE RISKS

As part of the OU-9 RI, a risk assessment was conducted with available data to estimate the potential risks posed to human health and the environment by Area A soils, surface water, and sediment. In the case of soils, the risk assessment addressed conditions after the performance of the removal actions.

A. Summary of Human Health Risk Assessment

The human health risk assessment estimates the risks posed to human health by Area A soils and associated surface water and sediment if no action is taken and identifies the contaminants and exposure pathways of concern. This section of the ROD summarizes the results of the

human health risk assessment for Area A soils, surface water, and sediment. To assess these risks, the potential exposure scenarios identified below were assumed.

- Ingestion of soils (both surface and subsurface).
- Ingestion and dermal contact with surface water and sediment.

1. Identification of Contaminants of Concern

The tables in Section VIII (Nature and Extent of Contamination) of this ROD summarize the range of detected concentrations (minimum and maximum) and the frequency of detection of hazardous substances in surface soils and subsurface soils for Sites 1, 2, and 3, and the Impoundment Area, as well as surface water and sediment associated with the nearby Area A stream. In the case of each hazardous substance detected in each medium, these tables also identify a representative concentration, which is the lower of the upper 95% confidence limit (UCL) of the mean concentration and the maximum concentration detected. These representative concentrations are the exposure point concentrations (EPCs) that were used to estimate risk to human health. These exposure point concentrations were compared to soil screening levels protective of industrial land use. Tables 13 through 18 identify the potential contaminants of concern (COCs) in surface and subsurface soils under the anticipated industrial land use. The RI also identified potential COCs for residential use by comparing the EPCs to screening criteria protective of residential use.

Potential COCs for surface water and sediment were chosen based on their occurrence and distribution, mobility, persistence, toxicity, and a comparison to background concentrations.

The following potential COCs were selected for surface water:

- 1,1-DCA
- 4,4'-DDT
- Chrysene
- Pyrene
- Carbon Disulfide
- Di-n-octylphthalate
- Barium
- Lead
- Zinc
- Thallium
- 2-Butanone
- Benz(a)anthracene
- Diethylphthalate
- Benzene
- Chloroethane
- PCE
- Copper
- Manganese
- Aluminum
- 4,4'-DDD
- Benzo(b)fluoranthene
- Fluoranthene
- Bromomethane
- Chloromethane
- TCE
- Iron
- Nickel
- Chromium

The following chemicals were selected as potential COCs in site-related sediment:

- 1,1,1-TCA
- 1,1-DCE
- 1,2-DCE (Total)
- 2-Butanone
- 2-Methylnaphthalene
- 4,4'-DDD
- 4,4'-DDT
- 4,4'-DDE
- 4-Methylphenol
- Acenaphthene
- Acetone
- Aldrin
- Alpha-Chlordane
- Anthracene
- Aroclor 1016
- Aroclor 1248
- Aroclor 1254
- Aroclor 1260
- Benz(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Carbazole
- Benzo(k)fluoranthene
- Benzo(g,h,i)perylene
- Chloroform
- Benzo(b)fluoranthene
- Vanadium
- Chloromethane
- Chrysene
- Butylbenzylphthalate
- Delta-BHC
- Di-n-butylphthalate
- Carbon Tetrachloride
- Dibenzofuran
- Di-n-octylphthalate
- Silver
- Dieldrin
- Endosulfan II
- Endosulfan Sulfate
- Endrin
- Endrin Aldehyde
- Endrin Ketone
- Ethylbenzene
- Fluoranthene
- Fluorene
- Gamma-Chlordane
- Naphthalene
- Zinc
- Pyrene
- PCE
- Toluene
- TCE
- Total Xylenes
- Aluminum
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Indeno(1,2,3-cd)pyrene
- Dibenz(a,h)anthracene
- Bis(2-ethylhexyl)phthalate

C. Exposure Assessment

Area A is located on a portion of the base that is planned for industrial use. The human health risk assessment was conducted assuming industrial use of the property. In addition, while residential use of the property is not reasonably anticipated, potential risks under residential use were also assessed. Current and future users were evaluated for exposure to surface soil (0 to 2 feet in depth) and subsurface soils [2 feet to maximum depth of contaminant (up to 15 feet below ground surface)]. In assessing risks posed by subsurface soils, it was assumed that these soils may be displaced to the surface (e.g., through excavation) and that resulting surface contaminant concentrations would be half the representative concentrations detected in the subsurface soils.

The exposure routes for human receptors to soil were identified as incidental ingestion and dermal contact.

Current and future recreational child receptors were assessed for exposure to surface water via wading and to sediment via ingestion and dermal contact.

Inhalation of volatile emissions was not quantitatively evaluated due to the low level and infrequent occurrence of volatile organic compounds. The data were reviewed qualitatively to ensure that inhalation was not a potential contributing factor to the potential risks associated with Area A.

D. Toxicity Assessment

The toxicity assessment characterizes the nature and magnitude of potential health effects associated with human exposure to COCs at a site. Quantitative risk estimates for each COC and exposure pathway are developed by integrating chemical-specific toxicity factors with estimated chemical intakes discussed in the previous section.

Quantitative risk estimates are calculated using cancer slope factors (CSFs) for COCs exhibiting carcinogenic effects and reference doses (RfDs) for COCs exhibiting systemic (noncarcinogenic) effects. The RfDs and CSFs used in the baseline human health risk assessment are presented in the OU-9 RI/FS Report.

CSFs and RfDs are based on ingestion (oral) or inhalation routes of exposure rather than dermal contact. Therefore, these values reflect administered doses rather than absorbed doses.

E. Risk Characterization

A risk characterization was performed in the RI to quantify carcinogenic and non-carcinogenic risks presented by Area A under the planned industrial use as well as residential use.

Excess lifetime carcinogenic risks are quantified by multiplying the intake level and the CSF. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime, under the specific exposure conditions at a site. Noncarcinogenic risks were estimated using the concept of a hazard quotient (HQ) and a hazard index (HI). HIs are the sums of the individual HQs for COCs. If the value of the HQ or the HI

exceeds unity (1.0), the potential for noncarcinogenic health risks are considered to be unacceptable.

1. Surface and Subsurface Soils

Tables 19 through 32 provide the estimated incremental carcinogenic and noncarcinogenic risks for the child resident and adult industrial worker contact with Area A surface and subsurface soils. Table 33 summarizes these results. No estimated carcinogenic risks or noncarcinogenic risks were above the target risk levels of 1×10^{-4} and 1.0, respectively, for the industrial land use scenario. These are the highest risks identified under intended reuse of Area A property. These risks, however, fell within the EPA's acceptable carcinogenic risk range of 1×10^{-4} to 1×10^{-6}.

Noncarcinogenic and carcinogenic risks above the target risk levels of 1.0 and 1×10^{-4}, respectively, were estimated for the hypothetical future residential child and evaluated for contaminants of potential concern in surface soil and subsurface soil (Table 33). Specifically, unacceptable non-carcinogenic risks to residential children were identified in Site 2 and Site 3 surface soils and in subsurface soils associated with all four sites at Area A. Antimony, chromium, manganese, or silver contributed to the noncarcinogenic risk estimates. Unacceptable carcinogenic risks under a residential use scenario were also estimated for subsurface soils at Site 3, primarily associated with benzo(a)pyrene.

For Site 2 surface and subsurface soils and Site 3 subsurface soil, lead was identified as a contaminant of potential concern. Blood-lead levels in hypothetical residential children were evaluated using the average lead concentration for these soils. The estimated percentages of residential children (ages 1 to 6) exposed to Site 2 surface and subsurface soils with blood-lead levels above 10 ug/dl were 0.26 percent and 0.73 percent, below the protective level of 5 percent. Therefore, lead levels in soils do not present an unacceptable risk at Site 2 to the future residential child.

The estimated percentage (6.42 percent) of hypothetical residential children exposed to subsurface soil at Site 3 with a blood-lead level above 10 ug/dl was above the protective level. However, the model also predicted a blood-lead level of 5.24 ug/dl for most children, which is below the protective level cutoff of 10ug/dl. Therefore, adverse effects to children are not expected from lead concentrations in Site 3 subsurface soil.

2. Surface Water and Sediment

Tables 34 through 37 provide the estimated incremental carcinogenic and noncarcinogenic risks for the future child recreational receptor regarding exposure to Area A surface water and sediment in the nearby stream. Estimated cancer and noncancer risks for recreational children exposed to surface water via wading and to sediment via ingestion and dermal contract were found to be acceptable (i.e., all cancer risks equal to or less than 1.0×10^{-6}; all HIs less than 1.0).

F. Summary of Ecological Risk Assessment

The presence of elevated PAH and metal concentrations in sediment samples adjacent to and downstream of Area A suggests contaminant inputs from Area A soils to the stream. The detection of PAHs and metals in Area A surface soil suggests that these substances are being released at low levels to the stream at this time, particularly from the vicinity of Site 2. Potential contaminants of ecological concern were determined by comparing surface water and sediment sample analytical results to AWQCs and published conservative sediment benchmarks protective of sensitive receptors. Tables 38 through 41 present the potential ecological contaminants of concern in Area A surface water and sediment.

The risks presented by the potential sediment COCs were then evaluated by calculating the Ecological Effects Quotient (EEQ) for each substance, or the ratio of the contaminant concentration to the sediment benchmark. To estimate cumulative toxicity, EEQs were summed to obtain an Ecological Effects Index (EEI). The calculated EEIs for organics and inorganics in surface water were indicative of a moderate potential risk to environmental receptors. The calculated EEIs for both organics and inorganics in sediment were indicative of high potential risks. The majority of the EEI for organics in sediment was attributable to PAHs. As discussed earlier, other sources may be substantial contributors to PAH levels in Area A sediment. While the calculated EEIs suggest potential moderate risks and high risks associated with Area A surface water and sediment, respectively, the OU-9 RI/FS Report indicated that calculated EEIs, may not reflect actual risk to environmental receptors due to the uncertainty associated with this risk assessment process. The OU-9 RI/FS Report recommended that further monitoring be performed to better characterize the ecological risks.

The ecological risk assessment prepared for Area A includes a degree of uncertainty in the risk characterization. This uncertainty stems from the fact that this assessment did not fully or toxicologically consider antagonistic or synergistic effects. Little or no information was available to determine the potential for antagonism or synergism for the contaminants evaluated. The

calculated EEIs were only an additive measure of total potential risk. Toxicity may actually increase, or even decrease, geometrically based on synergistic or antagonistic effects. Additionally, contaminants that account for a large percentage of potential risk may be mitigated by several factors, including a low frequency of detection or elevated concentrations in areas with no significant ecological habitat. For these reasons, the estimated EEIs should be considered as a rough estimate of total ecological risk, but they contain uncertainty and must be interpreted with caution.

As part of the ecological risk assessment, the OU-9 RI/FS Report evaluated whether soils in Area A may migrate to the stream via erosion and present a threat to environmental receptors. This was accomplished through the use of a surface water runoff contaminant fate and transport model. The model estimated the surface soil contaminant concentrations that should not be exceeded within Area A if the objective is to prevent contaminant concentrations in sediment which exceed the sediment benchmarks discussed above. The results of the modeling appear in Table 42. Due to Area A topography, only Site 2 and Site 3 soils were predicted to migrate to the stream and therefore surface soil concentrations protective of sediment were calculated for these soils. As reflected by Table 42, representative surface and/or subsurface soil concentrations at Sites 2 and 3 were found to exceed the surface soil concentrations protective of sediment for each of these sites.

Figure 27 reflects the estimated area where Site 2 surface soil contaminant concentrations exceed soil levels protective of sediment. Figure 28 shows the estimated area where Site 2 and Site 3 subsurface soil analytical results exceed surface soil concentrations protective of sediment. These soils present a potential unacceptable risk to ecological receptors if allowed to migrate to the stream via surface runoff, or if excavated and used as surface soils in the future. More specific information regarding Area A surface and subsurface soil sample locations and related contaminant concentrations exceeding sediment protection levels is available in the Administrative Record for the Site (Tetra Tech NUS, June 22, 2000).

G. Risk Assessment Conclusions

The carcinogenic and non-carcinogenic risks posed to human health by Area A soils are acceptable for industrial use, the reasonably anticipated land use for the property. While residential use is not reasonably anticipated, an assessment of risks to human health under residential use identified unacceptable non-carcinogenic risks for surface soils at Sites 2 and 3 and subsurface soils at Site 1, Site 2, Site 3, and the Impoundment Area, and unacceptable carcinogenic risks for subsurface soils at Site 3.

Surface water and sediment associated with Area A was determined not to present an unacceptable carcinogenic or noncarcinogenic risk to human health.

Surface water and sediment associated with Area A were determined to present moderate and high potential risks, respectively, to environmental receptors. However, there is substantial uncertainty associated the results of the ecological risk assessment.

Surface and/or subsurface soils were determined to present a potential unacceptable risk to environmental receptors associated with the stream if allowed to migrate to the stream via surface runoff.

Actual or threatened releases of hazardous substances from OU-9, if not addressed by a remedial action to be selected in this ROD, may present an imminent and substantial endangerment to public health, or welfare or the environment.

XI. REMEDIAL ACTION OBJECTIVES

Based on the conclusions of the results of the human health and ecological risk assessments, the objective of the remedial action for OU-9 is to prevent the migration of soils which present a threat to ecological receptors to the unnamed tributary of Little Neshaminy Creek. In addition, since residential use of the property is not reasonably anticipated and Area A soils contain hazardous substances at levels which present an unacceptable risk under residential use, land use controls must be implemented to ensure that the property is not used for residential purposes. Finally, measures should be undertaken to mitigate potential risks associated with existing contaminants in sediment, and to a lesser extent, surface water in the unnamed tributary of Little Neshaminy Creek.

To be protective of the unnamed tributary of Little Neshaminy Creek and associated environmental receptors, the remedial action should prevent the migration of soils at Sites 2 and 3 which contain COCs at levels which exceed the concentrations indicated in Table 42.

XII. DESCRIPTION OF ALTERNATIVES

A detailed analysis of the possible remedial alternatives is included in the OU-9 RI/FS Report. The analysis was conducted in accordance with the EPA document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* and the National Oil and Hazardous Substances Pollution Contingency Plan.

Based on the remedial action objectives, the following technologies and process options have been considered:

- Environmental monitoring
- Institutional controls
- Erosion controls
- Removal (e.g., dredging), treatment, and off-base disposal of sediment

Institutional control general response actions were evaluated as an option for addressing the objective of preventing migration of Area A soils which present a threat to the stream and retained as a potential component to a remedial alternative.

Two of the general response actions for Area A sediment did not pass the screening process. More specifically, additional containment measures (e.g., sediment traps and stream diversion measures) were not retained due to implementability concerns. The construction of additional surface water controls would be complex due to the small size of the stream itself, the relatively steep embankments along both sides of the stream, and difficulty in accessing the stream due to mature vegetation and the slopes themselves.

The removal of impacted sediment, treatment, and off-base disposal alternative was eliminated as an option due to effectiveness and implementability concerns. The small size of the stream, the limited amount of significant sediment deposits, and the potential to damage wetlands were determining factors.

In general, the Area A streambed is rocky and gravelly, while the few deeper (1 to 2-foot depths) and slower moving ponds within that portion of the stream near Sites 2 and 3 contain a layer of finer sediment. Grain size analysis for Area A sediment samples indicated that sediments adjacent to Sites 2 and 3 were predominantly sandy and sediments slightly downstream of Area A were sandy to silty. These types of substrates tend to have fewer binding sites for contaminants than finer silty to clayey sediments. Due to these reasons, the amount of contaminated sediment that could effectively be dredged is quite limited. Dredging would also facilitate the release of any existing contaminated sediment into more downstream portions of the Area A stream. In addition, dredging would not eliminate the opportunity for future sediments to become contaminated through transport processes (e.g., potential groundwater discharges to the stream and stormwater outfalls).

The Area A removal actions have already addressed a majority of the contaminated surface soils that could erode and subsequently transport residual contaminants to the nearby stream. As such,

the potential for significant additional contaminant sediment loading due to surface soil migration in the future is low.

Similar to the implementability of more complex surface water controls, dredging would be relatively complicated due to accessibility concerns (e.g., narrow stream channel, steep embankments, and presence of mature vegetation, including trees). While the technologies available for dredging are implementable, they have one or more significant disadvantages with regard to Area A sediment. The more common technologies include in-stream mechanical dredging and low-turbidity hydraulic dredging. The small size of the stream, the limited amount of significant sediment deposits, and the potential need to dewater dredged materials and revegetate any damaged wetlands, would further limit the ability to adequately perform this type of work.

Environmental monitoring was retained as a means of mitigating the effects of sediment that presents a potential risk to environmental receptors.

The alternatives that passed the screening process are briefly described below.

A. Alternative 1: No Action

Under this alternative, no action would be undertaken to limit soil migration or to mitigate the effects of surface water and sediment. This alternative was evaluated for the purpose of establishing a basis for comparison with other alternatives.

There are no costs associated with the no action alternative. Since no action would be taken, there is no time duration associated with Alternative 1.

B. Alternative 2: Institutional and Erosion Controls; Environmental Monitoring

Alternative 2 includes erosion controls to prevent the migration of surface soils which present a threat to stream quality, institutional controls to ensure maintenance of the erosion controls and to control excavation in areas where subsurface soils present a potential threat to stream quality, monitoring to ensure that the erosion controls and institutional controls are implemented and maintained as planned, and environmental monitoring to mitigate impacts on stream quality. In addition, institutional controls would be implemented to prohibit non-industrial use.

This alternative includes establishing and/or maintaining erosion controls in areas where surface soils contain COCs at concentrations exceeding remediation levels protective of stream sediment. The objective of the erosion controls is to prevent the migration, via erosion, of the subject soils to the unnamed tributary of Little Neshaminy Creek.

As part of transfer of the property by the Navy, the deed entered into for transfer of the property would provide that the erosion controls remain permanently in place. In addition, the deed would provide that any plans for excavation in areas where subsurface soils contain COCs which exceed concentrations protective of stream sediment must be approved by the Navy and/or EPA. Such approval would consider the available information and be contingent on the submission of a plan to ensure necessary measures are undertaken to protect human health and the environment. The information to be considered would include data regarding the nature and extent of COCs in the area proposed for excavation.

Periodic monitoring would be conducted to determine whether any maintenance activities are required for the erosion controls and to ensure adherence to deed restrictions. Any necessary maintenance of the erosion controls would be performed and necessary actions taken to ensure adherence to deed restrictions.

In addition, the unnamed tributary of Little Neshaminy Creek would be periodically monitored to identify the extent of any contaminant loading to the stream, to assess the ecological effects of any contaminant loading, and to determine the nature of any necessary actions based on these assessments.

Every 5 years, a review would be conducted to evaluate the site status and determine whether further action is necessary. Periodic review would be required because Area A soil contaminants would remain at concentrations which are not protective of unrestricted land use or unlimited exposure.

XIII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives previously described were evaluated in the FS against nine criteria as required by the NCP, and as presented below. A description of each criterion and associated evaluation of the alternatives for Area A soils, surface water, and sediment are provided below.

A. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled, through treatment, engineering controls, and/or institutional controls. The main concern addressed by this criterion is the protection of ecological receptors from adverse effects from contact with Area A sediment. Alternative 1 is not protective of the environment. Actions are not conducted that limit migration of soil contaminants that exceed soil concentrations protective of sediment and associated aquatic and terrestrial receptors.

Alternative 2 is protective by limiting the migration of soil contaminants to the nearby stream. This alternative provides long-term monitoring to evaluate stream conditions in the event that these conditions significantly change over time. If necessary, modifications to the monitoring program would be made to further define or quantify any actual or potential impacts to the stream and related ecological receptors. Therefore, Alternative 2 provides a greater measure of protectiveness for ecological receptors (both aquatic and terrestrial) than Alternative 1.

B. Compliance with ARARs

Section 121(d) of CERCLA and Section 300.430(f)(1)(ii)(B) of CERCLA require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs", unless such ARARs are waived under CERCLA section 121(d)(4). This criterion addresses compliance with chemical-specific, location-specific, and action-specific ARARs.

Alternative 2 would comply with the State erosion control requirements (PA Code, Title 25, Chapter 102) regarding the disturbance of Area A soils. Alternative 1 would not comply with this action-specific ARAR.

C. Long-Term Effectiveness

Long-term effectiveness and permanence refers to expected residual risk and the ability of the remedy to maintain reliable protection of human health and the environment over time. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

Alternative 1 is not effective in the long term because it does not involve controls and allows residual risk associated with Area A soils and sediment to remain uncontrolled. Neither alternative provides measures to mitigate the possible contamination of sediment from uncharacterized sources.

Alternative 2 provides for the management of risks associated with Area A soils through institutional controls as well as erosion controls. The effectiveness of these controls depends on their reliability and continued enforcement. Implementation of institutional controls through property transfer documents is an effective option for prohibiting certain types of land uses.

D. Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. Alternatives 1 and 2 do not reduce the toxicity and volume of ecological COCs in media of concern. However, technologies that reduce the toxicity and volume of metals, a major category of COCs found in Area A sediment, are not readily available. These alternatives also do not reduce the mobility or COCs in media of concern.

E. Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved. This criterion is not applicable to Alternative 1. Alternative 2 would be effective over the short-term period to monitor the overall quality of Area A sediments and the Area A stream in general. Periodic monitoring would ensure that sediments are not adversely impacted by Area A sources. Along with institutional controls, these activities do not pose short-term risks to human health and the environment. The stream monitoring results could be used to evaluate another type of remedial alternative for the unnamed tributary, if warranted.

F. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered. This criterion is not applicable to Alternative 1. Alternative 2 is readily implementable.

G. Costs

The capital, operation and maintenance (O&M), and present-worth costs for Alternative 2 are $295,522. There are no costs involved with Alternative 1.

H. State/Support Agency Acceptance

The Commonwealth of Pennsylvania, as represented by the Pennsylvania Department of Environmental Protection (PADEP), has concurred with the selected remedy for OU-9.

I. Community Acceptance

The selected remedy was presented to the public in a public meeting along with the Proposed Plan. Comments and questions raised by members of the community are addressed in the Responsiveness Summary presented in Section XV of this ROD. Comments received at the public meeting and during the comment period are presented in Appendix D. In selecting a final remedy, the Navy and EPA have evaluated and balanced the nine criteria discussed above.

J. Prinicpal Threat Wastes

There are no principal threat wastes, as defined by the NCP, identified in Area A soils, surface water, and sediment.

XIV. SELECTED REMEDY

The selected remedy is Alternative 2. This remedy includes erosion controls to prevent the migration of surface soils which present a threat to stream quality; institutional controls to ensure maintenance of the erosion controls and to control excavation in areas where subsurface soils present a potential threat to stream quality; monitoring to ensure that the erosion and institutional controls are implemented as planned; and environmental monitoring to mitigate impacts on stream quality. In addition, institutional controls would be implemented to prohibit residential use.

A. Summary of the Rationale for the Selected Remedy

Alternative 2 meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs.

B. Description of the Selected Remedy

Erosion controls will be established and maintained to ensure that surface soils exceeding soil concentrations protective of sediment quality do not migrate to the unnamed tributary of Little Neshaminy Creek (see table below for soil remediation levels). The surface soils of concern are located within Site 2 as delineated in Figure 27. The erosion controls will include vegetation and engineering controls such as grading. Initially, Site 2 will be evaluated to determine where vegetation and engineering controls are necessary at this time to prevent erosion of the surface soils of concern to the stream. Vegetation and engineering controls will be established as necessary based on this evaluation. Once established, the erosion controls will be permanently maintained.

Institutional controls to ensure permanent maintenance of the erosion controls will consist of deed restrictions. The deed(s) prepared by the Navy for transfer of the property will provide that the erosion controls established at the time of transfer remain permanently in place.

Institutional controls in the form of deed restrictions will also provide for excavation control in areas where subsurface soils exceed soil concentrations protective of sediment (see Table 42). The subsurface soils of concern are located within Site 2 and Site 3 (see Figure 28 for locations). The excavation controls require prior approval by the Navy and/or the EPA of any plans for excavation within Sites 2 and 3. Such approval will consider the available information and be contingent on the submission and approval of a plan that ensures that necessary measures are undertaken to prevent migration of the subject soils to the unnamed tributary of Little Nesharniny Creek and to otherwise protect human health and the environment. The information to be considered will include RI data regarding the nature and extent of subsurface soils exceeding the soil concentrations protective of sediment quality (Table 42).

The deed(s) will also provide that Area A (Site 1, Site 2, Site 3, and the Impoundment Area) will not be used for non-industrial purposes such as residential, recreational, and child day care land uses (see Figure 29 for the location of this area).

A. Summary of the Rationale for the Selected Remedy

Alternative 2 meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs.

B. Description of the Selected Remedy

Erosion controls will be established and maintained to ensure that surface soils exceeding soil concentrations protective of sediment quality do not migrate to the unnamed tributary of Little Neshaminy Creek (see table below for soil remediation levels). The surface soils of concern are located within Site 2 as delineated in Figure 27. The erosion controls will include vegetation and engineering controls such as grading. Initially, Site 2 will be evaluated to determine where vegetation and engineering controls are necessary at this time to prevent erosion of the surface soils of concern to the stream. Vegetation and engineering controls will be established as necessary based on this evaluation. Once established, the erosion controls will be permanently maintained.

Institutional controls to ensure permanent maintenance of the erosion controls will consist of deed restrictions. The deed(s) prepared by the Navy for transfer of the property will provide that the erosion controls established at the time of transfer remain permanently in place.

Institutional controls in the form of deed restrictions will also provide for excavation control in areas where subsurface soils exceed soil concentrations protective of sediment (see Table 42). The subsurface soils of concern are located within Site 2 and Site 3 (see Figure 28 for locations). The excavation controls require prior approval by the Navy and/or the EPA of any plans for excavation within Sites 2 and 3. Such approval will consider the available information and be contingent on the submission and approval of a plan that ensures that necessary measures are undertaken to prevent migration of the subject soils to the unnamed tributary of Little Neshaminy Creek and to otherwise protect human health and the environment. The information to be considered will include RI data regarding the nature and extent of subsurface soils exceeding the soil concentrations protective of sediment quality (Table 42).

The deed(s) will also provide that Area A (Site 1, Site 2, Site 3, and the Impoundment Area) will not be used for non-industrial purposes such as residential, recreational, and child day care land uses. (See Figure 29 for the location of this area).

Periodic monitoring will be conducted to identify maintenance activities required for erosion controls and to ensure adherence to deed restrictions. Any necessary maintenance of the vegetated soil cover will be performed and any actions necessary taken to enforce deed restrictions will be taken.

In addition, the unnamed tributary of Little Neshaminy Creek will be periodically monitored to identify the extent of any contaminant loading to the stream, to assess the ecological effects of any contaminant loading, and to determine the nature of any necessary actions based on these assessments.

Every 5 years, a review will be conducted to evaluate the site status and to determine whether further action is necessary. Periodic review will be required because the selected remedy allows Area A soil contaminants to remain at concentrations which are not protective of unrestricted land use or unlimited exposure.

C. Performance Criteria

1. Erosion Controls

Erosion controls will be established to prevent migration of surface soils exceeding soil concentrations protective of sediment quality to the unnamed tributary of Little Neshaminy Creek. The surface soils of concern are located within Site 2 as delineated in Figure 28. The erosion controls will include vegetation and engineering controls such grading. A work plan describing the planned establishment of the erosion controls will be submitted to EPA and PADEP for review and comment. The work plan will refer to the results of a field inspection as necessary to support the work proposed. Vegetation and engineering controls will be established as necessary based on this evaluation. Once established, the erosion controls will be permanently maintained.

This alternative includes establishing and/or maintaining erosion controls in areas where surface soils contain COCs in exceedance of remediation levels protective of stream sediment. The objective of the erosion controls is to prevent the migration, via erosion, of the subject soils to the unnamed tributary of Little Neshaminy Creek.

The pertinent erosion control regulations (PA Code, Title 25, Chapter 102) regarding the preparation of erosion and sedimentation control plans, permits, and other requirements are applicable if Area A soils are further disturbed.

2. Institutional Controls

The institutional controls to be implemented under the selected remedy will consist of restrictions included in the deed(s) entered into for transfer of the property. The restrictions will prohibit non-industrial use within the area shown in Figure 27.

Through deed restrictions, the institutional controls will ensure that the erosion controls are permanently maintained. The deed(s) prepared by the Navy for the transfer of property will ensure that the erosion controls in effect at the time of property transfer remain in place.

Institutional controls will also ensure that excavation controls will be established for those areas where subsurface soil levels exceed concentrations protective of sediment quality.

3. Excavation Controls

Institutional controls in the form of deed restrictions will be implemented to provide for excavation controls in the vicinity of Sites 2 and 3. The proposed areas for excavation controls are shown in Figure 28. Excavation restrictions will be placed on the property such that no excavation will be permitted without the written consent of the Navy and/or EPA. Approval to excavate in the areas shown in Figure 28 will be contingent on the submission and approval of a plan which ensures that necessary measures are undertaken to prevent migration of Site 2 and Site 3 subsurface soils of concern to the unnamed tributary of Little Neshaminy Creek. Measures will also be performed as needed to otherwise protect human health and the environment. Erosion control and/or sedimentation plans will be submitted in accordance with federal and state requirements.

4. Maintenance of Erosion Controls/Deed Restriction Enforcement

Periodic monitoring will be conducted under the selected remedy to identify maintenance activities required for erosion controls and to ensure adherence to deed restrictions. Maintenance will be performed as necessary to maintain the vegetation and engineering erosion controls based on the findings and recommendations of periodic monitoring. In addition, if deed restrictions are not being adhered to as required, the Navy will undertake the actions necessary to enforce the restrictions of concern.

5. Periodic Stream Monitoring

To monitor the performance of the selected remedy, a stream monitoring program will be implemented. The monitoring program will identify the extent of any contaminant loading to the

unnamed tributary of Little Neshaminy Creek, will assess the ecological effects of any such contaminant loading, and will determine the nature of any necessary actions based on these assessments. A workplan describing the stream monitoring program will be developed, submitted to EPA and PADEP for comment, and implemented to achieve the monitoring program goals. The workplan will, at a minimum, require the periodic collection and analysis of surface water, sediment, and/or biological samples. For each stream monitoring event, a report summarizing the findings of the monitoring will be prepared and submitted to EPA for comment.

D. Summary of Estimated Remedy Costs

The estimated costs for the selected remedy are as follows:

- Estimated capital costs for institutional controls: $25,000
- Estimated capital costs for environmental monitoring: $21,483
- Estimated O&M costs for Year 1 of environmental monitoring: $100,474
- Estimated O&M costs for Years 2 - 5 of environmental monitoring: $143,746
- Estimated O&M costs for Year 1 of erosion controls $5,000
- Estimated O&M costs for Years 2 – 5 of erosion controls $12,000
- Estimated costs for 5-year review: $12,000
- Estimated 5-year present worth: $295,522

Table 43 provides more detail regarding the estimated remedy costs. The information presented in Table 43 is based on the best available information regarding the anticipated scope of the selected remedy. Only a five-year O&M period was assumed for maintaining erosion controls, although these controls will be permanently maintained. It is anticipated that the remedy will be implemented in less than 6 months to establish the necessary institutional controls, erosion controls, and excavation controls, and to plan the stream-monitoring program.

E. Expected Outcome of the Selected Remedy

The expected outcomes of implementing the selected remedy in terms of land and resource uses and risk reduction are as follows:

- Human health risks posed by exposure to Area A soils will be mitigated through institutional controls, including land use restrictions, erosion controls, and excavation controls.

- Land use controls will be implemented to ensure that Area A is not used for non-industrial purposes.

- Erosion controls will be maintained to ensure that surface soils at Sites 2 and 3 do not migrate to the unnamed tributary of Little Neshaminy Creek and therefore threaten stream quality.

- Excavation controls will be implemented to ensure that Area A subsurface soil does not become surface soil and subsequently threaten stream quality.

- Ecological risks posed by the migration of Area A soil contaminants to the downgradient stream will be prevented.

- Monitoring will be conducted to ensure that all controls are implemented as planned and that stream quality is not adversely impacted over time.

XV. STATUTORY DETERMINATIONS

Remedies must meet the statutory requirements of Section 121 of CERCLA, 42 U.S.C. 9621, as discussed below. Remedies must achieve adequate protection of human health and the environment, comply with state and federal ARARs, be cost-effective, and utilize, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. Also, remedies that reduce the volume, toxicity, and/or mobility of hazardous waste as the principal element are preferred.

The following discussion summarizes the statutory requirements that are met by the selected remedy.

A. Protection of Human Health and the Environment

The selected remedy will be protective of human health by restricting non-industrial land use at Area A through institutional controls to eliminate the threat of exposure via ingestion of contaminated Area A soils. The current cancer and noncancer risks associated with ingestion of contaminated Area A soils for industrial employees or workers are acceptable. Excavation restrictions will prevent the migration of Area A soil contaminants to nearby surface water and sediment.

The potential risks to ecological receptors from Area A sediment contamination or from surface runoff of Area A soil contaminants will be mitigated through the long-term stream monitoring program, erosion controls, and excavation restrictions.

B. Compliance with ARARs

The pertinent erosion control regulations as prescribed by PA Code, Title 25, Chapter 102 regarding the preparation of erosion and sedimentation control plans, permits, and other potentially are applicable if remedial action involves disturbing Area A soils.

C. Cost-Effectiveness

The selected remedy is cost effective because it would provide overall effectiveness proportional to the cost.

D. Five-Year Review Requirements

Because the selected remedy will result in hazardous substances and contaminants remaining at Area A above levels that allow for unlimited land use and unrestricted exposure, a statutory review will be conducted within 5 years to ensure that the remedy is, or will be, protective of human health and the environment.

E. Documentation of Significant Changes

The preferred remedy of institutional controls and environmental stream monitoring was presented in the Proposed Plan and was presented at the public meeting held on May 11, 2000. No significant changes were made to the preferred remedy as presented in the Proposed Plan. However, the selected remedy includes the provision to establish and permanently maintain erosion controls to ensure that surface soils exceeding concentrations protective of sediment quality do not migrate to the Area A stream.

XVI. RESPONSIVENESS SUMMARY

In a Proposed Plan released for public comment on May 1, 2000, the Navy, with the support of the EPA, identified Alternative 2 as the preferred remedy for OU-9. Alternative 2 is described in Section XII.B of this ROD. A public comment period on the Proposed Plan was open from May 1, 2000 through May 31, 2000. A public meeting was held on May 11, 2000 to present the Proposed Plan for OU-9 and to answer any questions on the Proposed Plan and on the

documents in the information repositories. A brief presentation was provided during which questions were answered and informal discussions took place.

This Responsiveness Summary presents a review of the community involvement in the CERCLA process at NAWC and provides a summary of the comments received during the public comment period for OU-9 along with responses to those comments.

A. Background on Community Involvement

The Navy and NAWC Warminster have had a comprehensive public involvement program for the last 10 years. The Navy organized a Technical Review Committee (TRC) in January 1989 to review and discuss NAWC CERCLA issues with local community officials and concerned citizens. The TRC was reorganized into the Restoration Advisory Board (RAB) in November 1993. The RAB consists of representatives of the Navy, EPA, PADEP, the Bucks County Health Department, the Northampton Township Municipal Authority, the Warminster Township Municipal Authority, Ivyland Borough, and Upper Southampton Township, as well as members of the community and concerned environmental organizations.

In 1994, the Navy prepared a Community Relations Plan for environmental activities at the base. Community relations activities have been conducted in accordance with this plan. These activities have included regular technical and restoration activity meetings with local officials, communications with the media and the establishment of information repositories. The RAB and a technical subcommittee (TSC), consisting of representatives from the RAB, have met on a regular monthly basis since its formation. The RAB has been assisting in the planning and review of environmental investigation, remedial alternative evaluation, and remediation activities, along with future land use planning. The RI/FS and the Proposed Plan for OU-9 were discussed at the RAB meetings.

RAB meeting minutes along with reports presenting the results and findings of investigations are maintained in two local information repositories that contain the Administrative Record for NAWC Warminster. One repository is located at the base; Navy Caretaker Site Office located at 860 Flamingo Alley, Warminster, Pennsylvania; and the other is located in a local library; Bucks County Library located at 150 South Pine Street, Doylestown, Pennsylvania.

Community relations activities for the final selected remedy include the items below:

- The documents concerning the investigation and analysis at OU-9 were presented in RAB and TSC meetings and draft and final copies were provided to all RAB members for review, discussion, and comment.

- The documents concerning the investigations and analysis at OU-9, as well as a copy of the Proposed Plan, were placed in the information repositories.

- The Navy mailed copies of the Proposed Plan to about 400 local area residents whose names appeared on the RAB mailing list.

- Newspaper announcements on the availability of documents and the public meeting and comment period were published in the *Bucks County Courier Times, Philadelphia Inquirer,* and *Intelligencer.*

- The Navy established a 30-day public comment period starting May 1, 2000 and ending May 31, 2000.

- A Public Meeting was held on May 11, 2000 to present the Proposed Plan and to answer questions concerning OU-9. Approximately 20 people, including representatives of the local municipalities, attended the meeting.

B. Summary of Comments and Responses

The local community and representatives of local municipalities did not express significant concern regarding the preferred alternative (Alternative 2) presented in the Proposed Plan. Written comments were submitted on behalf of Warminster Township and Warminster Municipal Authority (WMA) (Appendix D). These comments and responses to these comments are provided below. The Navy has taken these concerns into consideration and believes that Alternative 2 adequately and appropriately addresses the contamination associated with OU-9 in a cost effective and responsible manner.

Comment 1: The surface and subsurface post-excavation concentrations for lead exceed the PADEP soil to groundwater pathway standard. The lead levels do exceed the clean-up goal of 1,000 mg/kg, which contradicts the first bullet in Section 4.9. The potential to impact groundwater and surface water needs to be addressed.

Response 1: A few soil samples contained lead at levels greater than the PADEP soil to groundwater pathway generic standard of 450 mg/kg. Surface (emphasis added) soils within Area A did not contain lead at concentrations greater than 1,000 mg/kg. The first bullet in Section 4.9 is correct. A few subsurface soil samples contained lead at levels above 1,000 mg/kg. The isolated nature of the lead detections above 450 mg/kg or 1,000 mg/kg did not reveal a consistent pattern of soil contamination at Area A.

The potential for lead in Area A soils to adversely impact groundwater was not quantitatively evaluated in the OU-9 RI/FS Report. This evaluation will be included in the final RI report for Area A groundwater, which is currently in preparation.

With regard to the potential for lead in Area A soils to adversely impact nearby surface water, Section 5.0 of the OU-9 RI/FS Report discusses potential contaminant migration routes at Area A. A surface runoff model was used to estimate soil concentrations that are acceptable for protecting stream sediment quality. The baseline risk assessment fully evaluated the risk to recreational children exposed to Area A surface water and sediment contaminants via wading. The risks were below the acceptable target risk range.

Comment 2: The report discusses detections of various contaminants in surface water but does not compare them to the PADEP surface water criteria (Chapter 16). A review of the surface water data reveals that there were several exceedances of the PADEP human health criteria. including tetrachloroethene, benzo(a)anthracene and pyrene. The risk assessment concluded that there was no unacceptable risk to humans because of the industrial land use. It was not clear in the report how far downstream the impacts extend and where the PADEP criteria are met. An evaluation of downstream impacts should be provided.

Response 2: Figure 25 displays the surface water sample results that exceeded federal Ambient Water Quality Criteria (AWQCs) for protection of human health. A comparison to state AWQC (25 PA Code, Chapter 16) was not performed as part of the OU-9 RI/FS Report. The relevant state AWQC values are contained in Table 44. Some surface water samples contained hazardous substances above the state AWQC values as noted by the commentor. Exceedances were noted for tetrachloroethene [1 sample (i.e., sample A8) out of 13 surface water samples], benzo(a)anthracene and chrysene [1 sample (i.e., sample A28) out of 8 samples], and total thallium [1 sample (i.e., sample A29) out of 15 samples]. Very few exceedances were noted, and concentrations that were greater or equal to the state AWQC were generally estimated values. Based on the minor and infrequent exceedances of state AWQCs, potential downstream impacts

(as determined by comparing surface water sample results to state AWQCs) were not evident. However, Figure 25 indicates that surface water sample exceedances of specific federal AWQCs were noted as far downstream as sample A16.

The baseline risk assessment fully evaluated the risk to recreational children exposed to Area A surface water contaminants via wading. The risks were below the acceptable target risk range.

Comment 3: Several organic and inorganic parameters were found with elevated concentrations posing ecological risks in the stream sediments. The apparent source is Area A and the storm sewer outfalls. The origin of the stormwater is not clearly delineated. Although ecological risks are present, no remediation alternatives for the sediments are proposed.

Response 3: The origin of the stormwater flowing through Outfall No. 1 (OF1) is surface runoff from built-up areas generally within Area D at the base. Potential remediation alternatives for Area A sediment were screened and evaluated in the OU-9 RI/FS Report. Based on the FS screening evaluation, only two alternatives were retained for detailed analysis. Section XII of the ROD discusses this evaluation in detail.

Comment 4: The only alternative evaluated in the FS is institutional controls and environmental monitoring. Alternatives that would have included remediation or capping of impacted soils or sediments were excluded in the screening process. Based on our review, we believe that there are feasible remediation alternatives that should be evaluated in the normal analysis process.

Response 4: Potential remediation alternatives for Area A sediment and soils were screened and evaluated in the OU-9 RI/FS Report. Based on the FS screening evaluation, only two alternatives were retained for detailed analysis (refer to Section XII of this ROD). Remediation of impacted soils and sediments was not retained due to implementability and effectiveness considerations.

Comment 5: Historically at NAWC Warminster, sanitary wastewater was treated at an on base treatment plant. The plant, which was constructed in 1945, had a history of not meeting permitted discharge criteria. The plant has been taken out of operation and the current waste stream discharges to the WMA wastewater treatment facility.

Under the current base reuse strategy, the Navy will transfer land in the vicinity of Site 1 (including the former on-base treatment plant) to WMA as part of a public benefit conveyance through the U.S. Department of Health and Human Services. The former treatment plant will be demolished and WMA will construct a new state-of-the-art facility in its place.

The remedial alternative for OU-9 preferred by the Navy and the EPA (Alternative 2) contemplates the protection of human health through the emplacement of institutional controls to prevent excavation and construction activities. As presented in the plan, the description of Alternative 2 is incomplete, as it provides no specific details as to where the institutional controls will be required. This is an important consideration given that the building of the new wastewater treatment plant will necessarily involve excavation and construction activities.

Response 5: The ROD (Figures 27, 28, and 29) provides more detail as to where institutional controls will be required. These controls will be implemented in the vicinity of Sites 1, 2, and 3, and the former Impoundment Area. Most of this property lies within 250 feet of the fenceline along the Navy property boundary. The ROD does not include institutional controls for the wastewater treatment plant area, since this area was not investigated as part of the Area A RI work. The selected remedy does not prohibit excavation or construction activities in the vicinity of Area A; it does, however, require prior approval of excavation plans by the Navy and/or the EPA.

The Navy conducted an environmental baseline survey (EBS) for the wastewater treatment plant area. The results of the EBS will be used to prepare a finding of suitability to transfer (FOST) for this area. The FOST will include a description of any restrictions to be placed on the wastewater treatment plant area.

Comment 6: Given WMA's planned use of the area, which is essential to base reuse, institutional controls are not adequately protective of public health or safety. WMA believes hazardous substances in the area of its proposed construction activities should be excavated and removed to an approved off-site treatment storage, and disposal (TSD) facility.

Response 6: The Navy believes that institutional controls in the case of Area A soils are protective of public health and safety. The selected remedy does not prohibit excavation or construction activities in the vicinity of Area A. The risk assessment for Area A soils indicated that these soils are safe for industrial land use, including those workers exposed to contaminated Area A soils during construction activities. Since residential land use is not reasonably anticipated for Area A, and industrial use is part of the base re-use plan, institutional controls are an effective mechanism for allowing the intended reuse and limiting residential use exposures.

APPENDIX A

TABLES

TABLE 1
AREA A SOILS
REMOVAL ACTION CLEAN-UP GOALS
NAWC WARMINSTER, PENNSYLVANIA

SITE	PARAMETER	CLEAN-UP GOAL
Site 1	Trichloroethylene (TCE)	60 ug/kg
Excavation 1A	Antimony	113 mg/kg
	Cadmium	76 mg/kg
	Chromium	16,161 mg/kg
Site 1	TCE	60 ug/kg
Excavation 1B	Antimony	113 mg/kg
	Cadmium	76 mg/kg
	Chromium	16,161 mg/kg
	Thallium[1]	14 mg/kg
Site 2	Antimony Surface Soils	50 mg/kg
Excavation 2A	Lead Surface Soils	1,000 mg/kg
	Antimony Subsurface Soils	113 mg/kg
	Lead Subsurface Soils	1,750 mg/kg
Site 2	Benz(a)anthracene	2,300 ug/kg
Excavation 2B	Indeno(1,2,3-cd)pyrene	1,100 ug/kg
Site 2C	Benzo(a)pyrene	78,000 ug/kg
Site 3	Anthracene	540 ug/kg
	Benz(a)anthracene	2,300 ug/kg
	Benzo(a)pyrene	2,500 ug/kg
	Fluoranthene	5,000 ug/kg

[1] Thallium was added as a clean-up goal for the eastern end of Excavation 1B after evaluation of characterization samples from drum excavation.

TABLE 2
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 1 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

	Background Data				Site-Related Data				
Substance	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Sampling Round and Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	1/1	16,600	16,600.00	SS-01-06	16,600
CHROMIUM	29/29	7.9 J - 35.3 J	BG-12	21.7	1/1	28.1	28.10	SS-01-06	28.1
COBALT	25/29	1.6 - 22.1	BG-23-DUP	10.4	1/1	11	11.00	SS-01-06	11
IRON	29/29	6980 - 410500	BG-04	35,030	1/1	24,300	24,300.00	SS-01-06	24,300
LEAD	29/29	1.6 J - 96.5 J	BG-13	16.4	1/1	11.8	11.80	SS-01-06	11.8
MANGANESE	29/29	30.9 - 2010	BG-28	604	1/1	512	512.00	SS-01-06	512
NICKEL	18/29	4.1 J - 21.7 J	BG-23-DUP	11.1	1/1	12.8	12.80	SS-01-06	12.8
POTASSIUM	25/29	89.1 - 3050	BG-24	997	1/1	892	892.00	SS-01-06	892
VANADIUM	29/29	15.4 - 45	BG-12	32.2	1/1	34.7	34.70	SS-01-06	34.7
BENZENE	0/19				1/1	2	2.00	SS-01-06	2
CHLOROBENZENE	0/19				1/1	2	2.00	SS-01-06	2
TOLUENE	3/19	2	BG-17, BG-21, BG-22	2	1/1	2	2.00	SS-01-06	2

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 3
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 1 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Substance	Frequency of Detection	Range of Positive Detections Min - Max	Sampling Round and Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Sampling Round and Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	17/17	5580 - 33500	15,852	SB-01-05	18,710
ANTIMONY	1/29	13.6 J	BG-16	4.11	9/30	0.31 - 15.2	1.91	SB-01-48	3.60
ARSENIC	25/29	0.28 - 12.1 J	BG-11	11.7	16/17	1.3 - 25.5	5.12	SB-01-14	8.32
BARIUM	25/29	34.1 - 225	BG-28	87.1	17/17	26.4 - 210	93	SB-01-02	130
BERYLLIUM	25/29	0.31 - 1.7 J	BG-23-DUP	0.88	15/17	0.41 - 3.1	1.40	SB-01-14	2.03
CADMIUM	0/29				23/40	0.05 - 61.4	6.01	SB-01-25	15.5
CALCIUM	23/29	240 - 1910	BG-24	781	17/17	314 - 53400	4,220	SB-01-25	5,468
CHROMIUM	29/29	7.9 J - 35.3 J	BG-12	21.7	38/39	7 - 4600	250	SB-01-48	233
COBALT	25/29	1.6 - 22.1	BG-23-DUP	10.4	16/17	7.1 - 66.1	17.2	SB-01-25	25.8
COPPER	27/29	3.6 J - 30.6	BG-29	14.1	17/17	2.5 - 299	65.7	SB-01-28	299
CYANIDE	0/20				1/5	1.6	0.69	SB-01-05	1.60
IRON	29/29	6980 - 410500	BG-04	35,030	17/17	9560 - 251000	38,462	SB-01-25	53,412
LEAD	29/29	1.6 J - 96.5 J	BG-13	16.4	24/24	2.1 - 135	19.7	SB-01-25	31.3
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	17/17	380 - 5890	3,084	SB-01-16	5,890
MANGANESE	29/29	30.9 - 2010	BG-28	604	17/17	230 - 2630	848	SB-01-02	1,264
MERCURY	1/29	0.37	BG-23	0.05	7/17	0.1 - 6.8	0.47	SB-01-25	0.46
NICKEL	18/29	4.1 J - 21.7 J	BG-23-DUP	11.1	14/17	3.1 - 87.9	18.0	SB-01-25	28.6
POTASSIUM	25/29	89.1 - 3050	BG-24	997	13/17	320 - 4600	1,888	SB-01-21	4,600
SELENIUM	0/29				6/17	0.88 - 3.3	0.72	SB-01-25	1.29
SILVER	0/29				11/17	0.67 - 360	22.0	SB-01-25	17
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	15/17	17.2 - 707	134	SB-01-25	226
THALLIUM	3/29	0.37 - 0.42	BG-23-DUP	0.42	10/24	0.4 - 1.7	0.55	SB-01-25	0.69
VANADIUM	29/29	15.4 - 45	BG-12	32.2	17/17	13.8 - 66.6	30.1	SB-01-05	38.4
ZINC	25/29	9 - 60	BG-13	30.0	17/17	11.8 - 451	67.1	SB-01-25	104
2-BUTANONE	0/19				1/6	4.8	6.05	SB-01-30	4.80
4,4'-DDD	1/21	16 J	BG-12	2.98	1/2	55	28.5	SB-01-06-MAX	55.0
4,4'-DDE	1/21	820	BG-12	820	2/2	4.3 - 12	8.15	SB-01-06-MAX	12.0
4-METHYL-2-PENTANONE	0/19		BG-17, BG-21, BG-22		1/6	1.6	5.52	SB-01-30	1.60
AROCLOR-1254	1/21	51	BG-13	41.3	1/8	41	22.1	SB-01-06-MAX	27.1
BIS(2-ETHYLHEXYL)PHTHALATE	1/11	50 J	BG-16	50.0	1/8	40	175	SB-01-06-MAX	40.0
ENDRIN	0/21				1/2	4.8	3.43	SB-01-06-MAX	4.80
TOLUENE	3/19	2 - 2		2.0	1/6	2.9	4.82	SB-01-30	2.90

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 4
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 2 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Substance	Background Data				Site-Related Data				
	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	20/20	142 - 19800	12,738	SS-02-63	19,800
ANTIMONY	1/29	13.6	BG-16	4.11	24/46	0.19 - 10.8	2.18	SS-02-42	3.81
ARSENIC	25/29	0.28 - 12.1	BG-11	11.7	20/20	0.88 - 13.1	5.40	SS-02-03	7.10
BARIUM	25/29	34.1 - 225	BG-28	87.1	20/20	4.4 - 452	119	SS-02-07-MAX	224
BERYLLIUM	25/29	0.31 - 1.7	BG-23-MAX	0.88	19/20	0.63 - 1.4	0.94	SS-02-64, SS-02-16-MAX	1.06
CADMIUM	0/29				36/48	0.09 - 20.3	2.55	SS-02-26	7.7
CALCIUM	23/29	240 - 1910	BG-24	781	20/20	1050 - 215000	19,443	SS-02-56	42,064
CHROMIUM	29/29	7.9 - 35.3	BG-12	21.7	24/24	1.1 - 133	46.6	SS-02-05-MAX	87.6
COBALT	25/29	1.6 - 22.1	BG-23-MAX	10.4	20/20	0.74 - 14.5	11.0	SS-02-06	14.5
COPPER	27/29	3.6 - 30.6	BG-29	14.1	44/44	5.7 - 1410	114	SS-02-22	161
IRON	29/29	6980 - 410500	BG-04	35,030	20/20	2360 - 38000	22,818	SS-02-07-MAX	25,933
LEAD	29/29	1.6 - 96.5	BG-13	16.4	48/48	8 - 994	108	SS-02-22	152
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	20/20	1900 - 135000	12,346	SS-02-56	16,429
MANGANESE	29/29	30.9 - 2010	BG-28	604	20/20	169 - 2080	711	SS-02-05-MAX	903
MERCURY	1/29	0.37	BG-23-MAX	0.05	8/20	0.18 - 1.1	0.25	SS-02-14	0.57
NICKEL	18/29	4.1 - 21.7	BG-23-MAX	11.1	11/20	4.9 - 47	15.3	SS-02-07-MAX	20.7
POTASSIUM	25/29	89.1 - 3050	BG-24	997	19/20	684 - 2590	1,403	SS-02-18	1,679
SELENIUM	0/29				3/18	0.89 - 1.6	0.47	SS-02-07-MAX	0.61
SILVER	0/29				25/43	0.14 - 58.4	3.83	SS-02-07-MAX	23.3
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	12/20	84.8 - 1870	273	SS-02-14	500
THALLIUM	3/29	0.37 - 0.42	BG-23-MAX	0.42	6/24	0.81 - 1.4	0.51	SS-02-07-MAX	0.68
VANADIUM	29/29	15.4 - 45	BG-12	32.2	20/20	24.1 - 119	39.1	SS-02-05-MAX	46.0
ZINC	25/29	9 - 60	BG-13	30	44/44	23 - 4800	319	SS-02-22	428
2-METHYLNAPHTHALENE	0/11				2/20	46 - 21000	1,264	SS-02-56	1,033
ACENAPHTHENE	0/11				4/20	43 - 180	1,033	SS-02-06	180
ACENAPHTHYLENE	0/11				6/20	44 - 440	1,027	SS-02-07-MAX	440
ANTHRACENE	0/11				12/20	51 - 640	1,037	SS-02-05-MAX	640
BENZO(A)ANTHRACENE	0/11				16/23	190 - 3300	1,413	SS-02-05-MAX	2,198
BENZO(A)PYRENE	0/11				17/24	47 - 3400	1,433	SS-02-05-MAX	2,590
BENZO(B)FLUORANTHENE	1/11	58	BG-13	58	14/20	300 - 5300	2,015	SS-02-05-MAX	4,841
BENZO(G,H,I)PERYLENE	0/11				23/38	55 - 4400	1,129	SS-02-39	1,522
BENZO(K)FLUORANTHENE	1/11	46	BG-13	46	14/20	110 - 1800	1,314	SS-02-05-MAX	1,756
BIS(2-ETHYLHEXYL)PHTHALATE	1/11	50	BG-16	50	2/20	1000 - 1800	1,115	SS-02-70-MAX	1,800
CARBAZOLE	0/11				9/20	48 - 560	1,000	SS-02-05-MAX	560
CHRYSENE	1/11	51	BG-13	51	14/20	260 - 3300	1,633	SS-02-05-MAX	3,009
DI-N-BUTYL PHTHALATE	0/11				2/20	43 - 61	1,033	SS-02-02	61.0
DIBENZO(A,H)ANTHRACENE	0/11				7/20	37 - 470	994	SS-02-05-MAX	470
DIBENZOFURAN	0/11				4/20	41 - 73	1,022	SS-02-02, SS-02-06	73.0
FLUORANTHENE	1/11	92	BG-13	92	14/20	390 - 6200	2,141	SS-02-05-MAX	5,211
FLUORENE	0/11				6/20	58 - 250	997	SS-02-05-MAX	250
INDENO(1,2,3-CD)PYRENE	0/11				31/41	37 - 5000	1,151	SS-02-39	1,717
NAPHTHALENE	0/11				1/20	52	1,039	SS-02-06	52.0
PHENANTHRENE	1/11	51	BG-13	51	14/20	120 - 3700	1,511	SS-02-05-MAX	2,742
PYRENE	1/11	100	BG-13	100	14/20	290 - 4600	1,925	SS-02-05-MAX	4,297

TABLE 4
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 2 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Substance	Background Data				Site-Related Data				
	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
TOLUENE	3/21	2	BG-17	2	1/12	2	6.08	SS-02-03	2.00
4,4'-DDD	1/23	16	BG-12	3	1/12	19	3.28	SS-02-56	4.57
4,4'-DDE	1/23	820	BG-12	15.3	1/12	8	3.08	SS-02-01	4.54
4,4'-DDT	1/23	1440	BG-12	21.5	4/12	4.2 - 23	5.32	SS-02-01	10.3
ALPHA-CHLORDANE	0/23				2/12	4.6 - 160	15.3	SS-02-69	50.4
AROCLOR-1254	1/23	51	BG-13	41.3	12/20	11 - 3700	284	SS-02-69	596
AROCLOR-1260	0/23				1/20	110	27.7	SS-02-08	33.5
DIELDRIN	0/23				1/12	32	5.08	SS-02-69	9.05
ENDRIN	0/23				4/12	5.8 - 370	35.4	SS-02-69	123
GAMMA-BHC (LINDANE)	0/23				5/12	2.3 - 5	2.65	SS-02-06	4.84
GAMMA-CHLORDANE	0/23				1/12	11	2.58	SS-02-69	4.98

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 5
OCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 2 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

	Background Data				Site Related Data				
Substance	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	66/66	5210 - 133000	14,984	TP10-0207	16,637
ANTIMONY	1/29	13.6	BG-16	4.11	36/76	0.37 - 90.5	7.27	SB-02-16	11.47
ARSENIC	25/29	0.28 - 12.1	BG-11	11.7	60/66	0.85 - 19.6	4.72	SB-02-09	6.26
BARIUM	25/29	34.1 - 225	BG-28	87.1	66/66	21.6 - 719	116	SB-02-28-MAX	121
BERYLLIUM	25/29	0.31 - 1.7	BG-23-MAX	0.88	56/66	0.25 - 8.2	0.89	SB-02-42	0.92
CADMIUM	0/29				44/93	0.14 - 293	8.10	SB-02-27	7.70
CALCIUM	23/29	240 - 1910	BG-24	781	65/66	366 - 74000	7,316	SB-02-15	9,426
CHROMIUM	29/29	7.9 - 35.3	BG-12	21.7	66/66	4 - 3840	173	SB-02-16	95
COBALT	25/29	1.6 - 22.1	BG-23-MAX	10.4	65/66	3.5 - 24.8	10.11	SB-02-08	10.7
COPPER	27/29	3.6 - 30.6	BG-29	14.1	79/80	4.6 - 7980	467	SB-02-75-MAX	396
CYANIDE	0/20				4/46	0.93 - 20.4	1.26	SB-02-16	0.91
IRON	29/29	6980 - 410500	BG-04	35,030	66/66	4000 - 103000	22,989	SB-02-08	26,992
LEAD	29/29	1.6 - 96.5	BG-13	16.4	86/93	1.5 - 2060	155	SB-02-71	230
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	65/66	680 - 29900	3,461	SB-02-32	3,522
MANGANESE	29/29	30.9 - 2010	BG-28	604	66/66	127 - 1760	545	SB-02-28-MAX	583
MERCURY	1/29	0.37	BG-23-MAX	0.05	25/66	0.04 - 0.98	0.13	SB-02-17	0.14
NICKEL	18/29	4.1 - 21.7	BG-23-MAX	11.1	57/66	3.1 - 143	18.6	SB-02-42	18.7
POTASSIUM	25/29	89.1 - 3050	BG-24	997	60/66	110 - 2690	813	SB-02-37	948
SELENIUM	0/29				4/60	0.78 - 7.3	0.53	TP10-0207	0.54
SILVER	0/29				30/81	0.11 - 317	14.2	SB-02-70-MAX	12.4
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	33/66	45 - 2910	137	TP02-02-02	134
THALLIUM	3/29	0.37 - 0.42	BG-23-MAX	0.42	1/66	0.69	0.50	TP10-0207	0.51
VANADIUM	29/29	15.4 - 45	BG-12	32.2	66/66	5.7 - 586	38.3	SB-02-42	41.4
ZINC	25/29	9 - 60	BG-13	30	80/80	5.2 - 5640	453	SB-02-42	535
1,1-DICHLOROETHANE	0/21				1/53	16	36.3	SB-02-35	16.0
1,2-DICHLOROETHENE (TOTAL)	0/21				3/53	3 - 60	36.8	SB-02-12	22.0
2-BUTANONE	0/21				3/53	4.5 - 20	38.5	SB-02-02	24.0
2-HEXANONE	0/19				2/53	1 - 2	36.9	TP11-0209	2.00
4-METHYL-2-PENTANONE	0/21				4/53	0.9 - 110	38.8	SB-02-31	27.6
ACETONE	0/21				8/53	49 - 170	64.0	SB-02-10	109
BENZENE	0/21				3/53	1 - 8	36.2	TP10-0207	8.00
BROMOMETHANE	0/21				1/52	360	22.3	SB-02-09	17.1
CARBON DISULFIDE	0/19				2/53	2 - 10	36.2	TP14-0213	10.0
CHLOROETHANE	0/19				1/53	3	36.4	TP11-0209	3.00
CHLOROFORM	0/19				1/53	1	36.0	TP02-02-02	4.00
CHLOROMETHANE	0/21				1/53	810	27.9	SB-02-09	17.8
ETHYLBENZENE	0/21				3/53	3 - 13	35.3	SB-02-32	13.0
METHYLENE CHLORIDE	0/21				5/53	1 - 23	21.7	SB-02-32	15.8
TETRACHLOROETHENE	0/21				13/53	2 - 36	36.4	SB-02-11-MAX	23.0
TOLUENE	3/21	2	BG-17	2	6/53	2 - 150	38.1	SB-02-32	26.2
TRANS-1,3-DICHLOROPROPENE	0/21				1/53	97.75	37.9	SB-02-07	25.0
TRICHLOROETHENE	0/21				12/53	1 - 12	36.2	SB-02-19	12.0
1,4-DICHLOROBENZENE	1/11	43	BG-11	43	1/38	68	371	SB-02-07	68.0
3,3'-DICHLOROBENZIDINE	0/11				1/38	400	380	SB-02-07	400
ACENAPHTHENE	0/11				6/38	75 - 1400	408	SB-02-53	471
ANTHRACENE	0/11				10/38	98 - 2200	418	SB-02-53	528
BENZO(A)ANTHRACENE	0/11				21/38	49 - 5200	598	SB-02-53	882
BENZO(A)PYRENE	0/11				22/39	44 - 3800	545	SB-02-53	810
BENZO(B)FLUORANTHENE	1/11	58	BG-13	58	21/38	51 - 4900	626	SB-02-53	941
BENZO(G,H,I)PERYLENE	0/11				19/38	51 - 2100	330	TP10-0207	451

TABLE 5
OCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 2 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

	Background Data				Site-Related Data				
Substance	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
BENZO(K)FLUORANTHENE	1/11	46	BG-13	46	20/38	23 - 2200	365	TP10-0207	546
BIS(2-ETHYLHEXYL)PHTHALATE	1/11	50	BG-16	50	6/39	46 - 2200	414	SB-02-41	700
BUTYLBENZYL PHTHALATE	0/11				3/33	55 - 110	364	SB-02-22	110.0
CARBAZOLE	0/11				6/38	91 - 1300	413	SB-02-53	480
CHRYSENE	1/11	51	BG-13	51	22/38	42 - 4900	587	SB-02-53	922
DI-N-BUTYL PHTHALATE	0/11				7/38	46 - 4200	448	SB-02-41	651
DIBENZO(A,H)ANTHRACENE	0/11				6/38	62 - 450	365	SB-02-53	417
DIBENZOFURAN	0/11				5/38	88 - 570	379	SB-02-53	417
DIETHYL PHTHALATE	0/11				2/38	48 - 67	366	SB-02-56-MAX	48.0
FLUORANTHENE	1/11	92	BG-13	92	22/38	68 - 13000	1,105	SB-02-53	1,711
FLUORENE	0/11				7/38	66 - 1000	410	SB-02-53	498
INDENO(1,2,3-CD)PYRENE	0/11				17/38	29 - 2500	451	TP10-0207	636
NAPHTHALENE	0/11				4/38	51 - 250	369	SB-02-53	250
PENTACHLOROPHENOL	0/11				1/38	62	883	SB-02-08	62.0
PHENANTHRENE	1/11	51	BG-13	51	18/38	43 - 9900	775	SB-02-53	1,181
PYRENE	1/11	100	BG-13	100	23/38	42 - 9800	983	SB-02-53	1,640
ALDRIN	0/23				1/40	3.6	1.30	SB-02-08	1.42
ALPHA-CHLORDANE	0/23				2/40	2.9 - 5.9	1.42	SB-02-27	1.59
AROCLOR-1248	0/23				1/42	110	26.4	SB-02-27	29.1
AROCLOR-1254	1/23	51	BG-13	41.3	5/42	11 - 1150	48.0	SB-02-07	37.5
AROCLOR-1260	0/23				7/42	9 - 1600	78.8	SB-02-07	65.3
DIELDRIN	0/23				2/40	4.3 - 5.8	2.60	SB-02-42	2.87
ENDOSULFAN II	0/23				2/39	2.4 - 8.5	2.17	SB-02-27	2.34
ENDOSULFAN SULFATE	0/21				1/40	9.3	2.63	TP11-0209	2.90
ENDRIN	0/23				6/40	2.1 - 20	3.78	SB-02-27	4.46
ENDRIN KETONE	0/23				3/40	1.2 - 5.5	2.51	SB-02-27	2.75
GAMMA-BHC (LINDANE)	0/23				1/40	2.5	1.29	SB-02-02	1.39
GAMMA-CHLORDANE	0/23				2/38	2.3 - 3.4	1.35	SB-02-08	1.50
HEPTACHLOR EPOXIDE	0/23				1/40	3.5	1.30	SB-02-08	1.42
HEXAVALENT CHROMIUM	0/0				5/13	0.00153 - 0.00359	0.0010	SB-02-24	0.0036
4,4'-DDE	1/23	820	BG-12	15.3	3/40	7.9 - 82	4.80	SB-02-42	4.45
4,4'-DDT	1/23	1440	BG-12	21.5	7/39	1.8 - 150	8.19	SB-02-42	6.16
XYLENES, TOTAL	0/21				5/53	2.8 - 38	36.1	SB-02-32	20.7
OCDD	0/0				4/5	0.25 - 0.68	0.38	SB-02-40	0.68
OCDF	0/0				1/5	0.25	0.10	SB-02-42	0.25
4,4'-DDD	1/23	16	BG-12	3	4/40	2.3 - 45	3.86	SB-02-08	3.92
2-METHYLNAPHTHALENE	0/11				3/38	110 - 360	375	SB-02-33	360

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 6
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 3 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

	Background Data				Site-Related Data				
Substance	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	5/5	7510 - 12800	9560	SS-03-02	1
ARSENIC	25/29	0.28 - 12.1	BG-11	11.7	5/5	3.5 - 7.9	5.9	SS-03-06	15
BARIUM	25/29	34.1 - 225	BG-28	87.1	5/5	66.7 - 99	83.3	SS-03-06	120
BERYLLIUM	25/29	0.31 - 1.7	BG-23-MAX	0.88	5/5	0.82 - 0.97	0.88	SS-03-06	12000.2929
CALCIUM	23/29	240 - 1910	BG-24	781	5/5	4060 - 30700	18732	SS-03-06	220
CHROMIUM	29/29	7.9 - 35.3	BG-12	21.7	5/5	16.2 - 36.8	25.68	SS-03-05	7.9
COBALT	25/29	1.6 - 22.1	BG-23-MAX	10.4	5/5	7.9 - 11.7	9.38	SS-03-06	99
COPPER	27/29	3.6 - 30.6	BG-29	14.1	5/5	11 - 42.3	23.04	SS-03-05	786.3156
CYANIDE	0/20				1/2	0.51	0.385	SS-03-02	1203.5322
IRON	29/29	6980 - 410500	BG-04	35,030	5/5	14800 - 28600	20560	SS-03-06	947.0797
LEAD	29/29	1.6 - 96.5	BG-13	16.4	5/5	18.2 - 30.4	23.14	SS-03-02	320
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	5/5	3280 - 12300	8476	SS-03-06	1000
MANGANESE	29/29	30.9 - 2010	BG-28	604	5/5	401 - 1180	701	SS-03-01	0.97
NICKEL	18/29	4.1 - 21.7	BG-23-MAX	11.1	4/5	10.5 - 21.5	14.93	SS-03-06	21
POTASSIUM	25/29	89.1 - 3050	BG-24	997	5/5	699 - 2510	1670	SS-03-02	27905.1078
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	4/5	147 - 3620	861.4	SS-03-02	36.8
THALLIUM	3/29	0.37 - 0.42	BG-23-MAX	0.42	1/5	1.1	0.489	SS-03-02	880.333
VANADIUM	29/29	15.4 - 45	BG-12	32.2	5/5	22.7 - 50.7	34.6	SS-03-06	11.0121
ZINC	25/29	9 - 60	BG-13	30	5/5	34.5 - 167	71.58	SS-03-05	42.3
ACENAPHTHYLENE	0/11				5/8	33 - 120	545.875	SS-03-07	0.51
ANTHRACENE	0/11				9/13	65 - 220	417.230769	SS-03-08	99
BENZO(A)ANTHRACENE	0/11				13/13	56 - 1200	619.692308	SS-03-08	2024.6605
BENZO(A)PYRENE	0/11				11/13	52 - 1400	907.076923	SS-03-15	41
BENZO(B)FLUORANTHENE	1/11	58	BG-13	58	8/8	130 - 1300	693.75	SS-03-08	2.4756
BENZO(G,H,I)PERYLENE	0/11				6/8	59 - 320	599.875	SS-03-08	380
BENZO(K)FLUORANTHENE	1/11	46	BG-13	46	5/8	79 - 1000	888.625	SS-03-08	28406.1576
CHRYSENE	1/11	51	BG-13	51	8/8	79 - 1200	621.125	SS-03-05	28.6973
DIBENZO(A,H)ANTHRACENE	0/11				3/8	35 - 99	642.125	SS-03-08	11642.437
FLUORANTHENE	1/11	92	BG-13	92	11/13	120 - 3300	1599.230769	SS-03-15	1180
FLUORENE	0/11				2/8	28 - 41	673.625	SS-03-07	20.7926
INDENO(1,2,3-CD)PYRENE	0/11				6/8	43 - 380	612.875	SS-03-08	1100
PHENANTHRENE	1/11	51	BG-13	51	7/8	40 - 1100	661.25	SS-03-05	2464.387
PYRENE	1/11	100	BG-13	100	8/8	100 - 1800	950	SS-03-05	1345.5579
1,1,2,2-TETRACHLOROETHANE	0/11				1/1	1	1	SS-03-06	3620
BROMOMETHANE	0/11				1/1	21	21	SS-03-06	1.1
4,4'-DDT	1/23	1440	BG-12	21.5	2/4	7.1 - 15	6.45	SS-03-03	46.2422
GAMMA-BHC (LINDANE)	0/23				2/4	1.9 - 2.5	1.5625	SS-03-03	167

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 7
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 3 SUBSURFACE SOIL
NAWC WARMINSTER, PENNSYLVANIA

	Background Data				Site-Related Data				
Substance	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	29/29	6960 - 29500	12725.17241	TP03-03-06	14,010
ANTIMONY	1/29	13.6	BG-16	4.11	9/29	0.42 - 16.6	5.410862	TP03-03-06	9.67
ARSENIC	25/29	0.28 - 12.1	BG-11	11.7	25/29	1.1 - 17.6	5.022414	SB-03-11	6.74
BARIUM	25/29	34.1 - 225	BG-28	87.1	28/29	50.3 - 1530	289.194828	TP03-03-06	419
BERYLLIUM	25/29	0.31 - 1.7	BG-23-MAX	0.88	25/29	0.63 - 3.1	1.122759	TP02-03-04	1.36
CADMIUM	0/29				15/29	1.1 - 67.1	7.959828	TP03-03-06	32.9
CALCIUM	23/29	240 - 1910	BG-24	781	27/29	600 - 42500	10743.86207	TP03-03-06	22,175
CHROMIUM	29/29	7.9 - 35.3	BG-12	21.7	28/29	13.6 - 83.4	30.812069	TP03-03-06	39.7
COBALT	25/29	1.6 - 22.1	BG-23-MAX	10.4	28/29	4.9 - 23.4	10.698276	TP02-03-04	12.3
COPPER	27/29	3.6 - 30.6	BG-29	14.1	28/29	5.2 - 3760	332.32931	TP03-03-06	1,390
IRON	29/29	6980 - 410500	BG-04	35,030	29/29	10900 - 69500	23293.10345	SB-03-11	26,714
LEAD	29/29	1.6 - 96.5	BG-13	16.4	35/35	5 - 4570	329.631429	SB-03-22	1,016
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	27/29	1710 - 15600	5588.103448	SB-03-07	7,149
MANGANESE	29/29	30.9 - 2010	BG-28	604	29/29	99.1 - 2330	732.865517	TP01-03-03	1,073
MERCURY	1/29	0.37	BG-23-MAX	0.05	16/29	0.15 - 9.7	1.263621	SB-03-07	8.20
NICKEL	18/29	4.1 - 21.7	BG-23-MAX	11.1	29/29	6.6 - 230	34.548276	SB-03-11	44.7
POTASSIUM	25/29	89.1 - 3050	BG-24	997	29/29	379 - 3710	1153.931034	TP02-03-04	1,407
SELENIUM	0/29				7/29	0.54 - 2.9	0.58	TP03-03-06	0.68
SILVER	0/29				16/29	0.96 - 368	33.952759	TP03-03-06	368
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	28/29	48.9 - 1460	341.551724	TP03-03-06	486
THALLIUM	3/29	0.37 - 0.42	BG-23-MAX	0.4	2/29	1.1 - 1.4	0.410862	SB-03-12	0.47
VANADIUM	29/29	15.4 - 45	BG-12	32.2	29/29	8.9 - 284	47.658621	SB-03-12	59.0
ZINC	25/29	9 - 60	BG-13	30	28/29	21.6 - 9100	724.763793	TP03-03-06	1,970
1,2-DICHLOROETHENE (TOTAL)	0/21				1/29	4	106.856897	SB-03-23-MAX	4.00
2-BUTANONE	0/21				8/29	5.6 - 1000	119.144828	TP01-03-01	128
ACETONE	0/21				6/29	8.4 - 140	116.651724	TP01-03-02	140
BENZENE	0/21				1/29	5.1	106.987931	SB-03-11	5.10
CARBON DISULFIDE	0/21				6/29	1.4 - 13	106.893103	SB-03-11	13.0
CHLOROBENZENE	0/19				2/29	11 - 140	111.581034	TP03-03-06	127
CHLOROFORM	0/19				2/29	1	106.581034	TP02-03-04, TP02-03-05	1.00
ETHYLBENZENE	0/21				3/29	4 - 130	112.708621	SB-03-12	130
METHYLENE CHLORIDE	0/21				1/29	3300	176.512069	SB-03-09	159
TOLUENE	3/21	2	BG-17	2	9/29	2 - 120	110.531034	SB-03-05	120
1,4-DICHLOROBENZENE	1/11	43	BG-11	43	2/20	52 - 120	1518.6	TP03-03-06	120
ACENAPHTHENE	0/11				9/26	110 - 4400	1422.307692	SB-03-18	3,646
ACENAPHTHYLENE	0/11				9/26	36 - 1200	1556.403846	SB-03-17	1,200
ANTHRACENE	0/11				13/26	3.6 - 21000	2153.523077	SB-03-18	21,000
BENZO(A)ANTHRACENE	0/11				19/26	1.2 - 53000	3725.276923	SB-03-18	37,125
BENZO(A)PYRENE	0/11				19/26	3 - 44000	3407	SB-03-18	24,550
BENZO(B)FLUORANTHENE	1/11	58	BG-13	58	18/26	1.7 - 45000	3578.142308	SB-03-18	35,976
BENZO(G,H,I)PERYLENE	0/11				15/26	100 - 26000	2251.498077	SB-03-18	15,030
BENZO(K)FLUORANTHENE	1/11	46	BG-13	46	16/26	3 - 34000	2750.615385	SB-03-18	32,962
BIS(2-ETHYLHEXYL)PHTHALATE	1/11	50	BG-16	50	2/20	280 - 4000	1681.5	SB-03-10	4,000
BUTYL BENZYL PHTHALATE	0/11				1/20	41	1525.05	TP03-03-07	41.0

TABLE 7
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN SITE 3 SUBSURFACE SOIL
NAWC WARMINSTER, PENNSYLVANIA

Substance	Background Data				Site-Related Data				
	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
CARBAZOLE	0/11				5/20	63 - 1000	1505.45	SB-03-21	1,000
CHRYSENE	1/11	51	BG-13	51	19/26	1.1 - 51000	3703.403846	SB-03-18	38,764
DI-N-BUTYL PHTHALATE	0/11				2/20	51 - 53	1482.225	SB-03-12	53.0
DI-N-OCTYL PHTHALATE	0/11				1/20	320	1538.5	SB-03-10	320
DIBENZO(A,H)ANTHRACENE	0/11				9/26	46 - 9400	1544.190385	SB-03-18	9,291
DIBENZOFURAN	0/11				4/20	57 - 300	1521.6	SB-03-12	300
DIETHYL PHTHALATE	0/11				1/20	86	1523.8	TP03-03-06	86.0
FLUORANTHENE	1/11	92	BG-13	92	20/26	1.9 - 120000	6676.534615	SB-03-18	64,827
FLUORENE	0/11				10/26	31 - 4500	1405.382692	SB-03-18	4,500
HEXACHLOROETHANE	0/11				1/20	640	1554.75	TP01-03-03	640
INDENO(1,2,3-CD)PYRENE	0/11				16/26	3.2 - 29000	2475.776923	SB-03-18	10,710
NAPHTHALENE	0/11				6/26	120 - 450	1560	SB-03-19-MAX	450
PHENANTHRENE	1/11	51	BG-13	51	18/26	1.8 - 71000	4634.223077	SB-03-18	36,617
PHENOL	0/11				1/20	150	1530	SB-03-10	150
PYRENE	1/11	100	BG-13	100	20/26	3.3 - 97000	5541.357692	SB-03-18	36,810
ALDRIN	0/23				5/12	2 - 180	19.4125	SB-03-21	123
AROCLOR-1242	0/21				2/19	36 - 84	46.342105	TP03-03-06	58.7
AROCLOR-1248	0/23				1/19	120	47.684211	SB-03-12	61.7
AROCLOR-1254	1/23	51	BG-13	41.3	6/19	64 - 5900	380.631579	SB-03-21	597
AROCLOR-1260	0/21				3/19	59 - 290	70.842105	TP01-03-03	118
ENDRIN	0/23				4/13	4.4 - 24	7.257692	SB-03-21	15.7
GAMMA-BHC (LINDANE)	0/21				1/12	3.5	3.070833	TP01-03-02	3.50
GAMMA-CHLORDANE	0/23				2/13	8 - 14	3.980769	SB-03-21	9.68
HEPTACHLOR EPOXIDE	0/21				1/13	6.1	3.111538	TP01-03-03	5.81
4,4'-DDE	1/21	820	BG-12	820	4/13	16 - 42	11.673077	TP01-03-01	42.0
4,4'-DDT	1/23	1440	BG-12	21.5	3/13	11 - 31	9.111538	SB-03-07	26.1
XYLENES, TOTAL	0/21				4/29	2.4 - 580	129.794828	SB-03-11	220
OCDD	0/0				2/4	0.76 - 2.2	0.9525	TP01-03-01	2.20
4,4'-DDD	1/23	16	BG-12	3	5/12	11 - 150	37.9	TP01-03-02	150
2-METHYLNAPHTHALENE	0/11				4/20	86 - 690	1538.2	TP01-03-03	690

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 8
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN IMPOUNDMENT AREA SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Substance	Background Data				Site-Related Data				
	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
ALUMINUM	29/29	4780 - 18100	BG-12	15,226	65/65	4500 - 20100	11,340.31	IM409	12,081
ANTIMONY	1/29	13.6	BG-16	4.11	10/39	0.56 - 144	10.18	IM711	19.1
ARSENIC	25/29	0.28 - 12.1	BG-11	11.7	40/65	0.42 - 6.4	1.76	IM711	2.19
BARIUM	25/29	34.1 - 225	BG-28	87.1	65/65	45.5 - 316	101.15	IM711	107
BERYLLIUM	25/29	0.31 - 1.7	BG-23-MAX	0.88	56/65	0.37 - 6.7	1.04	IM503	1.11
CADMIUM	0/29				10/65	0.8 - 91.1	4.45	IM101A	2.86
CALCIUM	23/29	240 - 1910	BG-24	781	65/65	552 - 132000	6,993.69	IM711	5,540
CHROMIUM	29/29	7.9 - 35.3	BG-12	21.7	65/65	2.5 - 4730	251.92	IM711	210
COBALT	25/29	1.6 - 22.1	BG-23-MAX	10.4	64/65	2.2 - 61.4	14.78	IM711	15.8
COPPER	27/29	3.6 - 30.6	BG-29	14.1	49/65	2.5 - 707	27.34	IM711	32.9
CYANIDE	0/20				9/37	0.66 - 79.6	4.67	IM711	5.35
HEXAVALENT CHROMIUM	0/0				14/39	0.9 - 22.5	1.61	IM406	15.4
IRON	29/29	6980 - 410500	BG-04	35,030	65/65	3350 - 91700	19,845.54	IM101	22,086
LEAD	29/29	1.6 - 96.5	BG-13	16.4	58/65	0.59 - 89.8	14.13	IM711	17.9
MAGNESIUM	25/29	518 - 4960	BG-24	2,269	65/65	544 - 42800	3,766.94	IM301-MAX	4,143
MANGANESE	29/29	30.9 - 2010	BG-28	604	65/65	90.3 - 6090	1,077.24	IM503	1,298
MERCURY	1/29	0.37	BG-23-MAX	0.05	13/65	0.06 - 2.6	0.14	IM307	0.1
NICKEL	18/29	4.1 - 21.7	BG-23-MAX	11.1	65/65	3.3 - 62.7	17.73	IM101	19
POTASSIUM	25/29	89.1 - 3050	BG-24	997	62/65	189 - 5680	1,517.78	IM409	1,897
SILVER	0/29				14/65	0.59 - 373	11.45	IM711	5.85
SODIUM	4/29	55.2 - 86.7	BG-25	86.7	20/65	68.8 - 612	116.80	IM409	121
THALLIUM	3/29	0.37 - 0.42	BG-23-MAX	0.42	1/65	1.1	0.47	IM301-MAX	0.49
VANADIUM	29/29	15.4 - 45	BG-12	32.2	65/65	4.8 - 33.7	17.87	IM101A	19.4
ZINC	25/29	9 - 60	BG-13	30	49/65	9.9 - 327	44.21	IM711	49.2
2-METHYLNAPHTHALENE	0/11				1/30	44	293.97	IM505	44
4-METHYLPHENOL	0/11				1/30	160	297.33	IM307	160
ACENAPHTHYLENE	0/11				1/30	560	284.50	IM302	299
ANTHRACENE	0/11				1/30	510	282.83	IM302	297
BENZO(A)ANTHRACENE	0/11				8/30	49 - 2700	317.07	IM107	355
BENZO(A)PYRENE	0/11				8/30	45 - 3000	340.60	IM107	372
BENZO(B)FLUORANTHENE	1/11	58	BG-13	58	9/30	46 - 2800	351.83	IM107	386
BENZO(G,H,I)PERYLENE	0/11				7/30	53 - 1700	272.17	IM107	318
BENZO(K)FLUORANTHENE	1/11	46	BG-13	46	6/30	51 - 1100	250.07	IM107	288
BIS(2-ETHYLHEXYL)PHTHALATE	1/11	50	BG-16	50	16/30	45 - 320	224.63	IM711	285
CHRYSENE	1/11	51	BG-13	51	8/30	60 - 3300	357.03	IM107	378
DI-N-BUTYL PHTHALATE	0/11				4/30	55 - 110	272.60	IM201	110
DIBENZO(A,H)ANTHRACENE	0/11				1/30	400	305.83	IM410-MAX	34
FLUORANTHENE	1/11	92	BG-13	92	11/30	48 - 3700	395.53	IM107	419
FLUORENE	0/11				1/30	240	273.83	IM302	240
INDENO(1,2,3-CD)PYRENE	0/11				7/30	45 - 1300	255.60	IM107	321
PENTACHLOROPHENOL	0/11				1/30	120	696.83	IM711	120
PHENANTHRENE	1/11	51	BG-13	51	6/30	56 - 1900	277.13	IM302	311
PYRENE	1/11	100	BG-13	100	11/30	42 - 7000	531.83	IM107	502

TABLE 8
OCCURRENCE AND DISTRIBUTION OF ORGANICS AND INORGANICS IN IMPOUNDMENT AREA SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Substance	Background Data				Site-Related Data				
	Frequency of Detection	Range of Positive Detections Min - Max	Location of Maximum	Exposure Point Concentration	Frequency of Detection	Range of Positive Detections Min - Max	Mean of All Data	Location of Maximum	Exposure Point Concentration
1,1,2,2-TETRACHLOROETHANE	0/19				1/59	2	95.04	IM605A	2
1,2-DICHLOROETHENE (TOTAL)	0/19				2/59	1 - 11	95.09	IM201	11
2-BUTANONE	0/19				3/59	6 - 23	87.76	IM101	23
4-METHYL-2-PENTANONE	0/19				1/59	450	101.71	IM504	76
ACETONE	4/19	8 - 12	BG-24	12	8/59	16 - 1100	264.58	IM503	523
CHLOROMETHANE	2/19	3	BG-27	3	1/59	2	79.02	IM406	2
ETHYLBENZENE	0/19				1/59	14	94.32	IM504	14
TETRACHLOROETHENE	0/19				1/59	10	94.76	IM403	10
TOLUENE	3/19	2	BG-17	2	1/59	8	95.13	IM101	8
TRICHLOROETHENE	0/19				6/59	2 - 15	94.11	IM504	15
4,4'-DDD	1/21	16	BG-12	3	11/30	0.11 - 150	13.07	IM501	21
4,4'-DDE	1/21	820	BG-12	15.3	7/30	0.29 - 3.7	2.80	IM501	3.47
4,4'-DDT	1/21	1440	BG-12	21.5	9/30	0.51 - 78	6.80	IM711	7.56
ALDRIN	0/21				1/30	2.3	1.54	IM301-MAX	1.65
ALPHA-CHLORDANE	0/21				1/30	0.25	1.47	IM309	0.25
AROCLOR-1242	0/21				1/30	31	29.25	IM309	31
AROCLOR-1254	1/21	51	BG-13	41.3	6/30	16 - 44	30.60	IM410-MAX	33.2
AROCLOR-1260	0/21				5/30	21 - 930	60.37	IM711	53.3
DELTA-BHC	0/21				2/30	0.067 - 9.9	1.60	IM711	2.11
DIELDRIN	0/21				6/30	0.046 - 21	2.57	IM711	5.32
ENDOSULFAN I	0/21				2/30	0.071 - 0.8	1.45	IM307	0.8
ENDOSULFAN II	0/21				4/30	0.11 - 19	3.13	IM711	4.36
ENDRIN	0/21				4/30	0.094 - 13	2.60	IM302	4
ENDRIN ALDEHYDE	0/21				1/30	0.63	2.84	IM307	0.63
ENDRIN KETONE	0/21				3/30	0.12 - 13	2.49	IM107	3.56
GAMMA-BHC (LINDANE)	0/21				2/30	0.14 - 0.19	1.41	IM410-MAX	0.19
GAMMA-CHLORDANE	0/21				4/30	0.067 - 13	1.60	IM711	2.02
HEPTACHLOR	0/21				2/30	0.061 - 1.2	1.47	IM307	1.2
HEPTACHLOR EPOXIDE	0/21				1/30	0.059	1.43	IM412	0.06
METHOXYCHLOR	0/21				1/30	0.81	13.62	IM410-MAX	0.81

Notes:
* - Minimum and maximum detected site-related concentrations are based on duplicate samples.
Units are mg/kg for inorganics, ug/kg for organics.
Number of sample results excludes rejected data or blank-qualified data. Duplicates are consolidated into one result.
Mean of all data includes positive detections and non-detected results. Detection limits are divided by two.
The determination of representative concentrations is based on comparison of maximum to the 95% UCL, which is presented in a separate table.
Frequency of detection refers to the number of times compound was detected among all samples versus total number of samples.
Number of samples may vary based on the number of usable results.

TABLE 9

OCCURRENCE AND DISTRIBUTION OF TOTAL INORGANICS IN SURFACE WATER AT AREA A

NAWC WARMINSTER, PENNSYLVANIA

(ug/L)

	BACKGROUND	SITE-RELATED			
SUBSTANCE	REPRESENTATIVE CONCENTRATION*	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION**	STATISTICAL DISTRIBUTION	REPRESENTATIVE CONCENTRATION
ALUMINUM	106	1 / 5	116	NONPARAMETRIC DIST	116
BARIUM	69.7	16 / 18	59.5 - 172	NORMAL	142.56
CADMIUM	4	1 / 16	2.5	NORMAL OVER LOGNORMAL	1.54
CALCIUM	19400	16 / 16	11100 - 64300	NONPARAMETRIC DIST	39279
CHROMIUM	-	1 / 14	4	LOGNORMAL OVER NORMAL	3.26
COPPER	-	4 / 8	5.6 - 106	NORMAL	64.71
IRON	690	9 / 9	69 - 2420	NONPARAMETRIC DIST	2420
LEAD	-	5 / 15	2.9 - 28.5	NORMAL OVER LOGNORMAL	9.89
MAGNESIUM	7240	16 / 16	4470 - 23900	NONPARAMETRIC DIST	16015
MANGANESE	83	15 / 16	15.1 - 486	NONPARAMETRIC DIST	382.34
NICKEL	-	3 / 18	12.5 - 82.75	NORMAL OVER LOGNORMAL	18.57
POTASSIUM	1700	12 / 12	1150 - 5380	NORMAL OVER LOGNORMAL	2434
SODIUM	16200	16 / 16	8020 - 58900	NORMAL	30262
THALLIUM	-	1 / 15	2	LOGNORMAL OVER NORMAL	1.58
ZINC	-	14 / 15	20.8 - 117	NORMAL OVER LOGNORMAL	55.62

* = REPRESENTATIVE CONCENTRATION FOR BACKGROUND IS PRESENTED IN TABLE X-X

** = QUALIFIERS FOR DATA ARE PRESENTED IN DATA PRESENTATION TABLES

TABLE 10

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT AREA A

NAWC WARMINSTER, PENNSYLVANIA

(ug/L)

SUBSTANCE	BACKGROUND	SITE-RELATED			
	REPRESENTATIVE CONCENTRATION*	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION**	STATISTICAL DISTRIBUTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	-	1 / 9	0.0092	LOGNORMAL OVER NORMAL	0.0092
4,4'-DDT	-	1 / 7	0.014	LOGNORMAL OVER NORMAL	0.014
BENZO(A)ANTHRACENE	-	1 / 8	0.1	LOGNORMAL OVER NORMAL	0.1
BENZO(B)FLUORANTHENE	-	1 / 8	0.2	LOGNORMAL OVER NORMAL	0.2
CHRYSENE	-	1 / 8	0.2	LOGNORMAL OVER NORMAL	0.2
DI-N-OCTYLPHTHALATE	-	2 / 6	0.1 - 0.2	NORMAL OVER LOGNORMAL	0.2
DIETHYLPHTHALATE	-	1 / 6	0.2	LOGNORMAL OVER NORMAL	0.2
FLUORANTHENE	-	1 / 8	0.3	LOGNORMAL OVER NORMAL	0.3
PYRENE	-	1 / 8	0.3	LOGNORMAL OVER NORMAL	0.3
1,1-DICHLOROETHANE	-	1 / 13	0.95	LOGNORMAL OVER NORMAL	0.95
2-BUTANONE	-	1 / 11	4	LOGNORMAL OVER NORMAL	4
BENZENE	-	1 / 13	0.2	LOGNORMAL OVER NORMAL	0.2
BROMOMETHANE	-	1 / 13	0.5	LOGNORMAL OVER NORMAL	0.5
CARBON DISULFIDE	-	1 / 13	6	LOGNORMAL OVER NORMAL	5.48
CHLOROETHANE	-	1 / 13	3	LOGNORMAL OVER NORMAL	3
CHLOROMETHANE	-	1 / 13	4	LOGNORMAL OVER NORMAL	4
TETRACHLOROETHENE	-	1 / 13	1	LOGNORMAL OVER NORMAL	1
TRICHLOROETHENE	-	3 / 13	1 - 2	NORMAL OVER LOGNORMAL	2

* = REPRESENTATIVE CONCENTRATION FOR BACKGROUND IS PRESENTED IN TABLE X-X

** = QUALIFIERS FOR DATA ARE PRESENTED IN DATA PRESENTATION TABLES

TABLE 11

OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT AREA A

NAWC WARMINSTER, PENNSYLVANIA

(mg/kg)

	BACKGROUND	SITE-RELATED			
SUBSTANCE	REPRESENTATIVE CONCENTRATION*	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION**	STATISTICAL DISTRIBUTION	REPRESENTATIVE CONCENTRATION
ALUMINUM	5420	27 / 27	4500 - 15650	NORMAL	8897
ARSENIC	2.8	25 / 25	2 - 14.05	NORMAL	6.71
BARIUM	65.9	25 / 26	62.7 - 1060	NORMAL OVER LOGNORMAL	247.88
BERYLLIUM	0.62	25 / 25	0.5 - 2.1	NORMAL	1.25
CADMIUM	-	7 / 9	0.2 - 8.4	NONPARAMETRIC DIST	8.4
CALCIUM	1290	25 / 25	1060 - 30200	NORMAL	11374
CHROMIUM	11.7	27 / 27	13.7 - 224	NORMAL OVER LOGNORMAL	74.46
COBALT	4.4	23 / 23	3.4 - 75.2	NORMAL OVER LOGNORMAL	21.96
COPPER	8.2	26 / 26	13.5 - 136	NORMAL	62.35
IRON	11200	27 / 27	10800 - 115500	NORMAL	34966
LEAD	24.6	27 / 27	23.9 - 404	NORMAL	151.77
MAGNESIUM	1320	26 / 26	1390 - 15000	NONPARAMETRIC DIST	7728
MANGANESE	289	27 / 27	115 - 11400	NORMAL	2389
MERCURY	-	16 / 27	0.09 - 2.25	NORMAL OVER LOGNORMAL	0.4
NICKEL	6.3	27 / 27	6.3 - 224	NORMAL OVER LOGNORMAL	52.62
POTASSIUM	492	25 / 25	451 - 3080	NONPARAMETRIC DIST	1762
SELENIUM	-	4 / 27	0.15 - 1.9	NORMAL OVER LOGNORMAL	0.48
SILVER	-	3 / 24	0.8 - 2	NORMAL OVER LOGNORMAL	0.94
SODIUM	340	16 / 16	176 - 2340	NORMAL	853.41
VANADIUM	13.6	27 / 27	14.5 - 157	NORMAL OVER LOGNORMAL	51.81
ZINC	3889	26 / 26	61 - 8435	NORMAL OVER LOGNORMAL	1101

* = REPRESENTATIVE CONCENTRATION FOR BACKGROUND IS PRESENTED IN TABLE X-X

** = QUALIFIERS FOR DATA ARE PRESENTED IN DATA PRESENTATION TABLES

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT AREA A
NAWC WARMINSTER, PENNSYLVANIA
(ug/kg)

	BACKGROUND	SITE-RELATED			
SUBSTANCE	REPRESENTATIVE CONCENTRATION*	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION**	STATISTICAL DISTRIBUTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	-	15 / 20	5 - 130	NORMAL OVER LOGNORMAL	31.80
4,4'-DDE	-	2 / 21	7 - 13	NORMAL OVER LOGNORMAL	13
4,4'-DDT	4.9	15 / 18	8.6 - 600	NORMAL	116.95
ALDRIN	-	5 / 21	2.1 - 78.5	NORMAL OVER LOGNORMAL	14.04
ALPHA-CHLORDANE	-	2 / 19	2.2 - 2.7	NORMAL OVER LOGNORMAL	2.7
AROCLOR-1016	-	1 / 21	110	NORMAL OVER LOGNORMAL	86.72
AROCLOR-1248	-	1 / 21	1500	NORMAL OVER LOGNORMAL	231.07
AROCLOR-1254	24	13 / 21	20 - 615	NORMAL OVER LOGNORMAL	187.03
AROCLOR-1260	-	3 / 21	160 - 1500	NORMAL OVER LOGNORMAL	273.32
DELTA-BHC	-	2 / 21	2.2 - 3.2	NORMAL OVER LOGNORMAL	3.20
DIELDRIN	-	1 / 21	4.8	NORMAL OVER LOGNORMAL	4.8
ENDOSULFAN II	-	5 / 21	3.8 - 11	NORMAL OVER LOGNORMAL	11
ENDOSULFAN SULFATE	-	1 / 21	8.8	NORMAL OVER LOGNORMAL	8.8
ENDRIN	5.5	13 / 21	6 - 48	NORMAL	22.35
ENDRIN ALDEHYDE	-	3 / 18	12 - 44	NORMAL OVER LOGNORMAL	13.56
ENDRIN KETONE	-	2 / 21	7.9 - 10	NORMAL OVER LOGNORMAL	10
GAMMA-CHLORDANE	-	8 / 19	0.98 - 7.1	NORMAL OVER LOGNORMAL	3.92
2-METHYLNAPTHALENE	-	1 / 7	320	NONPARAMETRIC DIST	320
4-METHYLPHENOL	200	2 / 19	420 - 1400	NORMAL	1400
ACENAPHTHENE	-	12 / 19	44 - 3500	NORMAL	1881
ACENAPHTHYLENE	-	4 / 19	100 - 270	NORMAL	270
ANTHRACENE	97	19 / 19	82 - 8300	NORMAL	2787
BENZO(A)ANTHRACENE	380	19 / 19	390 - 20000	NORMAL	9960
BENZO(A)PYRENE	560	19 / 19	360 - 17000	NORMAL	8096
BENZO(B)FLUORANTHENE	830	19 / 19	540 - 25000	NORMAL	11466
BENZO(G,H,I)PERYLENE	370	19 / 19	290 - 13000	NORMAL	5230
BENZO(K)FLUORANTHENE	290	19 / 19	210 - 20000	NORMAL	5400
BIS(2-ETHYLHEXYL)PHTHALAT	-	15 / 15	210 - 7900	NORMAL	3539
BUTYLBENZYL PHTHALATE	-	4 / 18	41 - 380	NORMAL	380
CARBAZOLE	240	17 / 17	61 - 5700	NORMAL	2348
CHRYSENE	590	19 / 19	390 - 24000	NORMAL	11094
DI-N-BUTYL PHTHALATE	59	2 / 12	50 - 310	NORMAL	310
DI-N-OCTYLPHTHALATE	-	2 / 7	765 - 860	NONPARAMETRIC DIST	860
DIBENZO(A,H)ANTHRACENE	53	10 / 19	130 - 5300	NORMAL	1782
DIBENZOFURAN	-	9 / 19	52 - 2400	NORMAL	1669
FLUORANTHENE	1400	19 / 19	940 - 43000	NORMAL	19725
FLUORENE	47	15 / 19	63 - 5900	NORMAL	2000
INDENO(1,2,3-CD)PYRENE	320	19 / 19	240 - 14000	NORMAL	5765
NAPHTHALENE	-	2 / 19	60 - 530	NORMAL	530
PYRENE	760	19 / 19	680 - 40000	NORMAL	18429
1,1,1-TRICHLOROETHANE	-	1 / 25	2	NORMAL OVER LOGNORMAL	2
1,1-DICHLOROETHENE	-	1 / 25	3	NORMAL OVER LOGNORMAL	3
1,2-DICHLOROETHENE (TOTAL	-	6 / 25	2 - 22	NORMAL OVER LOGNORMAL	18.33
2-BUTANONE	9	3 / 23	3 - 45	NORMAL OVER LOGNORMAL	13.83
ACETONE	-	1 / 11	108	NORMAL OVER LOGNORMAL	35.26
CARBON TETRACHLORIDE	-	1 / 25	28	NORMAL OVER LOGNORMAL	18.64
CHLOROFORM	-	2 / 25	4 - 14.75	NORMAL OVER LOGNORMAL	14.75
CHLOROMETHANE	-	1 / 25	21	NORMAL OVER LOGNORMAL	18.67
ETHYLBENZENE	-	1 / 25	4	NORMAL OVER LOGNORMAL	4
TETRACHLOROETHENE	-	9 / 24	2 - 130	NORMAL OVER LOGNORMAL	32.73
TOLUENE	4	1 / 24	82	NORMAL OVER LOGNORMAL	22.80
TRICHLOROETHENE	-	12 / 25	2 - 1300	NORMAL OVER LOGNORMAL	160.41
XYLENE (TOTAL)	-	1 / 13	19	NORMAL OVER LOGNORMAL	14.16

* = REPRESENTATIVE CONCENTRATION FOR BACKGROUND IS PRESENTED IN TABLE X-X

** = QUALIFIERS FOR DATA ARE PRESENTED IN DATA PRESENTATION TABLES

TABLE 13
OCCURENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 1 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe:
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 1

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	5580		33500		MG/KG	SB-01-05	17/17		33500	N	7800	N	N	BKG
7440-36-0	**ANTIMONY**	0.31		15.2	J	MG/KG	SB-01-48	9/30	0.17 - 19.2	15.2	N	3.1	N	Y	ASL
7440-38-2	ARSENIC	1.3		25.5		MG/KG	SB-01-14	16/17	1.8	25.5	N	0.43	C	N	BKG
7440-39-3	BARIUM	26.4		210		MG/KG	SB-01-02	17/17		210	N	550	N	N	BSL
7440-41-7	BERYLLIUM	0.41		3.1		MG/KG	SB-01-14	15/17	0.73 - 1.2	3.1	Y	16	N	N	BSL
7440-43-9	**CADMIUM**	0.05		61.4		MG/KG	SB-01-25	23/40	0.05 - 1	61.4	Y	7.8	N	Y	ASL
7440-70-2	CALCIUM	314		53400		MG/KG	SB-01-25	17/17		53400	Y	N/A	N	N	NUT
7440-47-3	**CHROMIUM**	7		4600		MG/KG	SB-01-48	38/39	9.7	4600	Y	23	N	Y	ASL
7440-48-4	COBALT	7.1		66.1		MG/KG	SB-01-25	16/17	4.5	66.1	Y	470	N	N	BSL
7440-50-8	COPPER	2.5		299	J	MG/KG	SB-01-28	17/17		299	Y	310	N	N	BSL
57-12-5	CYANIDE	1.6		1.6		MG/KG	SB-01-05	1/5	0.61 - 1.2	1.6	Y	160	N	N	BSL
7439-89-6	**IRON**	9560		251000		MG/KG	SB-01-25	17/17		251000	Y	2300	N	N	ASL
7439-92-1	LEAD	2.1		135		MG/KG	SB-01-25	24/24		135	Y	400	C	N	BSL
7439-95-4	MAGNESIUM	380		5890		MG/KG	SB-01-16	17/17		5890	Y	N/A	N	N	NUT
7439-96-5	**MANGANESE**	230		2630		MG/KG	SB-01-02	17/17		2630	Y	160	N	Y	ASL
7439-97-6	**MERCURY**	0.1		6.8		MG/KG	SB-01-25	7/17	0.05 - 0.12	6.8	Y	2.3	N	Y	ASL
7440-02-0	NICKEL	3.1		87.9		MG/KG	SB-01-25	14/17	10.2 - 18	87.9	Y	160	N	N	BSL
7440-09-7	POTASSIUM	320		4600		MG/KG	SB-01-21	13/17	190 - 300	4600	Y	N/A	N	N	NUT
7782-49-2	SELENIUM	0.88		3.3		MG/KG	SB-01-25	6/17	0.3 - 1.2	3.3	Y	39	N	N	BSL
7440-22-4	**SILVER**	0.67		360		MG/KG	SB-01-25	11/17	0.68 - 1.1	360	Y	39	N	Y	ASL
7440-23-5	SODIUM	17.2		707		MG/KG	SB-01-25	15/17	59.9 - 65.1	707	Y	N/A	N	N	NUT
7440-28-0	**THALLIUM**	0.4		1.7		MG/KG	SB-01-25	10/24	0.37 - 1.2	1.7	Y	0.55	N	Y	ASL
7440-62-2	VANADIUM	13.8		66.6		MG/KG	SB-01-05	17/17		66.6	N	55	N	N	BKG
7440-66-6	ZINC	11.8		451		MG/KG	SB-01-25	17/17		451	Y	2300	N	N	BSL
78-93-3	2-BUTANONE	4.8	J	4.8	J	UG/KG	SB-01-30	1/6	12 - 13	4.8	N/A	4700000	N	N	BSL
72-54-8	4,4'-DDD	55	J	55	J	UG/KG	SB-01-06-MAX	1/2	4.1	55	N/A	2700	C	N	BSL
72-55-9	4,4'-DDE	4.3		12	J	UG/KG	SB-01-06-MAX	2/2		12	N/A	1900	C	N	BSL
108-10-1	4-METHYL-2-PENTANONE	1.6	J	1.6	J	UG/KG	SB-01-30	1/6	12 - 13	1.6	N/A	630000	N	N	BSL
11097-69-1	AROCLOR-1254	41	J	41	J	UG/KG	SB-01-06-MAX	1/8	37 - 41	41	N/A	320	C	N	BSL
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	40	J	40	J	UG/KG	SB-01-06-MAX	1/8	370 - 410	40	N/A	46000	C	N	BSL
72-20-8	ENDRIN	4.8	J	4.8	J	UG/KG	SB-01-06-MAX	1/2	4.1	4.8	N/A	2300	N	N	BSL
108-88-3	TOLUENE	2.9	J	2.9	J	UG/KG	SB-01-30	1/6	2 - 13	2.9	N/A	1600000	N	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 14
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 2 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 2

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	142	J	19800		MG/KG	SS-02-63	20/20		19800	N	7800	N	N	BKG
7440-36-0	ANTIMONY	0.19	J	10.8	J	MG/KG	SS-02-42	24/46	0.2 - 8.8	10.8	N	3.1	N	N	BKG
7440-38-2	ARSENIC	0.88		13.1		MG/KG	SS-02-03	20/20		13.1	N	0.43	C	N	BKG
7440-39-3	BARIUM	4.4	J	452	J	MG/KG	SS-02-07-MAX	20/20		452	Y	550	N	N	BSL
7440-41-7	BERYLLIUM	0.63	J	1.4		MG/KG	SS-02-16-MAX	19/20	0.1	1.4	N	16	N	N	BKG
7440-43-9	**CADMIUM**	0.09		20.3	J	MG/KG	SS-02-26	36/48	0.03 - 2.8	20.3	Y	3.9	N	Y	ASL
7440-70-2	CALCIUM	1050		215000		MG/KG	SS-02-56	20/20		215000	Y		N	N	NUT
7440-47-3	**CHROMIUM**	1.1		133		MG/KG	SS-02-05-MAX	24/24		133	Y	23	N	Y	ASL
7440-48-4	COBALT	0.74	J	14.5		MG/KG	SS-02-06	20/20		14.5	N	470	N	N	BSL
7440-50-8	**COPPER**	5.7		1410		MG/KG	SS-02-22	44/44		1410	Y	310	N	Y	ASL
7439-89-6	IRON	2360	J	38000		MG/KG	SS-02-07-MAX	20/20		38000	N	2300	N	N	BKG
7439-92-1	**LEAD**	8	J	994	J	MG/KG	SS-02-22	48/48		994	Y	400	C	Y	ASL
7439-95-4	MAGNESIUM	1900		135000		MG/KG	SS-02-56	20/20		135000	Y		N	N	NUT
7439-96-5	MANGANESE	169	J	2080		MG/KG	SS-02-05-MAX	20/20		2080	N	160	N	N	BKG
7439-97-6	MERCURY	0.18	J	1.1	J	MG/KG	SS-02-14	8/20	0.04 - 0.25	1.1	Y	2.3	N	N	BSL
7440-02-0	NICKEL	4.9		47		MG/KG	SS-02-07-MAX	11/20	11.4 - 25.4	47	Y	160	N	N	BSL
7440-09-7	POTASSIUM	684		2590		MG/KG	SS-02-18	19/20	57.2	2590	N		N	N	NUT
7782-49-2	SELENIUM	0.89	J	1.6	J	MG/KG	SS-02-07-MAX	3/18	0.33 - 0.85	1.6	Y	39	N	N	BSL
7440-22-4	**SILVER**	0.14	J	58.4		MG/KG	SS-02-07-MAX	25/43	0.04 - 2.3	58.4	Y	39	N	Y	ASL
7440-23-5	SODIUM	84.8		1870	J	MG/KG	SS-02-14	12/20	78.5 - 242	1870	Y		N	N	NUT
7440-28-0	**THALLIUM**	0.81	J	1.4		MG/KG	SS-02-07-MAX	6/24	0.39 - 1.1	1.4	Y	0.55	N	Y	ASL
7440-62-2	**VANADIUM**	24.1		119		MG/KG	SS-02-05-MAX	20/20		119	Y	55	N	Y	ASL
7440-66-6	**ZINC**	23		4800		MG/KG	SS-02-22	44/44		4800	Y	2300	N	Y	ASL
91-57-6	2-METHYLNAPHTHALENE	46	J	21000	J	UG/KG	SS-02-56	2/20	340 - 1700	21000	N/A	160000	N	N	BSL
83-32-9	ACENAPHTHENE	43	J	180	J	UG/KG	SS-02-06	4/20	340 - 33000	180	N/A	470000	N	N	BSL
208-96-8	ACENAPHTHYLENE	44	J	440	J	UG/KG	SS-02-07-MAX	6/20	340 - 33000	440	N/A	160000	N	N	BSL
120-12-7	ANTHRACENE	51	J	640	J	UG/KG	SS-02-05-MAX	12/20	360 - 33000	640	N/A	2300000	N	N	BSL
56-55-3	**BENZO(A)ANTHRACENE**	190	J	3300		UG/KG	SS-02-05-MAX	16/23	360 - 33000	3300	N/A	870	C	Y	ASL
50-32-8	**BENZO(A)PYRENE**	47	J	3400		UG/KG	SS-02-05-MAX	17/24	360 - 33000	3400	N/A	87	C	Y	ASL
205-99-2	**BENZO(B)FLUORANTHENE**	300	J	5300		UG/KG	SS-02-05-MAX	14/20	360 - 33000	5300	N/A	870	C	Y	ASL
191-24-2	BENZO(G,H,I)PERYLENE	55	J	4400	J	UG/KG	SS-02-39	23/38	340 - 33000	4400	N/A	160000	N	N	BSL
207-08-9	BENZO(K)FLUORANTHENE	110	J	1800		UG/KG	SS-02-05-MAX	14/20	360 - 33000	1800	N/A	8700	C	N	BSL
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	1000		1800		UG/KG	SS-02-70-MAX	2/20	75 - 33000	1800	N/A	46000	C	N	BSL
86-74-8	CARBAZOLE	48	J	560	J	UG/KG	SS-02-05-MAX	9/20	340 - 33000	560	N/A	32000	C	N	BSL
218-01-9	CHRYSENE	260	J	3300		UG/KG	SS-02-05-MAX	14/20	360 - 33000	3300	N/A	87000	C	N	BSL
53-70-3	DIBENZO(A,H)ANTHRACENE	43	J	61	J	UG/KG	SS-02-02	2/20	340 - 33000	61	N/A	87	C	N	BSL
132-64-9	DIBENZOFURAN	37	J	470	J	UG/KG	SS-02-05-MAX	7/20	340 - 33000	470	N/A	31000	N	N	BSL
84-74-2	DI-N-BUTYL PHTHALATE	41	J	73	J	UG/KG	SS-02-02, SS-02-06	4/20	340 - 33000	73	N/A	780000	N	N	BSL
206-44-0	FLUORANTHENE	390		6200		UG/KG	SS-02-05-MAX	14/20	360 - 33000	6200	N/A	310000	N	N	BSL
86-73-7	FLUORENE	58	J	250	J	UG/KG	SS-02-05-MAX	6/20	340 - 33000	250	N/A	310000	N	N	BSL
193-39-5	**INDENO(1,2,3-CD)PYRENE**	37	J	5000	J	UG/KG	SS-02-39	31/41	360 - 33000	5000	N/A	870	C	Y	ASL
91-20-3	NAPHTHALENE	52	J	52	J	UG/KG	SS-02-06	1/20	340 - 33000	52	N/A	160000	N	N	BSL
85-01-8	PHENANTHRENE	120	J	3700		UG/KG	SS-02-05-MAX	14/20	360 - 33000	3700	N/A	160000	N	N	BSL
129-00-0	PYRENE	290	J	4600		UG/KG	SS-02-05-MAX	14/20	360 - 33000	4600	N/A	230000	N	N	BSL
108-88-3	TOLUENE	2	J	2	J	UG/KG	SS-02-03	1/12	10 - 31	2	N/A	1600000	N	N	BSL
72-54-8	4,4'-DDD	19	J	19	J	UG/KG	SS-02-56	1/12	3.4 - 4.1	19	N/A	2700	C	N	BSL
72-55-9	4,4'-DDE	7.9	J	7.9	J	UG/KG	SS-02-01	1/12	3.4 - 21	7.9	N/A	1900	C	N	BSL
50-29-3	4,4'-DDT	4.2	J	23	J	UG/KG	SS-02-01	4/12	3.5 - 21	23	N/A	1900	C	N	BSL
5103-71-9	ALPHA-CHLORDANE	4.6	J	160		UG/KG	SS-02-69	2/12	1.8 - 21	160	N/A	1800	C	N	BSL

TABLE 14
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 2 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 2

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
11097-69-1	**AROCLOR-1254**	11	J	3700		UG/KG	SS-02-69	12/20	35 - 41	3700	N/A	320	C	Y	ASL
11096-82-5	AROCLOR-1260	110	J	110	J	UG/KG	SS-02-08	1/20	34 - 180	110	N/A	320	C	N	BSL
60-57-1	DIELDRIN	32	J	32	J	UG/KG	SS-02-69	1/12	3.4 - 21	32	N/A	40	C	N	BSL
72-20-8	ENDRIN	5.8	J	370	J	UG/KG	SS-02-69	4/12	3.5 - 21	370	N/A	2300	N	N	BSL
58-89-9	GAMMA-BHC (LINDANE)	2.3	J	5	J	UG/KG	SS-02-06	5/12	1.8 - 21	5	N/A	490	C	N	BSL
5103-74-2	GAMMA-CHLORDANE	11	J	11	J	UG/KG	SS-02-69	1/12	1.8 - 21	11	N/A	1800	C	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 15
OCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 2 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 2

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	5210		133000		MG/KG	TP10-0207	66/66		133000	Y	7800	N	Y	ASL
7440-36-0	ANTIMONY	0.37	L	90.5	L	MG/KG	SB-02-16	36/76	0.32 - 12.8	90.5	Y	3.1	N	Y	ASL
7440-38-2	ARSENIC	0.85	L	19.6		MG/KG	SB-02-09	60/66	1.1 - 3	19.6	Y	0.43	C	Y	ASL
7440-39-3	BARIUM	21.6		719		MG/KG	SB-02-28-MAX	66/66		719	Y	550	N	Y	ASL
7440-41-7	BERYLLIUM	0.25		8.2		MG/KG	SB-02-42	56/66	0.48 - 1.5	8.2	Y	16	N	N	BSL
7440-43-9	CADMIUM	0.14	K	293		MG/KG	SB-02-27	44/93	0.05 - 3.8	293	Y	3.9	N	Y	ASL
7440-70-2	CALCIUM	366	J	74000		MG/KG	SB-02-15	65/66	643	74000	Y		N	N	NUT
7440-47-3	CHROMIUM	4	K	3840		MG/KG	SB-02-16	66/66		3840	Y	23	N	Y	ASL
7440-48-4	COBALT	3.5		24.8		MG/KG	SB-02-08	65/66	7.2	24.8	Y	470	N	N	BSL
7440-50-8	COPPER	4.6	J	7980		MG/KG	SB-02-75-MAX	79/80	0.99	7980	Y	310	N	Y	ASL
57-12-5	CYANIDE	0.93		20.4		MG/KG	SB-02-16	4/46	0.53 - 3.2	20.4	Y	160	N	N	BSL
7439-89-6	IRON	4000		103000		MG/KG	SB-02-08	66/66		103000	Y	2300	N	Y	ASL
7439-92-1	LEAD	1.5	J	2060	J	MG/KG	SB-02-71	86/93	9.1 - 43.9	2060	Y	400	C	Y	ASL
7439-95-4	MAGNESIUM	680		29900		MG/KG	SB-02-32	65/66	1720	29900	Y		N	N	NUT
7439-96-5	MANGANESE	127		1760		MG/KG	SB-02-28-MAX	66/66		1760	Y	160	N	Y	ASL
7439-97-6	MERCURY	0.04	L	0.98		MG/KG	SB-02-17	25/66	0.03 - 0.13	0.98	Y	2.3	N	N	BSL
7440-02-0	NICKEL	3.1	L	143		MG/KG	SB-02-42	57/66	10.9 - 18.3	143	Y	160	N	Y	ASL
7440-09-7	POTASSIUM	110		2690		MG/KG	SB-02-37	60/66	345 - 785	2690	Y		N	N	NUT
7782-49-2	SELENIUM	0.78	J	7.3	J	MG/KG	TP10-0207	4/60	0.34 - 1.2	7.3	Y	39	N	N	BSL
7440-22-4	SILVER	0.11	L	317		MG/KG	SB-02-70-MAX	30/81	0.05 - 2.2	317	Y	39	N	Y	ASL
7440-23-5	SODIUM	45		2910		MG/KG	TP02-02-02	33/66	20.8 - 460	2910	Y		N	N	NUT
7440-28-0	THALLIUM	0.69	J	0.69	J	MG/KG	TP10-0207	1/66	0.38 - 12.9	0.69	Y	0.55	N	Y	ASL
7440-62-2	VANADIUM	5.7		586		MG/KG	SB-02-42	66/66		586	Y	55	N	Y	ASL
7440-66-6	ZINC	5.2	J	5640		MG/KG	SB-02-42	80/80		5640	Y	2300	N	Y	ASL
75-34-3	1,1-DICHLOROETHANE	16		16		UG/KG	SB-02-35	1/53	4 - 1500	16	N/A	780000	N	N	BSL
540-59-0	1,2-DICHLOROETHENE (TOTAL)	3	J	60		UG/KG	SB-02-12	3/53	5.1 - 1500	60	N/A	70000	N	N	BSL
78-93-3	2-BUTANONE	4.5	J	20	J	UG/KG	SB-02-02	3/53	10 - 1600	20	N/A	4700000	N	N	BSL
591-78-6	2-HEXANONE	1	J	2	J	UG/KG	TP11-0209	2/53	10 - 1500	2	N/A	310000	N	N	BSL
108-10-1	4-METHYL-2-PENTANONE	0.9	J	110		UG/KG	SB-02-31	4/53	11 - 1500	110	N/A	630000	N	N	BSL
67-64-1	ACETONE	49		170		UG/KG	SB-02-10	8/53	1 - 1500	170	N/A	780000	N	N	BSL
71-43-2	BENZENE	1	J	8		UG/KG	TP10-0207	3/53	5 - 1500	8	N/A	22000	C	N	BSL
74-83-9	BROMOMETHANE	360	J	360	J	UG/KG	SB-02-09	1/52	4 - 750	360	N/A	11000	N	N	BSL
75-15-0	CARBON DISULFIDE	2	J	10		UG/KG	TP14-0213	2/53	4 - 1500	10	N/A	780000	N	N	BSL
75-00-3	CHLOROETHANE	3	J	3	J	UG/KG	TP11-0209	1/53	4 - 1500	3	N/A	220000	C	N	BSL
67-66-3	CHLOROFORM	1	J	1	J	UG/KG	TP02-02-02	1/53	1 - 1500	1	N/A	100000	C	N	BSL
74-87-3	CHLOROMETHANE	810	J	810	J	UG/KG	SB-02-09	1/53	4 - 480	810	N/A	49000	C	N	BSL
100-41-4	ETHYLBENZENE	3	J	13	J	UG/KG	SB-02-32	3/53	4 - 1500	13	N/A	780000	N	N	BSL
75-09-2	METHYLENE CHLORIDE	1	J	23	J	UG/KG	SB-02-32	5/53	2 - 1300	23	N/A	85000	C	N	BSL
127-18-4	TETRACHLOROETHENE	2	J	36	J	UG/KG	SB-02-11-MAX	13/53	5.1 - 1500	36	N/A	12000	C	N	BSL
108-88-3	TOLUENE	2	J	150		UG/KG	SB-02-32	6/53	1.6 - 1500	150	N/A	1600000	N	N	BSL
10061-02-6	TRANS-1,3-DICHLOROPROPENE	97.75	J	97.75	J	UG/KG	SB-02-07	1/53	4 - 1500	97.75	N/A	3500	C	N	BSL
79-01-6	TRICHLOROETHENE	1	J	12		UG/KG	SB-02-19	12/53	5.1 - 1500	12	N/A	58000	C	N	BSL
106-46-7	1,4-DICHLOROBENZENE	68	J	68	J	UG/KG	SB-02-07	1/38	190 - 8100	68	N/A	27000	C	N	BSL
91-94-1	3,3'-DICHLOROBENZIDINE	400		400		UG/KG	SB-02-07	1/38	190 - 8100	400	N/A	1400	C	N	BSL
83-32-9	ACENAPHTHENE	75	J	1400		UG/KG	SB-02-53	6/38	190 - 8100	1400	N/A	470000	N	N	BSL
120-12-7	ANTHRACENE	98	J	2200		UG/KG	SB-02-53	10/38	190 - 8100	2200	N/A	2300000	N	N	BSL
56-55-3	BENZO(A)ANTHRACENE	49	J	5200		UG/KG	SB-02-53	21/38	190 - 430	5200	N/A	870	C	Y	ASL
50-32-8	BENZO(A)PYRENE	44	J	3800		UG/KG	SB-02-53	22/39	190 - 430	3800	N/A	87	C	Y	ASL
205-99-2	BENZO(B)FLUORANTHENE	51	J	4900		UG/KG	SB-02-53	21/38	190 - 430	4900	N/A	870	C	Y	ASL
191-24-2	BENZO(G,H,I)PERYLENE	51	J	2100		UG/KG	TP10-0207	19/38	190 - 430	2100	N/A	160000	N	N	BSL
207-08-9	BENZO(K)FLUORANTHENE	23	J	2200		UG/KG	TP10-0207	20/38	190 - 580	2200	N/A	8700	C	N	BSL
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	46	J	2200	J	UG/KG	SB-02-41	6/39	47 - 8100	2200	N/A	46000	C	N	BSL
85-68-7	BUTYL BENZYL PHTHALATE	55		110	J	UG/KG	SB-02-22	3/33	360 - 8100	110	N/A	1600000	N	N	BSL
86-74-8	CARBAZOLE	91	J	1300		UG/KG	SB-02-53	6/38	190 - 8100	1300	N/A	32000	C	N	BSL
218-01-9	CHRYSENE	42	J	4900		UG/KG	SB-02-53	22/38	190 - 430	4900	N/A	87000	C	N	BSL
84-74-2	DI-N-BUTYL PHTHALATE	46	J	4200		UG/KG	SB-02-41	7/38	51 - 8100	4200	N/A	780000	N	N	BSL

TABLE 15
OCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 2 SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 2

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
53-70-3	DIBENZO(A,H)ANTHRACENE	62	J	450		UG/KG	SB-02-53	6/38	190 - 8100	450	N/A	87	C	Y	ASL
132-64-9	DIBENZOFURAN	88	J	570		UG/KG	SB-02-53	5/38	190 - 8100	570	N/A	31000	N	N	BSL
84-66-2	DIETHYL PHTHALATE	48	J	67	J	UG/KG	SB-02-56-MAX	2/38	190 - 8100	67	N/A	6300000	N	N	BSL
206-44-0	FLUORANTHENE	68	J	13000		UG/KG	SB-02-53	22/38	190 - 430	13000	N/A	310000	N	N	BSL
86-73-7	FLUORENE	66	J	1000		UG/KG	SB-02-53	7/38	190 - 8100	1000	N/A	310000	N	N	BSL
193-39-5	INDENO(1,2,3-CD)PYRENE	29	J	2500		UG/KG	TP10-0207	17/38	190 - 8100	2500	N/A	870	C	Y	ASL
91-20-3	NAPHTHALENE	51	J	250	J	UG/KG	SB-02-53	4/38	190 - 8100	250	N/A	160000	N	N	BSL
87-86-5	PENTACHLOROPHENOL	62	J	62	J	UG/KG	SB-02-08	1/38	380 - 20000	62	N/A	5300	C	N	BSL
85-01-8	PHENANTHRENE	43	J	9900		UG/KG	SB-02-53	18/38	190 - 770	9900	N/A	160000	N	N	BSL
129-00-0	PYRENE	42	J	9800		UG/KG	SB-02-53	23/38	190 - 430	9800	N/A	230000	N	N	BSL
309-00-2	ALDRIN	3.6		3.6		UG/KG	SB-02-08	1/40	1.7 - 20	3.6	N/A	38	C	N	BSL
5103-71-9	ALPHA-CHLORDANE	2.9	J	5.9		UG/KG	SB-02-27	2/40	1.7 - 20	5.9	N/A	1800	C	N	BSL
12672-29-6	AROCLOR-1248	110	J	110	J	UG/KG	SB-02-27	1/42	34 - 400	110	N/A	320	C	N	BSL
11097-69-1	AROCLOR-1254	11	J	1150	J	UG/KG	SB-02-07	5/42	34 - 58	1150	N/A	320	C	Y	ASL
11096-82-5	AROCLOR-1260	9	J	1600	J	UG/KG	SB-02-07	7/42	34 - 43	1600	N/A	320	C	Y	ASL
60-57-1	DIELDRIN	4.3	J	5.8	J	UG/KG	SB-02-42	2/40	3.4 - 40	5.8	N/A	40	C	N	BSL
33213-65-9	ENDOSULFAN II	2.4	J	8.5	J	UG/KG	SB-02-27	2/39	3.4 - 5.8	8.5	N/A	47000	N	N	BSL
1031-07-8	ENDOSULFAN SULFATE	9.3	J	9.3	J	UG/KG	TP11-0209	1/40	3.4 - 40	9.3	N/A	47000	N	N	BSL
72-20-8	ENDRIN	2.1	J	20	J	UG/KG	SB-02-27	6/40	3.4 - 40	20	N/A	2300	N	N	BSL
53494-70-5	ENDRIN KETONE	1.2	L	5.5	J	UG/KG	SB-02-27	3/40	3.4 - 40	5.5	N/A	2300	N	N	BSL
58-89-9	GAMMA-BHC (LINDANE)	2.5	J	2.5	J	UG/KG	SB-02-02	1/40	1.7 - 20	2.5	N/A	490	C	N	BSL
5103-74-2	GAMMA-CHLORDANE	2.3	J	3.4	J	UG/KG	SB-02-08	2/38	1.8 - 20	3.4	N/A	1800	C	N	BSL
1024-57-3	HEPTACHLOR EPOXIDE	3.5	J	3.5	J	UG/KG	SB-02-08	1/40	1.7 - 20	3.5	N/A	70	C	N	BSL
18540299	HEXAVALENT CHROMIUM	0.00153	J	0.00359	L	UG/KG	SB-02-24	5/13	.00024 - 0.00	0.00359	N/A	23	N	N	BSL
72-55-9	4,4'-DDE	7.9	J	82	J	UG/KG	SB-02-42	3/40	3.4 - 40	82	N/A	1900	C	N	BSL
50-29-3	4,4'-DDT	1.8	J	150	J	UG/KG	SB-02-42	7/39	3.6 - 40	150	N/A	1900	C	N	BSL
1330-20-7	XYLENES, TOTAL	2.8	J	38	J	UG/KG	SB-02-32	5/53	5.1 - 1500	38	N/A	16000000	N	N	BSL
3268-87-9	OCDD	0.25	J	0.68	J	UG/KG	SB-02-40	4/5	0.28	0.68	N/A	4.3	C	N	BSL
39001-02-0	OCDF	0.25	J	0.25	J	UG/KG	SB-02-42	1/5	0.032 - 0.25	0.25	N/A	4.3	C	N	BSL
72-54-8	4,4'-DDD	2.3	J	45	J	UG/KG	SB-02-08	4/40	3.4 - 40	45	N/A	2700	C	N	BSL
91-57-6	2-METHYLNAPHTHALENE	110	J	360	J	UG/KG	SB-02-33	3/38	190 - 8100	360	N/A	160000	N	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 16
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 3 SURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 3

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	7510		12800		MG/KG	SS-03-02	5/5	0	12800	N	7800	N	N	BKG
7440-38-2	ARSENIC	3.5	J	7.9		MG/KG	SS-03-06	5/5	0	7.9	N	0.43	C	N	BKG
7440-39-3	BARIUM	66.7		99		MG/KG	SS-03-06	5/5	0	99	Y	550	N	N	BSL
7440-41-7	BERYLLIUM	0.82		0.97		MG/KG	SS-03-06	5/5	0	0.97	N	16	N	N	BSL
7440-70-2	CALCIUM	4060		30700		MG/KG	SS-03-06	5/5	0	30700	Y		N	N	NUT
7440-47-3	**CHROMIUM**	16.2		36.8		MG/KG	SS-03-05	5/5	0	36.8	Y	23	N	Y	ASL
7440-48-4	COBALT	7.9		11.7		MG/KG	SS-03-06	5/5	0	11.7	N	470	N	N	BSL
7440-50-8	COPPER	11		42.3	J	MG/KG	SS-03-05	5/5	0	42.3	Y	310	N	N	BSL
57-12-5	CYANIDE	0.51	J	0.51	J	MG/KG	SS-03-02	1/2	0.52	0.51	Y	160	N	N	BSL
7439-89-6	IRON	14800		28600		MG/KG	SS-03-06	5/5	0	28600	N	2300	N	N	BKG
7439-92-1	LEAD	18.2		30.4		MG/KG	SS-03-02	5/5	0	30.4	Y	400	C	N	BSL
7439-95-4	MAGNESIUM	3280		12300		MG/KG	SS-03-06	5/5	0	12300	Y		N	N	NUT
7439-96-5	**MANGANESE**	401		1180	J	MG/KG	SS-03-01	5/5	0	1180	Y	160	N	Y	ASL
7440-02-0	NICKEL	10.5	J	21.5		MG/KG	SS-03-06	4/5	14.3	21.5	Y	160	N	N	BSL
7440-09-7	POTASSIUM	699		2510		MG/KG	SS-03-02	5/5	0	2510	Y		N	N	NUT
7440-23-5	SODIUM	147		3620		MG/KG	SS-03-02	4/5	128	3620	Y		N	N	NUT
7440-28-0	**THALLIUM**	1.1	J	1.1	J	MG/KG	SS-03-02	1/5	0.55 - 0.95	1.1	Y	0.55	N	Y	ASL
7440-62-2	VANADIUM	22.7		50.7		MG/KG	SS-03-06	5/5	0	50.7	Y	55	N	N	BSL
7440-66-6	ZINC	34.5		167		MG/KG	SS-03-05	5/5	0	167	Y	2300	N	N	BSL
208-96-8	ACENAPHTHYLENE	33	J	120	J	UG/KG	SS-03-07	5/8	340 - 3900	120	N/A	160000	N	N	BSL
120-12-7	ANTHRACENE	65	J	220	J	UG/KG	SS-03-08	9/13	340 - 3900	220	N/A	2300000	N	N	BSL
56-55-3	**BENZO(A)ANTHRACENE**	56	J	1200		UG/KG	SS-03-08	13/13	0	1200	N/A	870	C	Y	ASL
50-32-8	**BENZO(A)PYRENE**	52	J	1400		UG/KG	SS-03-15	11/13	3800 - 3900	1400	N/A	87	C	Y	ASL
205-99-2	**BENZO(B)FLUORANTHENE**	130	J	1300		UG/KG	SS-03-08	8/8	0	1300	N/A	870	C	Y	ASL
191-24-2	BENZO(G,H,I)PERYLENE	59	J	320	J	UG/KG	SS-03-08	6/8	3800 - 3900	320	N/A	160000	N	N	BSL
207-08-9	BENZO(K)FLUORANTHENE	79	J	1000		UG/KG	SS-03-08	5/8	340 - 3900	1000	N/A	8700	C	N	BSL
218-01-9	CHRYSENE	79	J	1200	J	UG/KG	SS-03-05	8/8	0	1200	N/A	87000	C	N	BSL
53-70-3	**DIBENZO(A,H)ANTHRACENE**	35	J	99	J	UG/KG	SS-03-08	3/8	340 - 3900	99	N/A	87	C	Y	ASL
206-44-0	FLUORANTHENE	120	J	3300		UG/KG	SS-03-15	11/13	3800 - 3900	3300	N/A	310000	N	N	BSL
86-73-7	FLUORENE	28	J	41	J	UG/KG	SS-03-07	2/8	340 - 3900	41	N/A	310000	N	N	BSL
193-39-5	INDENO(1,2,3-CD)PYRENE	43	J	380	J	UG/KG	SS-03-08	6/8	3800 - 3900	380	N/A	870	C	N	BSL
85-01-8	PHENANTHRENE	40	J	1100	J	UG/KG	SS-03-05	7/8	3900	1100	N/A	160000	N	N	BSL
129-00-0	PYRENE	100	J	1800	J	UG/KG	SS-03-05	8/8	0	1800	N/A	230000	N	N	BSL
79-34-5	1,1,2,2-TETRACHLOROETHANE	1	J	1	J	UG/KG	SS-03-06	1/1	0	1	N/A	25000	C	N	BSL
74-83-9	BROMOMETHANE	21		21		UG/KG	SS-03-06	1/1	0	21	N/A			N	
50-29-3	4,4'-DDT	7.1	J	15	J	UG/KG	SS-03-03	2/4	3.5 - 3.9	15	N/A	1900	C	N	BSL
58-89-9	GAMMA-BHC (LINDANE)	1.9	J	2.5	J	UG/KG	SS-03-03	2/4	1.8 - 1.9	2.5	N/A	490	C	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

5/22/00

TABLE 17
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 3 SUBSURFACE SOIL
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 3

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	6960	J	29500		MG/KG	TP03-03-06	29/29		29500	N	7800	N	N	BSL
7440-36-0	ANTIMONY	0.42	J	16.6		MG/KG	TP03-03-06	9/29	0.33 - 13	16.6	Y	3.1	N	Y	ASL
7440-38-2	ARSENIC	1.1		17.6	J	MG/KG	SB-03-11	25/29	2.7 - 5.3	17.6	Y	0.43	C	Y	ASL
7440-39-3	BARIUM	50.3		1530		MG/KG	TP03-03-06	28/29	74.7	1530	Y	550	N	Y	ASL
7440-41-7	BERYLLIUM	0.63		3.1		MG/KG	TP02-03-04	25/29	0.51 - 1.2	3.1	Y	16	N	N	BSL
7440-43-9	CADMIUM	1.1	J	67.1		MG/KG	TP03-03-06	15/29	0.52 - 3	67.1	Y	3.9	N	Y	ASL
7440-70-2	CALCIUM	600		42500		MG/KG	TP03-03-06	27/29	2090 - 8850	42500	Y			N	NUT
7440-47-3	CHROMIUM	13.6		83.4		MG/KG	TP03-03-06	28/29	8.3	83.4	Y	23	N	Y	ASL
7440-48-4	COBALT	4.9		23.4		MG/KG	TP02-03-04	28/29	8.1	23.4	N	470	N	N	BSL
7440-50-8	COPPER	5.2		3760		MG/KG	TP03-03-06	28/29	13.1	3760	Y	310	N	Y	ASL
7439-89-6	IRON	10900		69500		MG/KG	SB-03-11	29/29		69500	Y	2300	N	Y	ASL
7439-92-1	LEAD	5		4570	J	MG/KG	SB-03-22	35/35		4570	Y	400	C	Y	ASL
7439-95-4	MAGNESIUM	1710		15600		MG/KG	SB-03-07	27/29	3300 - 5250	15600	Y			N	NUT
7439-96-5	MANGANESE	99.1	J	2330		MG/KG	TP01-03-03	29/29		2330	Y	160	N	Y	ASL
7439-97-6	MERCURY	0.15	J	9.7		MG/KG	SB-03-07	16/29	0.05 - 0.12	9.7	Y	2.3	N	Y	ASL
7440-02-0	NICKEL	6.6		230		MG/KG	SB-03-11	29/29		230	Y	160	N	Y	ASL
7440-09-7	POTASSIUM	379		3710		MG/KG	TP02-03-04	29/29		3710	N			N	NUT
7782-49-2	SELENIUM	0.54	J	2.9		MG/KG	TP03-03-06	7/29	0.52 - 1.1	2.9	Y	39	N	N	BSL
7440-22-4	SILVER	0.96	J	368		MG/KG	TP03-03-06	16/29	0.7 - 2.3	368	Y	39	N	Y	ASL
7440-23-5	SODIUM	48.9		1460		MG/KG	TP03-03-06	28/29	1320	1460	Y			N	NUT
7440-28-0	THALLIUM	1.1		1.4	J	MG/KG	SB-03-12	2/29	0.42 - 1.2	1.4	Y	0.55	N	Y	ASL
7440-62-2	VANADIUM	8.9		284		MG/KG	SB-03-12	29/29		284	Y	55	N	Y	ASL
7440-66-6	ZINC	21.6		9100		MG/KG	TP03-03-06	28/29	41.7	9100	Y	2300	N	Y	ASL
540-59-0	1,2-DICHLOROETHENE (TOTAL)	4	J	4	J	UG/KG	SB-03-23-MAX	1/29	5.8 - 2900	4	N/A	70000	N	N	BSL
78-93-3	2-BUTANONE	5.6	J	1000	J	UG/KG	TP01-03-01	8/29	10 - 2900	1000	N/A	4700000	N	N	BSL
67-64-1	ACETONE	8.4	J	140		UG/KG	TP01-03-02	6/29	11 - 2900	140	N/A	780000	N	N	BSL
71-43-2	BENZENE	5.1	J	5.1	J	UG/KG	SB-03-11	1/29	5.8 - 2900	5.1	N/A	22000	C	N	BSL
75-15-0	CARBON DISULFIDE	1.4	J	13	J	UG/KG	SB-03-11	6/29	10 - 2900	13	N/A	780000	N	N	BSL
108-90-7	CHLOROBENZENE	11	J	140	J	UG/KG	TP03-03-06	2/29	5.8 - 2900	140	N/A	160000	N	N	BSL
67-66-3	CHLOROFORM	1	J	1	J	UG/KG	TP02-03-04, TP02-03-05	2/29	5.8 - 2900	1	N/A	100000	C	N	BSL
100-41-4	ETHYLBENZENE	4	J	130	J	UG/KG	SB-03-12	3/29	5.8 - 2900	130	N/A	780000	N	N	BSL
75-09-2	METHYLENE CHLORIDE	3300		3300		UG/KG	SB-03-09	1/29	5.8 - 2200	3300	N/A	85000	C	N	BSL
108-88-3	TOLUENE	2	J	120		UG/KG	SB-03-05	9/29	3.3 - 2900	120	N/A	1600000	N	N	BSL
106-46-7	1,4-DICHLOROBENZENE	52	J	120	J	UG/KG	TP03-03-06	2/20	340 - 39000	120	N/A	27000	C	N	BSL
83-32-9	ACENAPHTHENE	110	J	4400	J	UG/KG	SB-03-18	9/26	20 - 39000	4400	N/A	470000	N	N	BSL
208-96-8	ACENAPHTHYLENE	36	J	1200		UG/KG	SB-03-17	9/26	39 - 39000	1200	N/A	160000	N	N	BSL
120-12-7	ANTHRACENE	3.6		21000		UG/KG	SB-03-18	13/26	2 - 39000	21000	N/A	2300000	N	N	BSL
56-55-3	BENZO(A)ANTHRACENE	1.2	J	53000		UG/KG	SB-03-18	19/26	340 - 39000	53000	N/A	870	C	Y	ASL
50-32-8	BENZO(A)PYRENE	3		44000		UG/KG	SB-03-18	19/26	340 - 39000	44000	N/A	87	C	Y	ASL
205-99-2	BENZO(B)FLUORANTHENE	1.7	J	45000		UG/KG	SB-03-18	18/26	340 - 39000	45000	N/A	870	C	Y	ASL
191-24-2	BENZO(G,H,I)PERYLENE	100	J	26000		UG/KG	SB-03-18	15/26	3.9 - 39000	26000	N/A	160000	N	N	BSL
207-08-9	BENZO(K)FLUORANTHENE	3		34000		UG/KG	SB-03-18	16/26	2 - 39000	34000	N/A	8700	C	Y	ASL
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	280	J	4000		UG/KG	SB-03-10	2/20	120 - 39000	4000	N/A	46000	C	N	BSL
85-68-7	BUTYL BENZYL PHTHALATE	41	J	41	J	UG/KG	TP03-03-07	1/20	340 - 39000	41	N/A	1600000	N	N	BSL
86-74-8	CARBAZOLE	63	J	1000	J	UG/KG	SB-03-21	5/20	340 - 39000	1000	N/A	32000	C	N	BSL
218-01-9	CHRYSENE	1.1	J	51000		UG/KG	SB-03-18	19/26	340 - 39000	51000	N/A	87000	C	N	BSL
84-74-2	DI-N-BUTYL PHTHALATE	51	J	53	J	UG/KG	SB-03-12	2/20	44 - 39000	53	N/A	780000	N	N	BSL
117-84-0	DI-N-OCTYL PHTHALATE	320	J	320	J	UG/KG	SB-03-10	1/20	340 - 39000	320	N/A	160000	N	N	BSL
53-70-3	DIBENZO(A,H)ANTHRACENE	46	J	9400	J	UG/KG	SB-03-18	9/26	3.9 - 39000	9400	N/A	87	C	Y	ASL
132-64-9	DIBENZOFURAN	57	J	300	J	UG/KG	SB-03-12	4/20	340 - 39000	300	N/A	31000	N	N	BSL

TABLE 17
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, SITE 3 SUBSURFACE SOIL
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 3

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
84-66-2	DIETHYL PHTHALATE	86	J	86	J	UG/KG	TP03-03-06	1/20	340 - 39000	86	N/A	6300000	N	N	BSL
206-44-0	FLUORANTHENE	1.9	J	120000		UG/KG	SB-03-18	20/26	340 - 400	120000	N/A	310000	N	N	BSL
86-73-7	FLUORENE	31	J	4500	J	UG/KG	SB-03-18	10/26	3.9 - 39000	4500	N/A	310000	N	N	BSL
67-72-1	HEXACHLOROETHANE	640		640		UG/KG	TP01-03-03	1/20	340 - 39000	640	N/A	46000	C	N	BSL
193-39-5	**INDENO(1,2,3-CD)PYRENE**	3.2		29000		UG/KG	SB-03-18	16/26	340 - 39000	29000	N/A	870	C	Y	ASL
91-20-3	NAPHTHALENE	120	J	450	J	UG/KG	SB-03-19-MAX	6/26	20 - 39000	450	N/A	160000	N	N	BSL
85-01-8	PHENANTHRENE	1.8	J	71000		UG/KG	SB-03-18	18/26	340 - 39000	71000	N/A	160000	N	N	BSL
108-95-2	PHENOL	150	J	150	J	UG/KG	SB-03-10	1/20	340 - 39000	150	N/A	4700000	N	N	BSL
129-00-0	PYRENE	3.3		97000		UG/KG	SB-03-18	20/26	340 - 400	97000	N/A	230000	N	N	BSL
309-00-2	**ALDRIN**	2	J	180	J	UG/KG	SB-03-21	5/12	1.7 - 39	180	N/A	38	C	Y	ASL
53469-21-9	AROCLOR-1242	36	J	84	J	UG/KG	TP03-03-06	2/19	34 - 750	84	N/A	320	C	N	BSL
12672-29-6	AROCLOR-1248	120		120		UG/KG	SB-03-12	1/19	34 - 750	120	N/A	320	C	N	BSL
11097-69-1	**AROCLOR-1254**	64		5900		UG/KG	SB-03-21	6/19	34 - 750	5900	N/A	320	C	Y	ASL
11096-82-5	AROCLOR-1260	59	J	290	J	UG/KG	TP01-03-03	3/19	34 - 750	290	N/A	320	C	N	BSL
72-20-8	ENDRIN	4.4	J	24	J	UG/KG	SB-03-21	4/13	3.4 - 75	24	N/A	2300	N	N	BSL
58-89-9	GAMMA-BHC (LINDANE)	3.5	J	3.5	J	UG/KG	TP01-03-02	1/12	1.7 - 39	3.5	N/A	490	C	N	BSL
5103-74-2	GAMMA-CHLORDANE	8	J	14	J	UG/KG	SB-03-21	2/13	1.7 - 39	14	N/A	1800	C	N	BSL
1024-57-3	HEPTACHLOR EPOXIDE	6.1	J	6.1	J	UG/KG	TP01-03-03	1/13	1.7 - 39	6.1	N/A	70	C	N	BSL
72-55-9	4,4'-DDE	16	J	42	J	UG/KG	TP01-03-01	4/13	3.4 - 75	42	N/A	1900	C	N	BSL
50-29-3	4,4'-DDT	11	J	31	J	UG/KG	SB-03-07	3/13	3.4 - 75	31	N/A	1900	C	N	BSL
1330-20-7	XYLENES, TOTAL	2.4	J	580	J	UG/KG	SB-03-11	4/29	7.3 - 2900	580	N/A	16000000	N	N	BSL
3268-87-9	OCDD	0.76	J	2.2	J	UG/KG	TP01-03-01	2/4	0.4 - 1.3	2.2	N/A	4.3	C	N	BSL
72-54-8	4,4'-DDD	11	J	150		UG/KG	TP01-03-02	5/12	3.4 - 75	150	N/A	2700	C	N	BSL
91-57-6	2-METHYLNAPHTHALENE	86	J	690		UG/KG	TP01-03-03	4/20	340 - 39000	690	N/A	160000	N	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 18
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, IMPOUNDMENT AREA SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Impoundment Area

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
79-34-5	1,1,2,2-TETRACHLOROETHANE	2	J	2	J	UG/KG	IM605A	1/59	10 - 2800	2	N/A	3200	C	N	BSL
540-59-0	1,2-DICHLOROETHENE (TOTAL)	1	J	11	J	UG/KG	IM201	2/59	10 - 2800	11	N/A	70000	N	N	BSL
78-93-3	2-BUTANONE	6	J	23		UG/KG	IM101	3/59	5 - 2800	23	N/A	4700000	N	N	BSL
108-10-1	4-METHYL-2-PENTANONE	450		450		UG/KG	IM504	1/59	10 - 2800	450	N/A	630000	N	N	BSL
67-64-1	ACETONE	16	J	1100		UG/KG	IM503	8/59	4 - 11000	1100	N/A	780000	N	N	BSL
74-87-3	CHLOROMETHANE	2	J	2	J	UG/KG	IM406	1/59	10 - 1700	2	N/A	49000	C	N	BSL
100-41-4	ETHYLBENZENE	14	J	14	J	UG/KG	IM504	1/59	10 - 2800	14	N/A	780000	N	N	BSL
127-18-4	TETRACHLOROETHENE	10	J	10	J	UG/KG	IM403	1/59	10 - 2800	10	N/A	12000	C	N	BSL
108-88-3	TOLUENE	8	J	8	J	UG/KG	IM101	1/59	10 - 2800	8	N/A	1600000	N	N	BSL
79-01-6	TRICHLOROETHENE	2	J	15	J	UG/KG	IM504	6/59	10 - 2800	15	N/A	58000	C	N	BSL
91-57-6	2-METHYLNAPHTHALENE	44	J	44	J	UG/KG	IM505	1/30	320 - 4200	44	N/A	160000	N	N	BSL
106-44-5	4-METHYLPHENOL	160	J	160	J	UG/KG	IM307	1/30	320 - 4200	160	N/A	39000	N	N	BSL
208-96-8	ACENAPHTHYLENE	560	J	560	J	UG/KG	IM302	1/30	320 - 4200	560	N/A	160000	N	N	BSL
120-12-7	ANTHRACENE	510	J	510	J	UG/KG	IM302	1/30	320 - 4200	510	N/A	2300000	N	N	BSL
56-55-3	**BENZO(A)ANTHRACENE**	49	J	2700	J	UG/KG	IM107	8/30	320 - 920	2700	N/A	870	C	Y	ASL
50-32-8	**BENZO(A)PYRENE**	45	J	3000	J	UG/KG	IM107	8/30	320 - 920	3000	N/A	87	C	Y	ASL
205-99-2	**BENZO(B)FLUORANTHENE**	46	J	2800	J	UG/KG	IM107	9/30	320 - 920	2800	N/A	870	C	Y	ASL
191-24-2	BENZO(G,H,I)PERYLENE	46	J	1700	J	UG/KG	IM107	7/30	320 - 450	1700	N/A	160000	N	N	BSL
207-08-9	BENZO(K)FLUORANTHENE	51	J	1100	J	UG/KG	IM107	6/30	320 - 920	1100	N/A	8700	C	N	BSL
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	45	J	320	J	UG/KG	IM711	16/30	100 - 4200	320	N/A	46000	C	N	BSL
218-01-9	CHRYSENE	60	J	3300	J	UG/KG	IM107	8/30	320 - 920	3300	N/A	87000	C	N	BSL
53-70-3	DIBENZO(A,H)ANTHRACENE	34	J	34	J	UG/KG	IM410	1/30	320 - 4200	34	N/A	87	C	N	BSL
84-74-2	DI-N-BUTYL PHTHALATE	55	J	110	J	UG/KG	IM201	4/30	320 - 4200	110	N/A	780000	N	N	BSL
206-44-0	FLUORANTHENE	48	J	3700	J	UG/KG	IM107	11/30	320 - 920	3700	N/A	310000	N	N	BSL
86-73-7	FLUORENE	240	J	240	J	UG/KG	IM302	1/30	320 - 4200	240	N/A	310000	N	N	BSL
193-39-5	**INDENO(1,2,3-CD)PYRENE**	45	J	1300	J	UG/KG	IM107	7/30	320 - 920	1300	N/A	870	C	Y	ASL
87-86-5	PENTACHLOROPHENOL	120	J	120	J	UG/KG	IM711	1/30	820 - 10000	120	N/A	5300	C	N	BSL
85-01-8	PHENANTHRENE	56	J	1900	J	UG/KG	IM302	6/30	320 - 920	1900	N/A	160000	N	N	BSL
129-00-0	PYRENE	42	J	7000		UG/KG	IM107	11/30	320 - 920	7000	N/A	230000	N	N	BSL
72-54-8	4,4'-DDD	0.11	J	150		UG/KG	IM501	11/30	3.8 - 4.5	150	N/A	2700	C	N	BSL
72-55-9	4,4'-DDE	0.29	J	3.7	J	UG/KG	IM501	7/30	3.8 - 42	3.7	N/A	1900	C	N	BSL
50-29-3	4,4'-DDT	0.51	J	78		UG/KG	IM711	9/30	3.6 - 4.5	78	N/A	1900	C	N	BSL
309-00-2	ALDRIN	2.3	J	2.3	J	UG/KG	IM301	1/30	1.8 - 22	2.3	N/A	38	C	N	BSL
5103-71-9	ALPHA-CHLORDANE	0.25	J	0.25	J	UG/KG	IM309	1/30	1.8 - 22	0.25	N/A	1800	C	N	BSL
53469-21-9	AROCLOR-1242	31	J	31	J	UG/KG	IM309	1/30	36 - 420	31	N/A	320	C	N	BSL
11097-69-1	AROCLOR-1254	16	J	44		UG/KG	IM410	6/30	38 - 420	44	N/A	320	C	N	BSL
11096-82-5	**AROCLOR-1260**	21	J	930		UG/KG	IM711	5/30	36 - 420	930	N/A	320	C	Y	ASL
319-86-8	DELTA-BHC	0.067	J	9.9	J	UG/KG	IM711	2/30	0.34 - 22	9.9	N/A	100	C	N	BSL
60-57-1	DIELDRIN	0.046	J	21		UG/KG	IM711	6/30	3.6 - 4.5	21	N/A	40	C	N	BSL
959-98-8	ENDOSULFAN I	0.071	J	0.8	J	UG/KG	IM307	2/30	1.8 - 22	0.8	N/A	47000	N	N	BSL
33213-65-9	ENDOSULFAN II	0.11	J	19	J	UG/KG	IM711	4/30	3.6 - 42	19	N/A	47000	N	N	BSL
72-20-8	ENDRIN	0.094	J	13	J	UG/KG	IM302	4/30	3.6 - 18	13	N/A	2300	N	N	BSL
7421-93-4	ENDRIN ALDEHYDE	0.63	J	0.63	J	UG/KG	IM307	1/30	3.6 - 42	0.63	N/A	2300	N	N	BSL
53494-70-5	ENDRIN KETONE	0.12	J	13	J	UG/KG	IM107	3/30	3.6 - 18	13	N/A	2300	N	N	BSL
58-89-9	GAMMA-BHC (LINDANE)	0.14	J	0.19	J	UG/KG	IM410	2/30	0.3 - 22	0.19	N/A	490	C	N	BSL
5103-74-2	GAMMA-CHLORDANE	0.067	J	13	J	UG/KG	IM711	4/30	1.8 - 2.3	13	N/A	1800	C	N	BSL
76-44-8	HEPTACHLOR	0.061	J	1.2	J	UG/KG	IM307	2/30	1.8 - 22	1.2	N/A	140	C	N	BSL
1024-57-3	HEPTACHLOR EPOXIDE	0.059	J	0.059	J	UG/KG	IM412	1/30	0.29 - 22	0.059	N/A	70	C	N	BSL
72-43-5	METHOXYCHLOR	0.81	J	0.81	J	UG/KG	IM410	1/30	0.37 - 220	0.81	N/A	39000	N	N	BSL

TABLE 18
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN, IMPOUNDMENT AREA SUBSURFACE SOIL (POST-REMOVAL)
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Impoundment Area

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Site Greater Than Background (2)	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7429-90-5	ALUMINUM	4500		20100		MG/KG	IM409	65/65	N/A	20100	N	7800	N	N	BKG
7440-36-0	**ANTIMONY**	0.56	J	144	J	MG/KG	IM711	10/39	0.4 - 10.1	144	Y	3.1	N	Y	ASL
7440-38-2	ARSENIC	0.42		6.4		MG/KG	IM711	40/65	0.37 - 2.1	6.4	N	0.43	C	N	BKG
7440-39-3	BARIUM	36	J	316		MG/KG	IM711	65/65	N/A	316	N	550	N	N	BSL
7440-41-7	BERYLLIUM	0.37	J	6.7		MG/KG	IM503	56/65	0.38 - 1.1	6.7	N	16	N	N	BSL
7440-43-9	**CADMIUM**	0.59	J	91.1		MG/KG	IM101A	10/65	0.04 - 2.1	91.1	Y	3.9	N	Y	ASL
7440-70-2	CALCIUM	552		132000		MG/KG	IM711	65/65	N/A	132000	Y		N	N	NUT
7440-47-3	**CHROMIUM**	2.5	J	4730		MG/KG	IM711	65/65	N/A	4730	Y	23	N	Y	ASL
7440-48-4	COBALT	2.2		61.4		MG/KG	IM711	64/65	8.9	61.4	Y	470	N	N	BSL
7440-50-8	**COPPER**	2.2	J	707	J	MG/KG	IM711	49/65	1.1 - 9.5	707	Y	310	N	Y	ASL
57-12-5	CYANIDE	0.66		79.6		MG/KG	IM711	9/37	0.55 - 3.1	79.6	Y	160	N	N	BSL
18540299	HEXAVALENT CHROMIUM	0.9	J	22.5	J	MG/KG	IM406	14/39	0.01 - 2.4	22.5	Y	23	N	N	BSL
7439-89-6	IRON	3350		91700		MG/KG	IM101	65/65	N/A	91700	N	2300	N	N	BKG
7439-92-1	LEAD	0.59		89.8		MG/KG	IM711	58/65	2.6 - 5.9	89.8	N	400	C	N	BSL
7439-95-4	MAGNESIUM	542		42800		MG/KG	IM301	65/65	N/A	42800	Y		N	N	NUT
7439-96-5	**MANGANESE**	90.3		6090		MG/KG	IM503	65/65	N/A	6090	Y	160	N	Y	ASL
7439-97-6	**MERCURY**	0.06		2.6		MG/KG	IM307	13/65	0.04 - 0.12	2.6	Y	2.3	N	Y	ASL
7440-02-0	NICKEL	3.3		62.7		MG/KG	IM101	65/65	N/A	62.7	Y	160	N	N	BSL
7440-09-7	POTASSIUM	189		5680		MG/KG	IM409	62/65	667 - 864	5680	Y		N	N	NUT
7440-22-4	**SILVER**	0.59	J	373	J	MG/KG	IM711	14/65	0.16 - 1.1	373	Y	39	N	Y	ASL
7440-23-5	SODIUM	68.8		612		MG/KG	IM409	20/65	44.9 - 527	612	N		N	N	NUT
7440-28-0	THALLIUM	1.1	J	1.1	J	MG/KG	IM301	1/65	0.69 - 1.5	1.1	N	0.55	N	N	BKG
7440-62-2	VANADIUM	4.8		33.7		MG/KG	IM101A	65/65	N/A	33.7	N	55	N	N	BSL
7440-66-6	ZINC	9.9	J	327	J	MG/KG	IM711	49/65	10.9 - 46.4	327	Y	2300	N	N	BSL

(1) Mimimum/maximum detected concentration
(2) Refer to supporting information for background discussion.
Y - Site (>) Background; N - Site (not >) Background; NA - Not Applicable (inorganics - insufficient site or back info; organics).
(3) EPA Region III Risk-Based Concentration Screening Values (Residential Land Use) (EPA, 10/27/99). Office of Soild Waste and Emergency Response (OSWER) [for lead only] (EPA, 1994).
(4) Rationale Codes Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information, discussed in uncertainty section of HHRA (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 19

CALCULATION OF NON-CANCER HAZARDS - ADULT INDUSTRIAL WITH SITE 1 SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Site 1
Receptor Population: Industrial/Commercial
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	CHROMIUM VI	233.00	mg/kg	233.00	mg/kg	1	1.1E-04	mg/kg/day	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	0.04
												Total Hazard Index Across All Exposure Routes/Pathways	0.04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 20
CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH SITE 1 SUBSURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Contact with Site 1 Subsurface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Antimony	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.60E-05	mg/kg-day	4.00E-04	mg/kg-day	N/A	N/A	0.12
	Cadmium	1.55E+01	mg/kg	1.55E+01	mg/kg	M	1.98E-04	mg/kg-day	1.00E-03	mg/kg-day	N/A	N/A	0.20
	Chromium	2.33E+02	mg/kg	2.33E+02	mg/kg	M	2.98E-03	mg/kg-day	3.00E-03	mg/kg-day	N/A	N/A	0.99
	Manganese	1.26E+03	mg/kg	1.26E+03	mg/kg	M	1.61E-02	mg/kg-day	2.40E-02	mg/kg-day	N/A	N/A	0.67
	Mercury	4.60E-01	mg/kg	4.60E-01	mg/kg	M	5.88E-06	mg/kg-day	1.00E-04	mg/kg-day	N/A	N/A	0.06
	Silver	1.70E+01	mg/kg	1.70E+01	mg/kg	M	2.17E-04	mg/kg-day	5.00E-03	mg/kg-day	N/A	N/A	0.04
	Thallium	6.90E-01	mg/kg	6.90E-01	mg/kg	M	8.82E-06	mg/kg-day	7.00E-05	mg/kg-day	N/A	N/A	0.13
												Total of Routes	2.21

TABLE 21
CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH SITE 2 SURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact with Site 2 Surface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Cadmium	7.70E+00	mg/kg	7.70E+00	mg/kg	M	9.84E-05	mg/kg-day	1.00E-03	mg/kg-day	N/A	N/A	0.10
	Chromium	8.76E+01	mg/kg	8.76E+01	mg/kg	M	1.12E-03	mg/kg-day	3.00E-03	mg/kg-day	N/A	N/A	0.37
	Copper	1.61E+02	mg/kg	1.61E+02	mg/kg	M	2.06E-03	mg/kg-day	4.00E-02	mg/kg-day	N/A	N/A	0.05
	Silver	2.33E+01	mg/kg	2.33E+01	mg/kg	M	2.98E-04	mg/kg-day	5.00E-03	mg/kg-day	N/A	N/A	0.06
	Thallium	6.80E-01	mg/kg	6.80E-01	mg/kg	M	8.69E-06	mg/kg-day	7.00E-05	mg/kg-day	N/A	N/A	0.12
	Vanadium	4.60E+01	mg/kg	4.60E+01	mg/kg	M	5.88E-04	mg/kg-day	7.00E-03	mg/kg-day	N/A	N/A	0.08
	Zinc	4.28E+02	mg/kg	4.28E+02	mg/kg	M	5.47E-03	mg/kg-day	3.00E-01	mg/kg-day	N/A	N/A	0.02
	Aroclor-1254	5.96E+02	ug/kg	5.96E+02	ug/kg	M	7.62E-06	mg/kg-day	2.00E-05	mg/kg-day	N/A	N/A	0.38
	Benz(a)anthracene	2.20E+03	ug/kg	2.20E+03	ug/kg	M	2.81E-05	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	Benzo(a)pyrene	2.59E+03	ug/kg	2.59E+03	ug/kg	M	3.31E-05	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	Benzo(b)fluoranthene	4.84E+03	ug/kg	4.84E+03	ug/kg	M	6.19E-05	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	Indeno(1,2,3-cd)pyrene	1.72E+03	ug/kg	1.72E+03	ug/kg	M	2.20E-05	mg/kg-day	--	mg/kg-day	N/A	N/A	--
													1.19
												Total of Routes	1.19

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

TABLE 22

CALCULATION OF NON-CANCER HAZARDS - ADULT INDUSTRIAL CONTACT WITH SITE 2 SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Site 2
Receptor Population: Industrial/Commercial
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	ANTIMONY	11.47	mg/kg	11.47	mg/kg	1	5.6E-06	mg/kg/day	4.0E-04	mg/kg/day	4.0E-04	mg/kg/day	0.01
	ARSENIC	6.26	mg/kg	6.26	mg/kg	1	3.1E-06	mg/kg/day	3.0E-04	mg/kg/day	3.0E-04	mg/kg/day	0.01
	CADMIUM	7.70	mg/kg	7.70	mg/kg	1	3.8E-06	mg/kg/day	1.0E-03	mg/kg/day	1.0E-03	mg/kg/day	0.00
	CHROMIUM VI	95.00	mg/kg	95.00	mg/kg	1	4.7E-05	mg/kg/day	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	0.02
												Total Hazard Index Across All Exposure Routes/Pathways	0.04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 23
CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH SITE 2 SUBSURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Contact with Site 2 Subsurface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aluminum	1.66E+04	mg/kg	1.66E+04	mg/kg	M	2.12E-01	mg/kg-day	1.00E+00	mg/kg-day	N/A	N/A	0.21
	Antimony	1.15E+01	mg/kg	1.15E+01	mg/kg	M	1.47E-04	mg/kg-day	4.00E-04	mg/kg-day	N/A	N/A	0.37
	Arsenic	6.26E+00	mg/kg	6.26E+00	mg/kg	M	8.00E-05	mg/kg-day	3.00E-04	mg/kg-day	N/A	N/A	0.27
	Barium	1.21E+02	mg/kg	1.21E+02	mg/kg	M	1.55E-03	mg/kg-day	7.00E-02	mg/kg-day	N/A	N/A	0.02
	Cadmium	7.70E+00	mg/kg	7.70E+00	mg/kg	M	9.84E-05	mg/kg-day	1.00E-03	mg/kg-day	N/A	N/A	0.10
	Chromium	9.50E+01	mg/kg	9.50E+01	mg/kg	M	1.21E-03	mg/kg-day	3.00E-03	mg/kg-day	N/A	N/A	0.40
	Copper	3.96E+02	mg/kg	3.96E+02	mg/kg	M	5.06E-03	mg/kg-day	4.00E-02	mg/kg-day	N/A	N/A	0.13
	Manganese	5.83E+02	mg/kg	5.83E+02	mg/kg	M	7.45E-03	mg/kg-day	2.40E-02	mg/kg-day	N/A	N/A	0.31
	Nickel	1.87E+01	mg/kg	1.87E+01	mg/kg	M	2.39E-04	mg/kg-day	2.00E-02	mg/kg-day	N/A	N/A	0.01
	Silver	1.24E+01	mg/kg	1.24E+01	mg/kg	M	1.59E-04	mg/kg-day	5.00E-03	mg/kg-day	N/A	N/A	0.03
	Thallium	5.10E-01	mg/kg	5.10E-01	mg/kg	M	6.52E-06	mg/kg-day	7.00E-05	mg/kg-day	N/A	N/A	0.09
	Vanadium	4.14E+01	mg/kg	4.14E+01	mg/kg	M	5.29E-04	mg/kg-day	7.00E-03	mg/kg-day	N/A	N/A	0.08
	Zinc	5.35E+02	mg/kg	5.35E+02	mg/kg	M	6.84E-03	mg/kg-day	3.00E-01	mg/kg-day	N/A	N/A	0.02
	Aroclor-1254	3.75E+01	ug/kg	3.75E+01	ug/kg	M	4.79E-07	mg/kg-day	2.00E-05	mg/kg-day	N/A	N/A	0.02
	Aroclor-1260	6.53E+01	ug/kg	6.53E+01	ug/kg	M	8.35E-07	mg/kg-day	--	mg/kg-day	N/A	N/A	--
												Total of Routes	2.07

TABLE 24
CALCULATION OF CANCER RISKS - CHILD RESIDENT CONTACT WITH SITE 2 SURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINTER, PENNSYVANIA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Contact with Site 2 Surface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Cadmium	7.70E+00	mg/kg	7.70E+00	mg/kg	M	8.44E-06	mg/kg-day	--	1/(mg/kg-day)	--
	Chromium	8.76E+01	mg/kg	8.76E+01	mg/kg	M	9.60E-05	mg/kg-day	--	1/(mg/kg-day)	--
	Copper	1.61E+02	mg/kg	1.61E+02	mg/kg	M	1.76E-04	mg/kg-day	--	1/(mg/kg-day)	--
	Silver	2.33E+01	mg/kg	2.33E+01	mg/kg	M	2.55E-05	mg/kg-day	--	1/(mg/kg-day)	--
	Thallium	6.80E-01	mg/kg	6.80E-01	mg/kg	M	7.45E-07	mg/kg-day	--	1/(mg/kg-day)	--
	Vanadium	4.60E+01	mg/kg	4.60E+01	mg/kg	M	5.04E-05	mg/kg-day	--	1/(mg/kg-day)	--
	Zinc	4.28E+02	mg/kg	4.28E+02	mg/kg	M	4.69E-04	mg/kg-day	--	1/(mg/kg-day)	--
	Aroclor-1254	5.96E+02	ug/kg	5.96E+02	ug/kg	M	6.53E-07	mg/kg-day	2.00E+00	1/(mg/kg-day)	1.31E-06
	Benz(a)anthracene	2.20E+03	ug/kg	2.20E+03	ug/kg	M	2.41E-06	mg/kg-day	7.30E-01	1/(mg/kg-day)	1.76E-06
	Benzo(a)pyrene	2.59E+03	ug/kg	2.59E+03	ug/kg	M	2.84E-06	mg/kg-day	7.30E+00	1/(mg/kg-day)	2.07E-05
	Benzo(b)fluoranthene	4.84E+03	ug/kg	4.84E+03	ug/kg	M	5.30E-06	mg/kg-day	7.30E-01	1/(mg/kg-day)	3.87E-06
	Indeno(1,2,3-cd)pyrene	1.72E+03	ug/kg	1.72E+03	ug/kg	M	1.88E-06	mg/kg-day	7.30E-01	1/(mg/kg-day)	1.38E-06
	(Total)										2.90E-05
										Total of Routes	2.90E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 25
CALCULATION OF CANCER RISKS - CHILD RESIDENT CONTACT WITH SITE 2 SUBSURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Suburface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Contact with Site 2 Subsurface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	6.26E+00	mg/kg	6.26E+00	mg/kg	M	6.86E-06	mg/kg-day	1.50E+00	1/(mg/kg-day)	1.03E-05
	Aroclor-1254	3.75E+01	ug/kg	3.75E+01	ug/kg	M	4.11E-08	mg/kg-day	2.00E+00	1/(mg/kg-day)	8.22E-08
	Aroclor-1260	6.53E+01	ug/kg	6.53E+01	ug/kg	M	7.16E-08	mg/kg-day	2.00E+00	1/(mg/kg-day)	1.43E-07
	Benz(a)anthracene	8.82E+02	ug/kg	8.82E+02	ug/kg	M	9.67E-07	mg/kg-day	7.30E-01	1/(mg/kg-day)	7.06E-07
	Benzo(a)pyrene	8.10E+02	ug/kg	8.10E+02	ug/kg	M	8.88E-07	mg/kg-day	7.30E+00	1/(mg/kg-day)	6.48E-06
	Benzo(b)fluoranthene	9.41E+02	ug/kg	9.41E+02	ug/kg	M	1.03E-06	mg/kg-day	7.30E-01	1/(mg/kg-day)	7.53E-07
	Dibenz(a,h)anthracene	4.17E+02	ug/kg	4.17E+02	ug/kg	M	4.57E-07	mg/kg-day	7.30E+00	1/(mg/kg-day)	3.34E-06
	Indeno(1,2,3-cd)pyrene	6.36E+02	ug/kg	6.36E+02	ug/kg	M	6.97E-07	mg/kg-day	7.30E-01	1/(mg/kg-day)	5.09E-07
										Total of Routes	2.23E-05

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 26

CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH SITE 3 SURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future (Hypothetical)
Medium: Soil
Exposure Medium: Surface
Exposure Point: Site 3
Receptor Population: Residential
Receptor Age: Child (0-6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	CHROMIUM VI	36.80	mg/kg	36.80	mg/kg	1	4.7E-04	mg/kg/day	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	0.16
	MANGANESE	1180.00	mg/kg	1180.00	mg/kg	1	1.5E-02	mg/kg/day	2.0E-02	mg/kg/day	2.0E-02	mg/kg/day	0.76
	THALLIUM	1.1	mg/kg	1.1	mg/kg	1	1.4E-05	mg/kg/day	7.0E-05	mg/kg/day	7.0E-05	mg/kg/day	0.20
												Total Hazard Index Across All Exposure Routes/Pathways	1.11

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 27
CALCULATION OF NON-CANCER HAZARDS - ADULT INDUSTRIAL WORKER CONTACT WITH SITE 3 SUBSURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Contact with Site 3 Subsurface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	6.74E+00	mg/kg	6.74E+00	mg/kg	M	3.30E-06	mg/kg-day	3.00E-04	mg/kg-day	N/A	N/A	0.01
	Aroclor-1254	5.97E+02	ug/kg	5.97E+02	ug/kg	M	2.92E-07	mg/kg-day	2.00E-05	mg/kg-day	N/A	N/A	0.01
												Total of Routes	0.03

TABLE 28
CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH SITE 3 SUBSURFACE SOIL
REASONABLE MAXIMUM EXPOSURE
NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Contact with Site 3 Subsurface Soil
Receptor Population: Resident
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Antimony	9.67E+00	mg/kg	9.67E+00	mg/kg	M	1.24E-04	mg/kg-day	4.00E-04	mg/kg-day	N/A	N/A	0.31
	Arsenic	6.74E+00	mg/kg	6.74E+00	mg/kg	M	8.62E-05	mg/kg-day	3.00E-04	mg/kg-day	N/A	N/A	0.29
	Barium	4.19E+02	mg/kg	4.19E+02	mg/kg	M	5.36E-03	mg/kg-day	7.00E-02	mg/kg-day	N/A	N/A	0.08
	Cadmium	3.29E+01	mg/kg	3.29E+01	mg/kg	M	4.21E-04	mg/kg-day	1.00E-03	mg/kg-day	N/A	N/A	0.42
	Chromium	3.97E+01	mg/kg	3.97E+01	mg/kg	M	5.08E-04	mg/kg-day	3.00E-03	mg/kg-day	N/A	N/A	0.17
	Copper	1.39E+03	mg/kg	1.39E+03	mg/kg	M	1.78E-02	mg/kg-day	4.00E-02	mg/kg-day	N/A	N/A	0.44
	Manganese	1.07E+03	mg/kg	1.07E+03	mg/kg	M	1.37E-02	mg/kg-day	2.40E-02	mg/kg-day	N/A	N/A	0.57
	Mercury	8.20E+00	mg/kg	8.20E+00	mg/kg	M	1.05E-04	mg/kg-day	1.00E-04	mg/kg-day	N/A	N/A	1.05
	Nickel	4.47E+01	mg/kg	4.47E+01	mg/kg	M	5.72E-04	mg/kg-day	2.00E-02	mg/kg-day	N/A	N/A	0.03
	Silver	3.68E+02	mg/kg	3.68E+02	mg/kg	M	4.71E-03	mg/kg-day	5.00E-03	mg/kg-day	N/A	N/A	0.94
	Thallium	4.70E-01	mg/kg	4.70E-01	mg/kg	M	6.01E-06	mg/kg-day	7.00E-05	mg/kg-day	N/A	N/A	0.09
	Vanadium	5.90E+01	mg/kg	5.90E+01	mg/kg	M	7.54E-04	mg/kg-day	7.00E-03	mg/kg-day	N/A	N/A	0.11
	Zinc	1.97E+03	mg/kg	1.97E+03	mg/kg	M	2.52E-02	mg/kg-day	3.00E-01	mg/kg-day	N/A	N/A	0.08
	Aldrin	1.23E+02	ug/kg	1.23E+02	ug/kg	M	1.57E-06	mg/kg-day	3.00E-05	mg/kg-day	N/A	N/A	0.05
	Aroclor-1254	5.97E+02	ug/kg	5.97E+02	ug/kg	M	7.63E-06	mg/kg-day	2.00E-05	mg/kg-day	N/A	N/A	0.38
												Total of Routes	5.01

TABLE 29

CALCULATION OF CANCER RISKS - CHILD RESIDENT CONTACT WITH SITE 3 SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future (Hypothetical)
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Site 3
Receptor Population: Residential
Receptor Age: Child (0-6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	ARSENIC	6.74	mg/kg	6.74	mg/kg	1	7.39E-06	mg/kg/day	1.50E+00	mg/kg/day	1.11E-05
	BENZ[A]ANTHRACENE	37.13	mg/kg	37.13	mg/kg	1	4.07E-05	mg/kg/day	7.30E-01	mg/kg/day	2.97E-05
	BENZO[A]PYRENE	24.55	mg/kg	24.55	mg/kg	1	2.69E-05	mg/kg/day	7.30E+00	mg/kg/day	1.96E-04
	BENZO[B]FLUORANTHENE	35.98	mg/kg	35.98	mg/kg	1	3.94E-05	mg/kg/day	7.30E-01	mg/kg/day	2.88E-05
	BENZO[K]FLUORANTHENE	32.96	mg/kg	32.96	mg/kg	1	3.61E-05	mg/kg/day	7.30E-02	mg/kg/day	2.64E-06
	DIBENZ[A,H]ANTHRACENE	9.29	mg/kg	9.29	mg/kg	1	1.0E-05	mg/kg/day	7.30E+00	mg/kg/day	7.45E-05
	INDENO[1,2,3-C,D]PYRENE	10.71	mg/kg	10.71	mg/kg	1	1.17E-05	mg/kg/day	7.30E-01	mg/kg/day	8.54E-06
	ALDRIN	0.12	mg/kg	0.12	mg/kg	1	1.4E-07	mg/kg/day	1.70E+01	mg/kg/day	2.30E-06
	AROCLOR-1254	0.60	mg/kg	0.60	mg/kg	1	6.5E-07	mg/kg/day	2.00E+00	mg/kg/day	1.31E-06
											3.6E-04

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 30

CALCULATION OF NON-CANCER HAZARDS - ADULT INDUSTRIAL CONTACT WITH IMPOUNDMENT AREA SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Impoundment area
Receptor Population: Industrial/Commercial
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	ANTIMONY	21.11	mg/kg	21.11	mg/kg	1	1.0E-05	mg/kg/day	4.0E-04	mg/kg/day	4.0E-04	mg/kg/day	0.03
	CHROMIUM VI	243.58	mg/kg	243.58	mg/kg	1	1.2E-04	mg/kg/day	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	0.04
	MANGANESE	1355.14	mg/kg	1355.14	mg/kg	1	6.6E-04	mg/kg/day	2.0E-02	mg/kg/day	2.0E-02	mg/kg/day	0.03
												Total Hazard Index Across All Exposure Routes/Pathways	0.10

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 31

CALCULATION OF NON-CANCER HAZARDS - CHILD RESIDENT CONTACT WITH IMPOUNDMENT AREA SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future (Hypothetical)
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Impoundment area
Receptor Population: Residential
Receptor Age: Child (0-6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	ANTIMONY	21.11	mg/kg	21.11	mg/kg	1	2.7E-04	mg/kg/day	4.0E-04	mg/kg/day	4.0E-04	mg/kg/day	0.68
	CADMIUM	3.56	mg/kg	3.56	mg/kg	1	4.6E-05	mg/kg/day	1.0E-03	mg/kg/day	1.0E-03	mg/kg/day	0.05
	CHROMIUM VI	243.58	mg/kg	243.58	mg/kg	1	3.1E-03	mg/kg/day	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	1.04
	COPPER	34.67	mg/kg	34.67	mg/kg	1	4.4E-04	mg/kg/day	4.0E-02	mg/kg/day	4.0E-02	mg/kg/day	0.01
	MANGANESE	1355.14	mg/kg	1355.14	mg/kg	1	1.7E-02	mg/kg/day	2.0E-02	mg/kg/day	2.0E-02	mg/kg/day	0.87
	MERCURY	0.11	mg/kg	0.11	mg/kg	1	1.4E-06	mg/kg/day	1.0E-04	mg/kg/day	1.0E-04	mg/kg/day	0.01
	SILVER	7.23	mg/kg	7.23	mg/kg	1	9.2E-05	mg/kg/day	5.0E-03	mg/kg/day	5.0E-03	mg/kg/day	0.02
												Total Hazard Index Across All Exposure Routes/Pathways	2.67

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 32

CALCULATION OF CANCER RISKS - CHILD RESIDENT CONTACT WITH IMPOUNDMENT AREA SUBSURFACE SOIL

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future (Hypothetical)
Medium: Soil
Exposure Medium: Subsurface
Exposure Point: Impoundment area
Receptor Population: Residential
Receptor Age: Child (0-6 years)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	BENZ[A]ANTHRACENE	0.37	mg/kg	0.37	mg/kg	1	4.05E-07	mg/kg/day	7.30E-01	mg/kg/day	2.96E-07
	BENZO[A]PYRENE	0.39	mg/kg	0.39	mg/kg	1	4.27E-07	mg/kg/day	7.30E+00	mg/kg/day	3.12E-06
	BENZO[B]FLUORANTHENE	0.41	mg/kg	0.41	mg/kg	1	4.49E-07	mg/kg/day	7.30E-01	mg/kg/day	3.28E-07
	INDENO[1,2,3-C,D]PYRENE	0.33	mg/kg	0.33	mg/kg	1	3.62E-07	mg/kg/day	7.30E-01	mg/kg/day	2.64E-07
	AROCLOR-1260	0.06	mg/kg	0.06	mg/kg	1	6.58E-08	mg/kg/day	2.00E+00	mg/kg/day	1.32E-07
											4.1E-06

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 33

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (POST-REMOVAL)

REASONABLE MAXIMUM EXPOSURE

NAWC WARMINSTER, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface	Site 2	all	2.90E-05	N/A	N/A	2.90E-05	all		1.19	N/A	N/A	1.19
		Site 3	all	N/A	N/A	N/A	N/A	all		1.11	N/A	N/A	1.11
	Subsurface	Site 1	all	N/A	N/A	N/A	N/A	all		2.21	N/A	N/A	2.21
		Site 2	all	2.23E-05	N/A	N/A	2.23E-05	all		2.07	N/A	N/A	2.07
		Site 3	all	3.55E-04	N/A	N/A	3.55E-04	all		5.01	N/A	N/A	5.01
		Impoundment area	all	4.14E-06	N/A	N/A	4.14E-06	all		2.67	N/A	N/A	2.67

Scenario Timeframe: Future
Receptor Population: Industrial/Commercial
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface	Site 2	all	N/A	N/A	N/A	N/A	all		0.05	N/A	N/A	0.05
		Site 3	all	N/A	N/A	N/A	N/A	all		N/A	N/A	N/A	N/A
	Subsurface	Site 1	all	N/A	N/A	N/A	N/A	all		0.04	N/A	N/A	0.04
		Site 2	all	3.56E-06	N/A	N/A	3.56E-06	all		0.04	N/A	N/A	0.04
		Site 3	all	N/A	N/A	N/A	N/A	all		0.03	N/A	N/A	0.03
		Impoundment area	all	N/A	N/A	N/A	N/A	all		0.10	N/A	N/A	0.1

Scenario Timeframe: Future
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Stream	Surface Water		all	4.70E-09	N/A	1.20E-07	1.25E-07	all		2.80E-05	N/A	5.30E-06	3.33E-05
	Sediment		all	1.50E-06	N/A	3.10E-07	1.81E-06	all		5.60E-04	N/A	8.90E-05	6.49E-04

TABLE 34
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - AREA A
SEDIMENT
NAWC WARMINSTER, PA

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	3.6E-05	1.8E-05
ALDRIN	7.2E-05	5.7E-05
ALPHA-CHLORDANE	NA	NA
AROCLOR-1016	1.9E-04	5.3E-05
AROCLOR-1248	NA	NA
AROCLOR-1254	1.4E-03	4.0E-04
AROCLOR-1260	NA	NA
DELTA-BHC	NA	NA
DIELDRIN	1.5E-05	1.2E-05
ENDOSULFAN II	2.8E-07	1.9E-07
ENDOSULFAN SULFATE	2.3E-07	1.8E-07
ENDRIN	1.1E-05	7.0E-06
ENDRIN ALDEHYDE	6.9E-06	5.5E-06
ENDRIN KETONE	5.1E-06	4.1E-06
GAMMA-CHLORDANE	1.0E-05	5.0E-06
2-METHYLNAPHTHALENE	NA	NA
4-METHYLPHENOL	4.3E-05	2.8E-05
ACENAPHTHENE	4.8E-06	3.8E-06
ACENAPHTHYLENE	NA	NA
ANTHRACENE	1.4E-06	8.7E-07
BENZ(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALA	2.7E-05	2.2E-05
BUTYL BENZYL PHTHALATE	2.9E-07	2.3E-07
CARBAZOLE	NA	NA
CHRYSENE	NA	NA
DI-N-BUTYL PHTHALATE	4.8E-07	1.9E-07
DI-N-OCTYL PHTHALATE	6.6E-06	5.2E-06
DIBENZ(A,H)ANTHRACENE	NA	NA
DIBENZOFURAN	6.4E-05	5.1E-05
FLUORANTHENE	7.6E-05	6.0E-05
FLUORENE	7.7E-06	6.1E-06
INDENO(1,2,3-CD)PYRENE	NA	NA
NAPHTHALENE	2.0E-06	1.2E-06
PYRENE	9.4E-05	5.7E-05
1,1,1-TRICHLOROETHANE	3.4E-09	1.0E-11
1,1-DICHLOROETHENE	5.1E-08	1.6E-10
1,2-DICHLOROETHENE (TOTA	3.1E-07	6.2E-10
2-BUTANONE	3.5E-09	7.0E-12
ACETONE	5.4E-08	8.0E-09
CARBON TETRACHLORIDE	4.1E-06	9.5E-09
CHLOROFORM	2.3E-07	4.5E-10
CHLOROMETHANE	NA	NA
ETHYLBENZENE	6.1E-09	9.1E-10
TETRACHLOROETHENE	5.0E-07	6.0E-08
TOLUENE	1.7E-08	2.1E-09
TRICHLOROETHENE	4.1E-06	4.9E-07
TOTAL XYLENES	1.1E-09	1.3E-10
ALUMINUM	1.4E-03	5.4E-05
ARSENIC	3.4E-03	1.4E-04
BARIUM	5.4E-04	5.4E-04
BERYLLIUM	3.8E-05	1.5E-04
CADMIUM	2.6E-03	2.0E-03
CHROMIUM	1.1E-05	2.3E-05
COBALT	5.6E-05	2.2E-06
COPPER	2.4E-04	1.6E-05
IRON	1.8E-02	7.1E-04
LEAD	NA	NA
MANGANESE	1.6E-02	2.1E-02
MERCURY	2.0E-04	1.2E-04
NICKEL	4.0E-04	1.1E-04
SELENIUM	1.5E-05	7.3E-07
SILVER	2.9E-05	5.7E-06
VANADIUM	1.1E-03	4.5E-03
ZINC	5.6E-04	8.9E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 35
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - AREA A
SEDIMENT
NAWC WARMINSTER, PA

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	1.0E-10	5.0E-11
4,4'-DDE	5.6E-11	2.8E-11
4,4'-DDT	5.2E-10	2.6E-10
ALDRIN	3.1E-09	2.5E-09
ALPHA-CHLORDANE	N/A	N/A
AROCLOR-1016	8.8E-09	2.5E-09
AROCLOR-1248	2.3E-08	6.5E-09
AROCLOR-1254	1.9E-08	5.3E-09
AROCLOR-1260	2.8E-08	7.7E-09
DELTA-BHC	N/A	N/A
DIELDRIN	1.0E-09	8.0E-10
ENDOSULFAN II	N/A	N/A
ENDOSULFAN SULFATE	N/A	N/A
ENDRIN	N/A	N/A
ENDRIN ALDEHYDE	N/A	N/A
ENDRIN KETONE	N/A	N/A
GAMMA-CHLORDANE	6.7E-11	3.3E-11
2-METHYLNAPHTHALENE	N/A	N/A
4-METHYLPHENOL	N/A	N/A
ACENAPHTHENE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ANTHRACENE	N/A	N/A
BENZ(A)ANTHRACENE	9.6E-08	*
BENZO(A)PYRENE	7.8E-07	*
BENZO(B)FLUORANTHENE	1.1E-07	*
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	5.2E-09	*
BIS(2-ETHYLHEXYL)PHTHALA	6.5E-10	5.2E-10
BUTYL BENZYL PHTHALATE	N/A	N/A
CARBAZOLE	6.2E-10	*
CHRYSENE	1.1E-09	*
DI-N-BUTYL PHTHALATE	N/A	N/A
DI-N-OCTYL PHTHALATE	N/A	N/A
DIBENZ(A,H)ANTHRACENE	1.7E-07	*
DIBENZOFURAN	N/A	*
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
INDENO(1,2,3-CD)PYRENE	5.5E-08	*
NAPHTHALENE	N/A	N/A
PYRENE	N/A	N/A
1,1,1-TRICHLOROETHANE	N/A	N/A
1,1-DICHLOROETHENE	2.4E-11	7.2E-14
1,2-DICHLOROETHENE (TOTA	N/A	N/A
2-BUTANONE	N/A	N/A
ACETONE	N/A	N/A
CARBON TETRACHLORIDE	3.2E-11	7.4E-14
CHLOROFORM	1.2E-12	2.3E-15
CHLOROMETHANE	3.2E-12	5.1E-13
ETHYLBENZENE	N/A	N/A
TETRACHLOROETHENE	2.2E-11	2.7E-12
TOLUENE	N/A	N/A
TRICHLOROETHENE	2.3E-11	2.8E-12
TOTAL XYLENES	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	1.3E-07	5.5E-09
BARIUM	N/A	N/A
BERYLLIUM	7.1E-08	2.8E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
SILVER	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	1.5E-06	3.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMI
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 36
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - AREA A
SURFACE WATER
NAWC WARMINSTER, PA

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
4,4'-DDD	N/A	N/A
4,4'-DDT	4.3E-06	3.3E-04
BENZ(A)ANTHRACENE	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A
CHRYSENE	N/A	N/A
DI-N-OCTYL PHTHALATE	1.5E-06	1.9E-04
DIETHYL PHTHALATE	3.8E-08	4.8E-06
FLUORANTHENE	1.2E-06	1.4E-04
PYRENE	1.5E-06	1.5E-04
1,1-DICHLOROETHANE	1.5E-06	9.1E-05
2-BUTANONE	1.0E-06	6.4E-05
BENZENE	N/A	N/A
BROMOMETHANE	5.5E-05	3.4E-03
CARBON DISULFIDE	8.4E-06	1.0E-03
CHLOROETHANE	1.2E-06	7.2E-05
CHLOROMETHANE	N/A	N/A
TETRACHLOROETHENE	1.5E-05	9.6E-04
TRICHLOROETHENE	5.1E-05	3.2E-03
ALUMINUM	1.8E-05	8.3E-07
BARIUM	3.1E-04	3.6E-04
CHROMIUM	5.0E-07	1.2E-06
COPPER	2.5E-04	1.9E-05
IRON	1.2E-03	5.8E-05
LEAD	N/A	N/A
MANGANESE	2.5E-03	4.0E-03
NICKEL	1.4E-04	4.4E-05
THALLIUM	3.0E-03	1.4E-04
ZINC	2.8E-05	5.3E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICA
L

TABLE 37
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - AREA A
SURFACE WATER
NAWC WARMINSTER, PA

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
4,4'-DDD	2.9E-11	2.3E-09
4,4'-DDT	6.3E-11	4.9E-09
BENZ(A)ANTHRACENE	9.6E-10	*
BENZO(B)FLUORANTHENE	1.9E-09	*
CHRYSENE	1.9E-11	*
DI-N-OCTYL PHTHALATE	N/A	N/A
DIETHYL PHTHALATE	N/A	N/A
FLUORANTHENE	N/A	N/A
PYRENE	N/A	N/A
1,1-DICHLOROETHANE	N/A	N/A
2-BUTANONE	N/A	N/A
BENZENE	7.6E-11	4.8E-09
BROMOMETHANE	N/A	N/A
CARBON DISULFIDE	N/A	N/A
CHLOROETHANE	N/A	N/A
CHLOROMETHANE	6.8E-10	4.3E-08
TETRACHLOROETHENE	6.8E-10	4.3E-08
TRICHLOROETHENE	2.9E-10	1.8E-08
ALUMINUM	N/A	N/A
BARIUM	N/A	N/A
CHROMIUM	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
NICKEL	N/A	N/A
THALLIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	4.7E-09	1.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICA
* = DERMAL CONTACT WITH CARCINOGENIC PAHs IS NOT ESTIMATED

TABLE 38

DATA SUMMARY FOR SEDIMENT INORGANICS - AREA A

NAWC WARMINSTER, PENNSYLVANIA

(mg/kg)

CONTAMINANT OF POTENTIAL CONCERN	BACKGROUND		SITE-RELATED			BENCHMARK (mg/kg) (1)
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	EXPOSURE CONCENTRATION	
ARSENIC	2 / 2	2.3 - 2.8	25 / 25	2 - 14.1	14.1	8.2 (ER-L) (2)
BARIUM	3 / 4	31.4 - 65.4	25 / 26	62.7 - 1060	1060	500 (3)
BERYLLIUM	3 / 3	0.52 - 0.62	25 / 25	0.5 - 2.1	2.1	NA
CADMIUM	NOT DETECTED	-	7 / 9	0.2 - 8.4	8.4	1.2 (ER-L) (4)
CHROMIUM (TOTAL)	4 / 4	7.7 - 11.7	27 / 27	13.7 - 224	224	26 (LEL) (5)
COBALT	1 / 1	4.4	23 / 23	3.4 - 75.2	75.2	50 (6)
COPPER	3 / 3	5.4 - 8.2	26 / 26	13.5 - 136	136	34 (ER-L) (2)
LEAD	3 / 4	9.8 - 24.6	27 / 27	23.9 - 404	404	46.7 (ER-L) (2)
MANGANESE	4 / 4	144 - 289	27 / 27	115 - 11400	11400	460 (LEL) (5)
MERCURY	NOT DETECTED	-	16 / 27	0.09 - 2.25	2.25	0.15 (ER-L) (2)
NICKEL	3 / 3	4.4 - 6.3	27 / 27	6.3 - 224	224	20.9 (ER-L) (2)
SELENIUM	NOT DETECTED	-	4 / 27	0.15 - 1.9	1.9	1 (3)
SILVER	NOT DETECTED	-	3 / 24	0.8 - 2	2	1 (ER-L) (4)
VANADIUM	4 / 4	10.3 - 13.6	27 / 27	14.5 - 157	157	NA
ZINC	5 / 5	32.9 - 6180	26 / 26	61 - 8435	8435	150 (ER-L) (2)

NA = Benchmark not available.

ER-L = Effects Range-Low; value from data based on studies conducted primarily on coastal marine and estuarine environments.

LEL = Lowest Effect Level; level of contamination tolerated by the majority of benthic organisms.

1: Benchmarks are for freshwater sediments, unless otherwise indicated.

2: Region III BTAG screening level (August 9, 1995).

3: Wisconsin Department of Natural Resources (1985, 1990), Criteria for Sediments from Great Lakes harbors for disposal in water, in: Washington Department of Ecology, 1991, Summary of Criteria and Guidelines for Contamina

4: NOAA, 1994. NOAA Screening Guidelines for Organics and Inorganics, Quick Reference Cards, HAZMAT REPORT 94-8.

5: MOE, 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, Ministry of Environment and Energy, Ontario, Canada (August).

6: Open Water Disposal Guideline, in: MOE, 1993 (see footnote 5).

TABLE 39

SELECTION OF ECOLOGICAL CONTAMINANTS OF CONCERN FOR SURFACE WATER ORGANICS - AREA A

NAWC WARMINSTER, PENNSYLVANIA

(µg/l)

CONTAMINANT OF POTENTIAL CONCERN	EXPOSURE CONCENTRATION	BENCHMARK (µg/l)	ECOLOGICAL EFFECTS QUOTIENT (EEQ)	RETAINED AS COC?
Volatile Organic Chemicals				
BENZENE	0.2	530	0.00	NO
BROMOMETHANE	0.5	NA		YES
2-BUTANONE	4	322000	0.00	NO
CARBON DISULFIDE	5.5	NA		YES
CHLOROETHANE	3	NA		YES
CHLOROMETHANE	4	NA		YES
1,1-DICHLOROETHANE	0.95	20000	0.00	NO
TETRACHLOROETHENE	1	840	0.00	NO
TRICHLOROETHENE	2	21900	0.00	NO
Semivolatile Organic Chemicals				
BENZ(A)ANTHRACENE	0.1	6.3	0.02	NO
BENZO(B)FLUORANTHENE	0.2	30	0.01	NO
CHRYSENE	0.2	30	0.01	NO
DI-N-OCTYLPHTHALATE	0.2	0.3	0.67	NO
DIETHYLPHTHALATE	0.2	3	0.07	NO
FLUORANTHENE	0.3	398	0.00	NO
PYRENE	0.3	30	0.01	NO
Semivolatile Organic Chemicals				
4,4'-DDD	0.0092	0.06	0.15	NO
4,4'-DDT	0.014	0.001	14.00	YES
ECOLOGICAL EFFECTS INDEX (EEI)			14.94	

1: COPC was retained as a COC if the benchmark was exceeded or if no benchmark was available

NA = No benchmark available.

TABLE 40

SELECTION OF ECOLOGICAL CONTAMINANTS OF CONCERN IN SEDIMENT: INORGANICS - AREA A

NAWC WARMINSTER, PENNSYLVANIA

(mg/kg)

CONTAMINANT OF POTENTIAL CONCERN	EXPOSURE CONCENTRATION	BENCHMARK (mg/kg)	ECOLOGICAL EFFECTS QUOTIENT (EEQ)	RETAINED AS COC? (1)
ARSENIC	14.1	8.2	1.72	YES
BARIUM	1060	500	2.12	YES
BERYLLIUM	2.1	NA		YES
CADMIUM	8.4	1.2	7.00	YES
CHROMIUM	224	26	8.62	YES
COBALT	75.2	50	1.50	YES
COPPER	136	34	4.00	YES
LEAD	404	46.7	8.65	YES
MANGANESE	11400	460	24.78	YES
MERCURY	2.25	0.15	15.00	YES
NICKEL	224	20.9	10.72	YES
SELENIUM	1.9	1	1.90	YES
SILVER	2	1	2.00	YES
VANADIUM	157	NA		YES
ZINC	8435	150	56.23	YES
ECOLOGICAL EFFECTS INDEX (EEI)			144.24	

1: COPC was retained as a COC if the benchmark was exceeded or if no benchmark was available

NA = No benchmark available.

TABLE 41 (PAGE 1 OF 2)

SELECTION OF ECOLOGICAL CONTAMINANTS OF CONCERN IN SEDIMENT: ORGANICS - AREA A
NAWC WARMINSTER, PENNSYLVANIA
(µg/kg)

CONTAMINANT OF POTENTIAL CONCERN	EXPOSURE CONCENTRATION	BENCHMARK (µg/kg)	ECOLOGICAL EFFECTS QUOTIENT (EEQ)	RETAINED AS COC? (1)
Volatile Organic Chemicals				
ACETONE	108	NA		YES
CARBON TETRACHLORIDE	28	NAP		NO
CHLOROFORM	14.75	6300	0.00	NO
CHLOROMETHANE	21	NAP		NO
1,1-DICHLOROETHENE	3	NAP		NO
1, 2-DICHLOROETHENE (TOTAL	18.33	NA		YES
ETHYLBENZENE	4	NAP		NO
TETRACHLOROETHENE	130	57	2.28	YES
2-BUTANONE	45	NA		YES
TOLUENE	82	NAP		NO
1,1,1-TRICHLOROETHANE	2	NAP		NO
TRICHLOROETHENE	1300	1600	0.81	NO
XYLENE (TOTAL)	19	NAP		NO
Semivolatile Organic Chemicals				
ACENAPHTHENE	3500	16	218.75	YES
ACENAPHTHYLENE	270	44	6.14	YES
ANTHRACENE	8300	85.3	97.30	YES
BENZ(A)ANTHRACENE	20000	261	76.63	YES
BENZO(A)PYRENE	17000	430	39.53	YES
BENZO(B)FLUORANTHENE	25000	3200	7.81	YES
BENZO(G,H,I)PERYLENE	13000	670	19.40	YES
BENZO(K)FLUORANTHENE	20000	3200	6.25	YES
BIS(2-ETHYLHEXYL)PHTHALATE	7900	1300	6.08	YES
BUTYLBENZYLPHTHALATE	380	63	6.03	YES
CARBAZOLE	5700	NA		YES
CHRYSENE	24000	384	62.50	YES
DI-N-BUTYLPHTHALATE	310	6200	0.05	NO
DI-N-OCTYLPHTHALATE	860	6200	0.14	NO
DIBENZ(A,H)ANTHRACENE	5300	63.4	83.60	YES
DIBENZOFURAN	2400	540	4.44	YES
FLUORANTHENE	43000	600	71.67	YES
FLUORENE	5900	19	310.53	YES
INDENO(1,2,3-CD)PYRENE	14000	600	23.33	YES
2-METHYLNAPTHALENE	320	70	4.57	YES
4-METHYLPHENOL	1400	670	2.09	YES
NAPHTHALENE	530	160	3.31	YES
PYRENE	40000	665	60.15	YES

TABLE 41 (PAGE 2 OF 2)

SELECTION OF ECOLOGICAL CONTAMINANTS OF CONCERN IN SEDIMENT: ORGANICS - AREA A
NAWC WARMINSTER, PENNSYLVANIA
(µg/kg)

CONTAMINANT OF POTENTIAL CONCERN	EXPOSURE CONCENTRATION	BENCHMARK (µg/kg)	ECOLOGICAL EFFECTS QUOTIENT (EEQ)	RETAINED AS COC? (1)
Pesticides and PCBs				
4,4'-DDD	130	16	8.13	YES
4,4'-DDE	12.6	2.2	5.73	YES
4,4'-DDT	600	1	600.00	YES
ALDRIN	78.5	100	0.79	NO
ALPHA-CHLORDANE	2.7	100	0.03	NO
AROCLOR-1016	110	NAP		NO
AROCLOR-1248	1500	NAP		NO
AROCLOR-1254	615	5	123.00	YES
AROCLOR-1260	1500	5	300.00	YES
DELTA-BHC	3.2	100	0.03	NO
DIELDRIN	4.8	NAP		NO
ENDOSULFAN II	11	5.4	2.04	YES
ENDOSULFAN SULFATE	8.8	NAP		NO
ENDRIN	48	100	0.48	NO
ENDRIN ALDEHYDE	44	100	0.44	NO
ENDRIN KETONE	10	100	0.10	NO
GAMMA-CHLORDANE	7.1	100	0.07	NO
ECOLOGICAL EFFECTS INDEX (EEI)			2153.4	

1: COPC was retained as a COC if it exceeded the benchamark value or no benchmark was available

NA = No benchmark available.

NAP = Not applicable since frequency of detection is <5%.

TABLE 42
SURFACE SOIL CONCENTRATIONS PROTECTIVE OF SEDIMENT/ECOLOGICAL RECEPTORS[3]
NAWC WARMINSTER, PENNSYLVANIA

COCs	SOIL LEVEL PROTECTIVE OF SEDIMENT		SITE 2 MAXIMUM LEVEL		SITE 3 MAXIMUM LEVEL	
	SITE 2	SITE 3	SURFACE SOIL	SUBSURFACE SOIL	SURFACE SOIL	SUBSURFACE SOIL
INORGANICS (mg/kg)						
Cadmium	7.69	9.08	20.3	293	-	67.1
Chromium	531	531	133	3840	36.8	83.4
Copper	202	238	1,410	7980	42.3	3760
Lead	365	365	994	2060	30.4	4570
Mercury	2.32	2.32	1.1	0.98	-	9.7
Nickel	143	143	47	143	21.5	230
Selenium	3.32	3.32	1.6	7.3	-	2.9
Silver	3.32	3.92	58.4	317	-	368
Zinc	895	895	4800	5640	167	9100
ORGANICS (μg/kg)						
2-Methylnapthalene	129	153	21000	360	-	690
4,4'-DDD	25.9	25.9	19	45	-	150
4,4'-DDE	49.4	58.4	8	82	-	42
Acenaphthene	164	194	180	1400	-	4400
Acenaphthylene	239	283	440	-	120	1200

TABLE 42
SURFACE SOIL CONCENTRATIONS PROTECTIVE OF SEDIMENT/ECOLOGICAL RECEPTORS[3]
NAWC WARMINSTER, PENNSYLVANIA

COCs	SOIL LEVEL PROTECTIVE OF SEDIMENT		SITE 2 MAXIMUM LEVEL		SITE 3 MAXIMUM LEVEL	
	SITE 2	SITE 3	SURFACE SOIL	SUBSURFACE SOIL[1]	SURFACE SOIL	SUBSURFACE SOIL[1]
ORGANICS (mg/kg)						
Anthracene	458	541	640[2]	2200	220	21000
Benzo(a)anthracene	2290	2290	3300	5200	1200	53000
Benzo(a)pyrene	2520	2520	3400	3800	1400	44000
Benzo(b)fluoranthene	5860	1060	5300	4900	1300	45000
Benzo(g,h,i)perylene	1230	2220	4400	2100	320	26000
Benzo(k)fluoranthene	5860	1060	1800	2200	1000	34000
Chrysene	2820	2820	3300	4900	1200	51000
Dibenzo(a,h)anthracene	464	464	470	450	99	9400
Fluoranthene	4970	4970	6200	13000	3300	120000
Fluorene	464	464	250	1000	41	4500
Indeno(1,2,3-cd)pyrene	1100	1990	5000	2500	380	29000
Naphthalene	0.73	0.86	52	250	-	450
Pyrene	4640	4640	4600	9800	1800	97000

(1) Assumes subsurface soils become surface soils in the future.

(2) Shaded cell indicates the maximum soil COC analytical result exceeds the PRG protective of sediment.

(3) Table adapted from Table 7-3 of OU-9 RI/FS Report, Tetra Tech NUS, April 2000.

TABLE 43
PRESENT WORTH ANALYSIS
ALTERNATIVE 2 - ENVIRONMENTAL MONITORING AND INSTITUTIONAL CONTROLS
OPERABLE UNIT 9, AREA A MEDIA OTHER THAN GROUNDWATER
NAWC WARMINSTER, PENNSYLVANIA

	Year 1	2	3	4	5	Total Present Worth
Capital Costs						
Institutional Controls	$25,000					
Capital Costs	$21,483					
Total Yearly Capital Cost	$46,483					
O&M Costs						
Erosion & Sedimentation O&M	$5,000	$3,000	$3,000	$3,000	$3,000	
Monitoring Costs	$100,474	$57,499	$28,749	$28,749	$28,749	
Total Yearly O&M Cost	$105,474	$60,499	$31,749	$31,749	$31,749	
5-Year Reviews					$12,000	
Total Yearly Cost	$151,957	$60,499	$31,749	$31,749	$43,749	
Present Worth Factor Based on 7%	1.0000	0.9346	0.8734	0.8163	0.7629	
Present Worth	$151,957	$56,542	$27,730	$25,917	$33,376	**$295,522**

TABLE 43
ALTERNATIVE 2 - ENVIRONMENTAL MONITORING AND INSTITUTIONAL CONTROLS
OPERABLE UNIT 9, AREA A MEDIA OTHER THAN GROUNDWATER
NAWC WARMINSTER, PENNSYLVANIA

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor Equipment	Subtotal Direct Cost	Comments	source	
CAPITAL COSTS												
1 SUBCONTRACTED COSTS												
1.01 Surveyor	1	ls	$3,000.00			$3,000	$0	$0	$0	$3,000		M98-029-308-5400
1.02						$0	$0	$0	$0	$0		
1.03						$0	$0	$0	$0	$0		
1.04						$0	$0	$0	$0	$0		
1.05						$0	$0	$0	$0	$0		
1.06						$0	$0	$0	$0	$0		
Subtotal						$3,000	$0	$0	$0	$3,000		
Overhead on Labor Cost @ 30%								$0		$0		
G & A on Labor Cost @ 10%								$0		$0		
PA Sales Tax on Material 6%							$0			$0		
G & A on Material Cost @ 10%							$0			$0		
G & A on Subcontract Cost @ 10%						$300				$300		
Total Direct Cost						$6,300	$0	$0	$0	$6,300		
Indirects on Total Direct Labor Cost @ 75%								$0		$0		
Profit on Total Direct Cost @ 10%										$630		
Total Field Cost										$6,930		
2 PROFESSIONAL LABOR												P4
2.01 Preparatory (WP, SAP, HASP, Procure Sub)	80	hr			$60.00	$0	$0	$4,800	$0	$4,800		$43.
2.02 Procure Subcontracts	40	hr			$60.00	$0	$0	$2,400	$0	$2,400		$43.
2.03						$0	$0	$0	$0	$0		$43.
2.04						$0	$0	$0	$0	$0		$43.
2.05						$0	$0	$0	$0	$0		$43.
						$0.00		$7,200.00		$7,200		
Overhead on Labor Cost @ 30%										$2,160		
G & A on Labor Cost @ 10%										$720		
Indirects on Total Prof. Labor Cost @ 25%										$1,800		
Profit on Total Cost @ 10%										$720.00		
Total Prof. Labor Cost										$12,600		
Total Field Cost + Prof. Labor										$19,530		
Contingency @ 10%										$1,953		
ESTIMATED CAPITAL COSTS										**$21,483**		

TABLE 43
ALTERNATIVE 2 - ENVIRONMENTAL MONITORING AND INSTITUTIONAL CONTROLS
OPERABLE UNIT 9, AREA A MEDIA OTHER THAN GROUNDWATER
NAWC WARMINSTER, PENNSYLVANIA

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal Direct Cost	Comments
1 MONITORING												
YEAR 1, Quarterly Monitoring												
1.01 Analytical 15 samples/quarter	60	sample	$726.00				$43,560	$0	$0	$0	$43,560	
1.02 Macroinvertabrate Analytical 2 events	10	sample	$400.00				$4,000	$0	$0	$0	$4,000	
1.03 Per Diem /Staff Ecologist	8	days	$117.00				$936	$0	$0	$0	$936	
1.04 Vehicle	16	days	$75.00				$1,200	$0	$0	$0	$1,200	
1.05 Vehicle rental/Staff Ecologist	8	days	$42.00				$336	$0	$0	$0	$336	
1.06 Travel/Staff Ecologist	2	trips	$525.00				$1,050	$0	$0	$0	$1,050	
1.07 Field labor2 people/event +mob/demob 50hr./event	200	hours			$25.00		$0	$0	$5,000	$0	$5,000	
1.08 Field labor Staff Ecologist 2 events @ 46 hrs/event=	92	hours			$30.00		$0	$0	$2,760	$0	$2,760	
1.09 Data Validation (QA\QC) 4 hr/quarter	12	hours			$30.00		$0	$0	$360	$0	$360	
1.10 Report Preparation 45 hr./report	180	hours			$30.00		$0	$0	$5,400	$0	$5,400	
1.11 IDW	0	events					$0	$0	$0	$0	$0	
1.12 ODC's @$500/event	4	events		$500.00			$0	$2,000	$0	$0	$2,000	
1.13 Equipment Rental @$300/event	4	events				$300.00	$0	$0	$0	$1,200	$1,200	
1.14 Project Management 5hr./event	20	hrs			$35.00		$0	$0	$700	$0	$700	
Subtotal							$51,082	$2,000	$14,220	$1,200	$68,502	
Overhead on Labor Cost @ 30%									$4,266		$4,266	
G & A on Labor Cost @ 10%									$1,422		$1,422	
PA Sales Tax on Material 6%: 6%								$120			$120	
G & A on Material Cost @ 10%								$212			$212	
G & A on Subcontract Cost @ 10%							$5,108				$5,108	
Total Direct Cost							$56,190	$2,332	$19,908	$1,200	$79,630	
Indirects on Total Direct Labor Cost @ 50%									$9,954		$9,954	
Profit on Total Direct Cost @ 10%											$7,963	
Subtotal											$97,547	
Health & Safety Monitoring @ 3%											$2,926	
Total Monitoring Cost											$100,474	
2 YEARS 2 through 5, Semi-annual monitoring												
2.01 Analytical 15 samples/event	30	sample	$726.00				$21,780	$0	$0	$0	$21,780	
2.02 Macroinvertabrate Analytical 2 events	10	sample	$400.00				$4,000	$0	$0	$0	$4,000	
2.03 Per Diem /Staff Ecologist	8	days	$117.00				$936	$0	$0	$0	$936	
2.04 Vehicle	8	days	$75.00				$600	$0	$0	$0	$600	
2.05 Vehicle rental/Staff Ecologist	8	days	$42.00				$336	$0	$0	$0	$336	
2.06 Travel/Staff Ecologist	2	trips	$525.00				$1,050	$0	$0	$0	$1,050	
2.07 Field labor 2 people/event+mob/demob	100	hours			$25.00		$0	$0	$2,500	$0	$2,500	
2.08 Field labor Staff Ecologist 2 events @ 46 hrs/event=	92	hours			$30.00		$0	$0	$2,760	$0	$2,760	
2.09 Data Validation (QA\QC) 4 hr/event	8	hours			$30.00		$0	$0	$240	$0	$240	
2.10 Report Preparation 45 hr./report	90	hours			$30.00		$0	$0	$2,700	$0	$2,700	
2.11 IDW	0	events					$0	$0	$0	$0	$0	
2.12 ODC's @$500/event	2	events		$500.00			$0	$1,000	$0	$0	$1,000	
2.13 Equipment Rental @$300/event	2	events				$300.00	$0	$0	$0	$600	$600	
2.14 Project Management 5hr./event	10	hrs			$35.00		$0	$0	$350	$0	$350	
Subtotal							$28,702	$1,000	$8,550	$600	$38,852	
Overhead on Labor Cost @ 30%									$2,565		$2,565	
G & A on Labor Cost @ 10%									$855		$855	
ME Sales Tax on Material 6%: 6%								$60			$60	
G & A on Material Cost @ 10%								$106			$106	
G & A on Subcontract Cost @ 10%							$2,870				$2,870	
Total Direct Cost							$31,572	$1,166	$11,970	$600	$45,308	
Indirects on Total Direct Labor Cost @ 50%									$5,985		$5,985	
Profit on Total Direct Cost @ 10%											$4,531	
Subtotal											$55,824	

TABLE 44
FEDERAL AND STATE WATER QUALITY STANDARDS AND AWQCs FOR AREA A SEDIMENT
NAWC WARMINSTER, PENNSYLVANIA

COCs[4]	Federal AWQC for Ingestion[1] (Mg/L)		State AWQC for Protection of Aquatic Life[2] (µg/L)		State AWQC for Protection of Human Health[2] (µg/L)	State Health Standard for Groundwater[5] (µg/L) ≤ 2500 TDS / > 2500 TDS
	Water and Organisms	Organisms	Continuous Concentration	Maximum Concentration		
INORGANICS						
Antimony	14	4,300	219	1095	10	6/600
Arsenic	.0018	0.14	190[8]	360[8]	50	50 / 5,000
Barium	NA	NA	4,100	20,500	1,000	2000 / 200,000
Cadmium	NA	NA	1.0[3][8]	3.7[3][8]	10	5 / 500
Chromium	NA	670,000	10[7][8]	15[3][7][8]	NP	100 / 10,000[6]
Cobalt	NA	NA	19	95	NP	None
Copper	1300	NA	11[3][8]	17[3][8]	1,000	1,000 / 100,000
Lead	50	NA	2.5[3][8]	65[3][8]	50	5 / 500
Manganese	50	100	NP	NP	NP	1, 000[9]
Mercury	0.14	0.15	0.012	2.1[8]	0.144	2 / 200
Nickel	610	4,600	160[3][8]	1,400[3][8]	600	100 / 10,000
Silver	NA	50	NP	3.5[3][8]	200	100 / 10,000
Vanadium	NA	NA	103	515	NP	None
Zinc	NA	NA	100[3][8]	110[3][8]	5,000	None
ORGANICS						
Acenaphthene	1,200	2,700	17	85	20	None
Acenaphthylene	NA	NA	NP	NP	NP	None
Acetone	NA	NA	86,000	446,000	4,000	None
Anthracene	9,600	110,000	NP	NP	10,000	None

TABLE 44
FEDERAL AND STATE WATER QUALITY STANDARDS AND AWQCs FOR AREA A SEDIMENT
NAWC WARMINSTER, PENNSYLVANIA

COCs[4]	Federal AWQC for Ingestion[1] (Mg/L)		State AWQC for Protection of Aquatic Life[2] (µg/L)		State AWQC for Protection of Human Health[2] (µg/L)	State Health Standard for Groundwater[5] (µg/L) ≤ 2500 TDS / > 2500 TDS
	Water and Organisms	Organisms	Continuous Concentration	Maximum Concentration		
Aroclor-1254	4.4E-05	4.5E-05	0.014	1.0	0.00004	0.5150
Aroclor-1260	4.4E-05	4.5E-05	0.014	1.0	0.00004	0.5150
Benzo(a)anthracene	0.0028	0.031	0.1	0.5	0.003	None
Benzo(a)pyrene	0.0028	0.031	NP	NP	0.003	0.2 / 20
Benzo(b)fluoranthene	NA	NA	NP	NP	0.003	None
Benzo(g,h,i)perylene	NA	NA	NP	NP	NP	None
Benzo(k)fluoranthene	0.0028	0.031	NP	NP	0.003	None
Bis(2-ethylhexyl)phthalate	1.8E-03	5.9E-3	909	4,545	2	6 / 600
2-Butanone	NA	NA	32,200	161,000	2,000	None
Butylbenzylphthalate	3	5.2	35	140	300	None
Carbazole	NA	NA	NP	NP	NP	None
Chrysene	0.0028	0.031	NP	NP	0.003	None
4,4'-DDD	5.9E-04	5.9E-04	0.001	0.55	NP	None
4,4'-DDE	5.9E-04	5.9E-04	0.001	0.55	NP	None
4,4'-DDT	5.9E-04	5.9E-04	0.001	0.55	0.0005	None
Dibenz(a,h)anthracene	0.0028	0.031	NP	NP	0.003	None
Dibenzofuran	NA	NA	NP	NP	NP	None
Cis-1,2-Dichloroethene	NA	NA	NP	NP	NP	70 / 7,000
Trans-1,2-Dichloroethene	700	NA	1,350	6,750	700	100 / 10,000
Endosulfan II	NA	NA	NP	NP	NP	None

TABLE 44
FEDERAL AND STATE WATER QUALITY STANDARDS AND AWQCs FOR AREA A SEDIMENT
NAWC WARMINSTER, PENNSYLVANIA

COCs[4]	Federal AWQC for Ingestion[1] (Mg/L)		State AWQC for Protection of Aquatic Life[2] (µg/L)		State AWQC for Protection of Human Health[2] (µg/L)	State Health Standard for Groundwater[5] (µg/L) ≤ 2500 TDS / > 2500 TDS
	Water and Organisms	Organisms	Continuous Concentration	Maximum Concentration		
Fluoranthene	300	300	40	200	300	None
Fluorene	1,300	14,000	NP	NP	1,000	None
Indeno(1,2,3-cd)pyrene	.00028	.0031	NP	NP	0.003	None
2-Methylnaphthalene	NA	NA	NP	NP	NP	None
4-Methylphenol	NA	NA	NP	NP	NP	None
Naphthalene	NA	NA	43	135	10	20 / 2,000
Pyrene	960	11,000	NP	NP	1,000	None
Tetrachloroethene	0.8	8.85	139	695	0.7	5 / 500

(1) EPA, 1993. Water Quality Criteria Summary-Draft. Office of Science and Technology, Health and Criteria Division (4304), Washington, DC.
(2) 25 PA Code Chapter 16
(3) Based on assumed hardness of 100 µg/L, must be evaluated on a site-specific basis for receiving stream(s) of concern.
(4) COCs include risk-based COCs for soil and ecological COCs for Area A sediment.
(5) PADEP Land Recycling Program Technical Guidance Manual Supplement, November 1996.
(6) Value for total chromium.
(7) Value for Chromium VI.
(8) Dissolved criteria.
(9) 25 PA Code, Chapter 93.
TDS Total Dissolved Solids.
NA Not Available/Not Promulgated

APPENDIX B

FIGURES

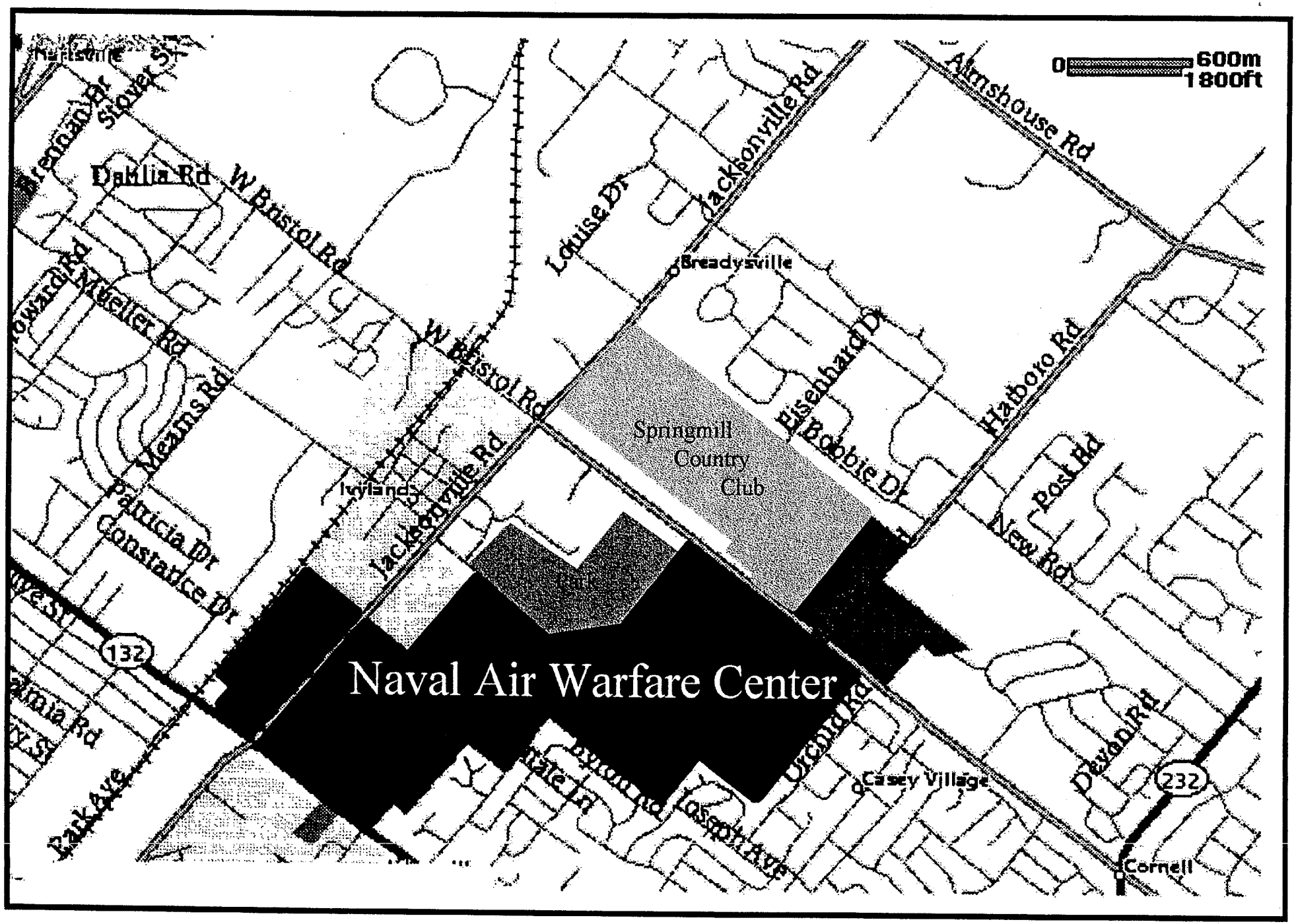


Figure 1. The former NAWC, Warminster, PA

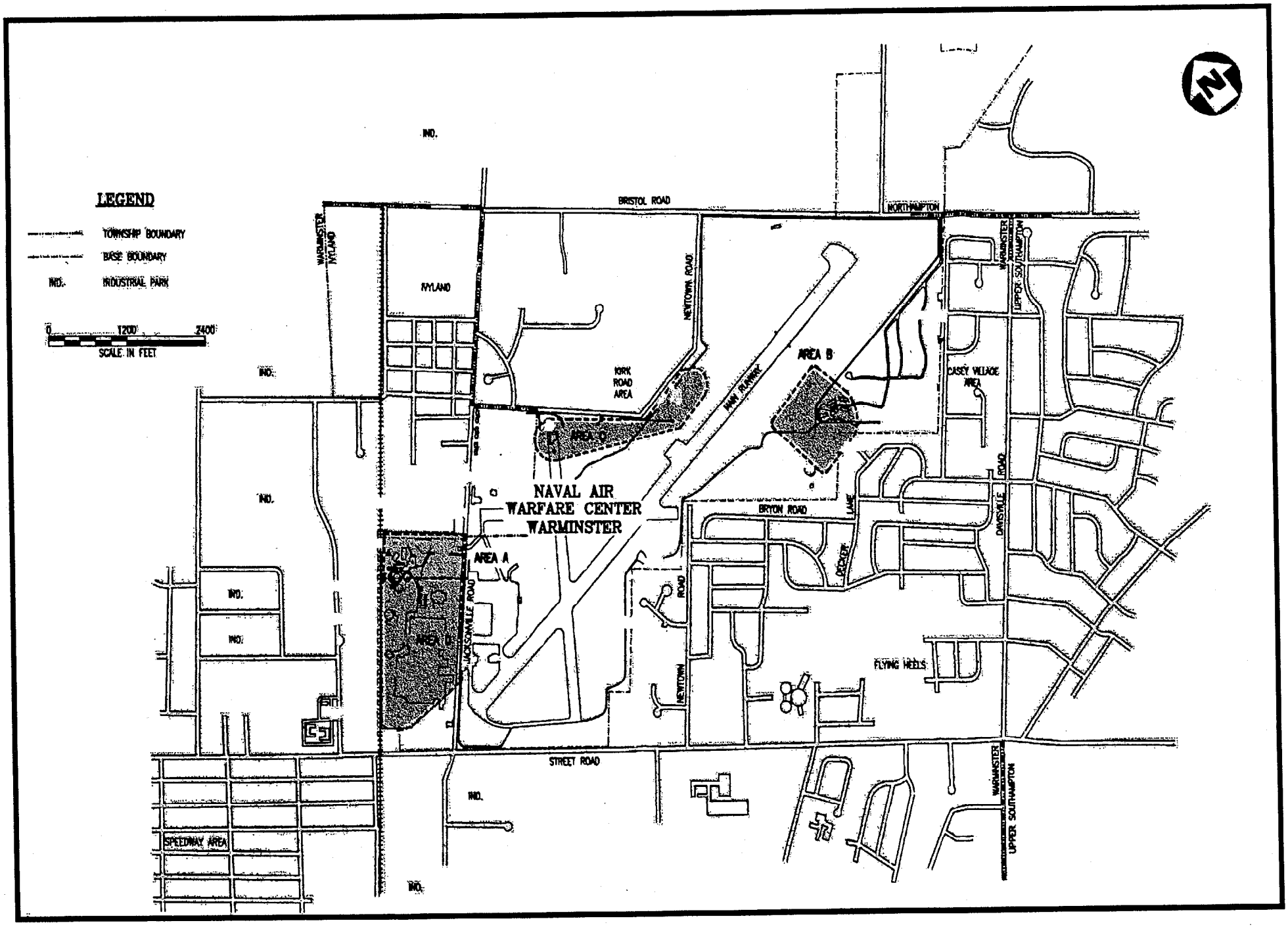
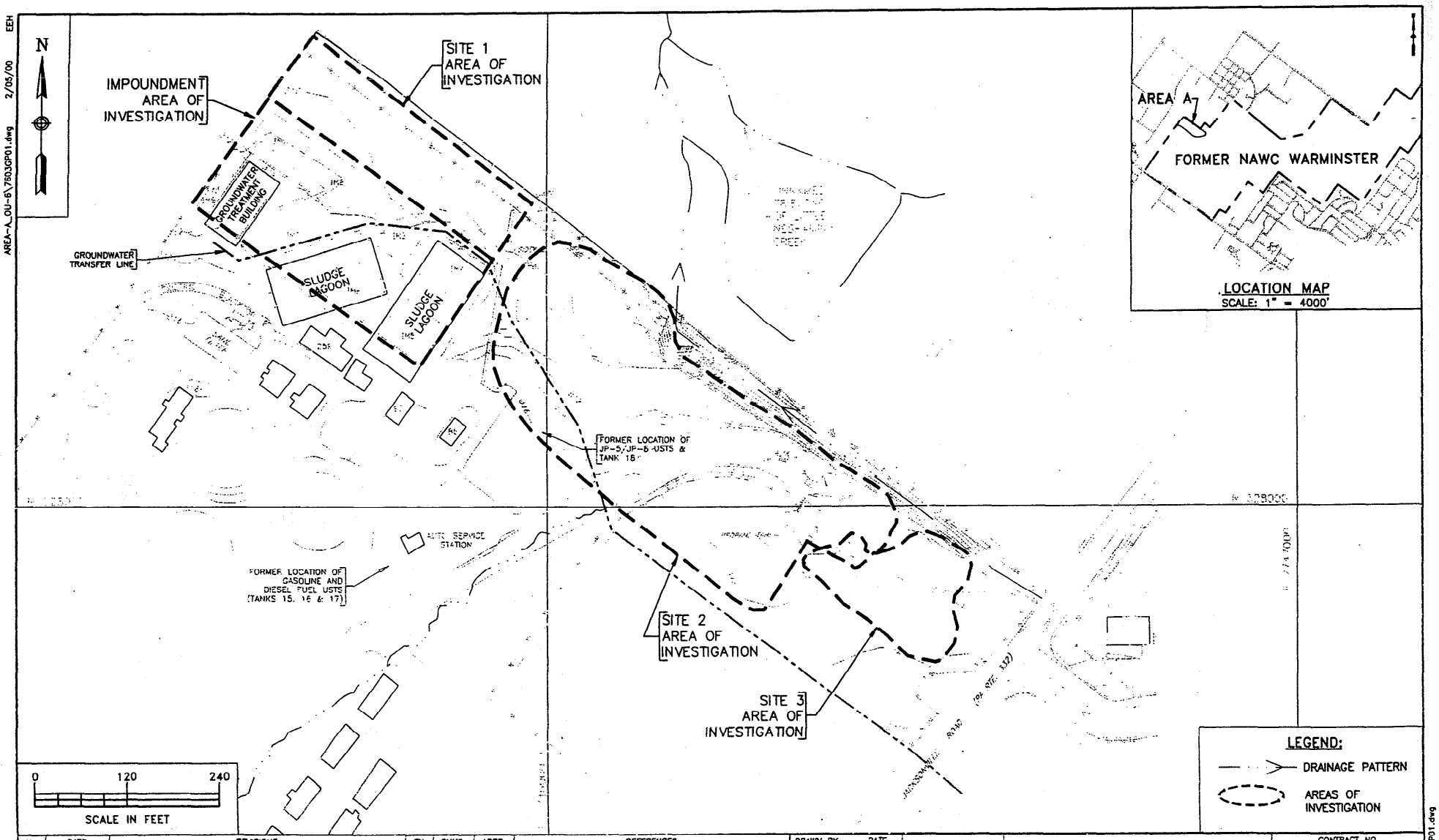


Figure 2. NAWC Site Location Map



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/20/00	OHM TRAILER AREA REMOVED, FORMER TANK LOCATIONS AND GROUNDWATER TRANSFER LINE ADDED.	LDL/EEH			

DRAWN BY EEH/LDL DATE 2/8/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

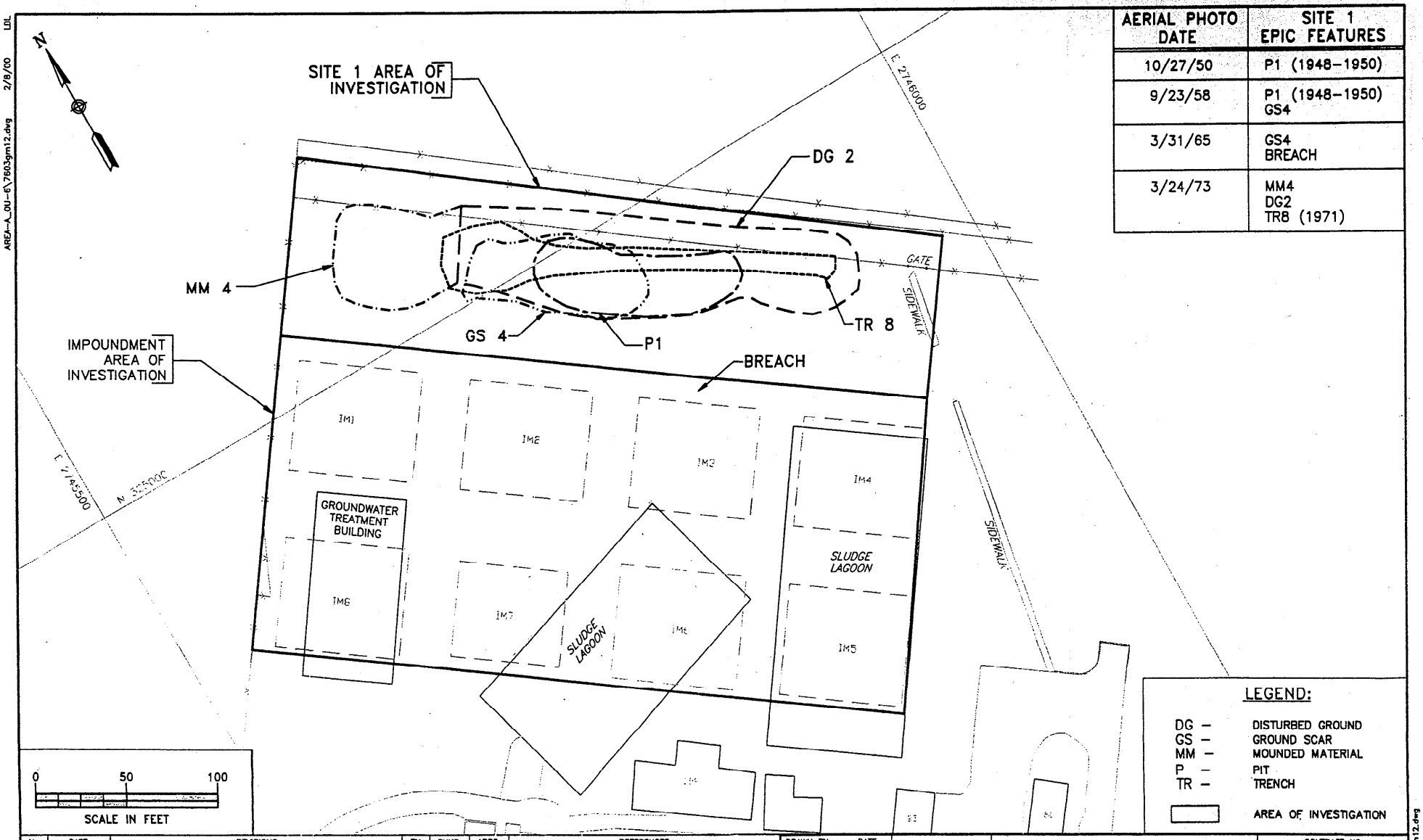
Tetra Tech NUS, Inc.

AREA A LAYOUT

FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE 4/10/00
DRAWING NO. FIGURE 3 REV. 1

AREA-A_OU-6\7603GP01.dwg 2/05/00 EEH



AERIAL PHOTO DATE	SITE 1 EPIC FEATURES
10/27/50	P1 (1948–1950)
9/23/58	P1 (1948–1950) GS4
3/31/65	GS4 BREACH
3/24/73	MM4 DG2 TR8 (1971)

No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/18/00	OHM TRAILER AREA REMOVED.	LDL			

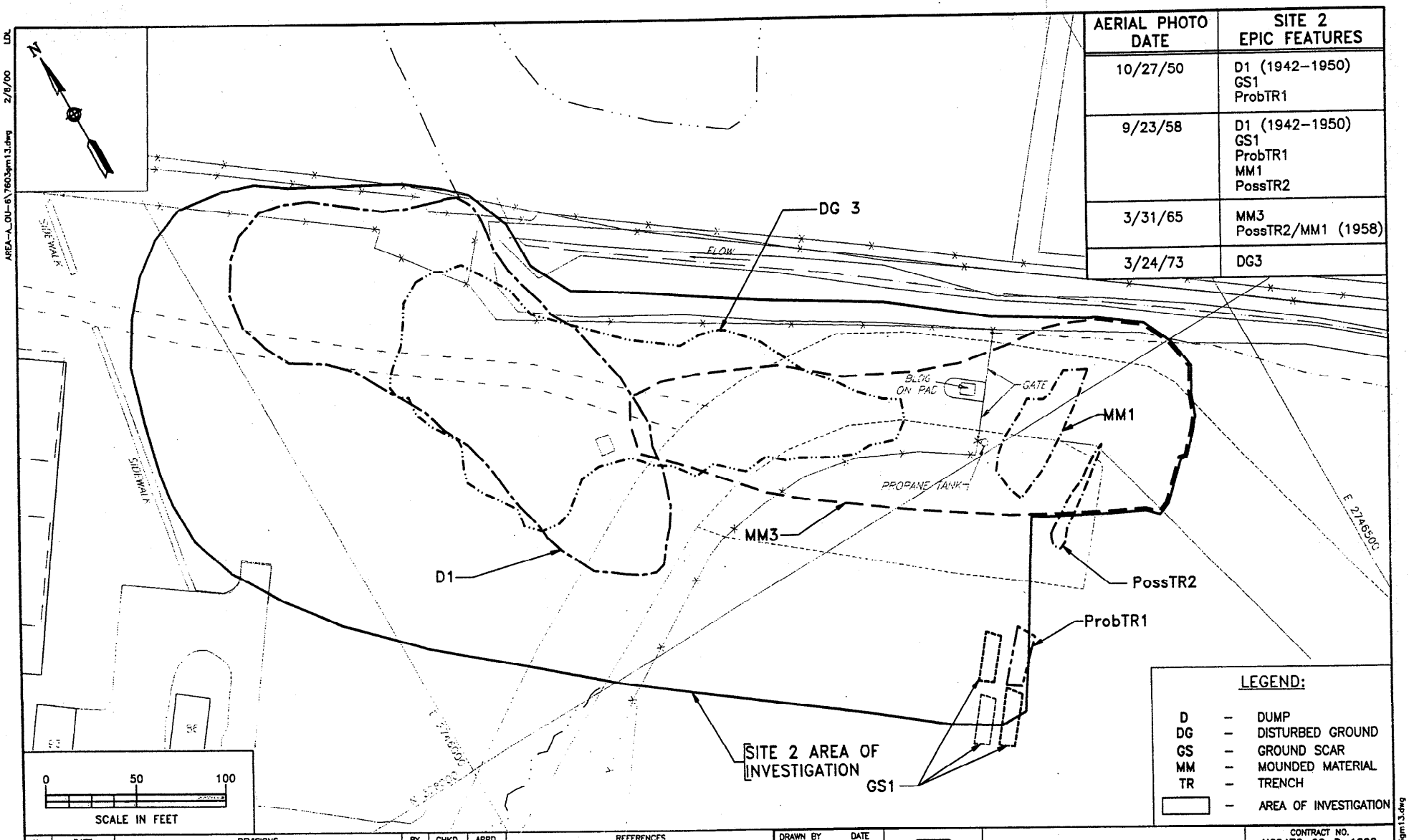
DRAWN BY LDL DATE 2/8/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

Tetra Tech NUS, Inc.

SITE 1 & IMPOUNDMENT AREA
EPIC FEATURES
FORMER NAWC WARMINSTER
WARMINSTER, PA

CONTRACT NO. N62472-90-D-1298
OWNER NO. 7603
APPROVED BY DATE
DRAWING NO. FIGURE 4
REV. 1

LDL 2/8/00 AREA-A_OU-6\7603gm12.dwg



AERIAL PHOTO DATE	SITE 2 EPIC FEATURES
10/27/50	D1 (1942–1950) GS1 ProbTR1
9/23/58	D1 (1942–1950) GS1 ProbTR1 MM1 PossTR2
3/31/65	MM3 PossTR2/MM1 (1958)
3/24/73	DG3

No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/18/00	OHM TRAILER AREA REMOVED.	LDL			

DRAWN BY LDL DATE 2/9/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

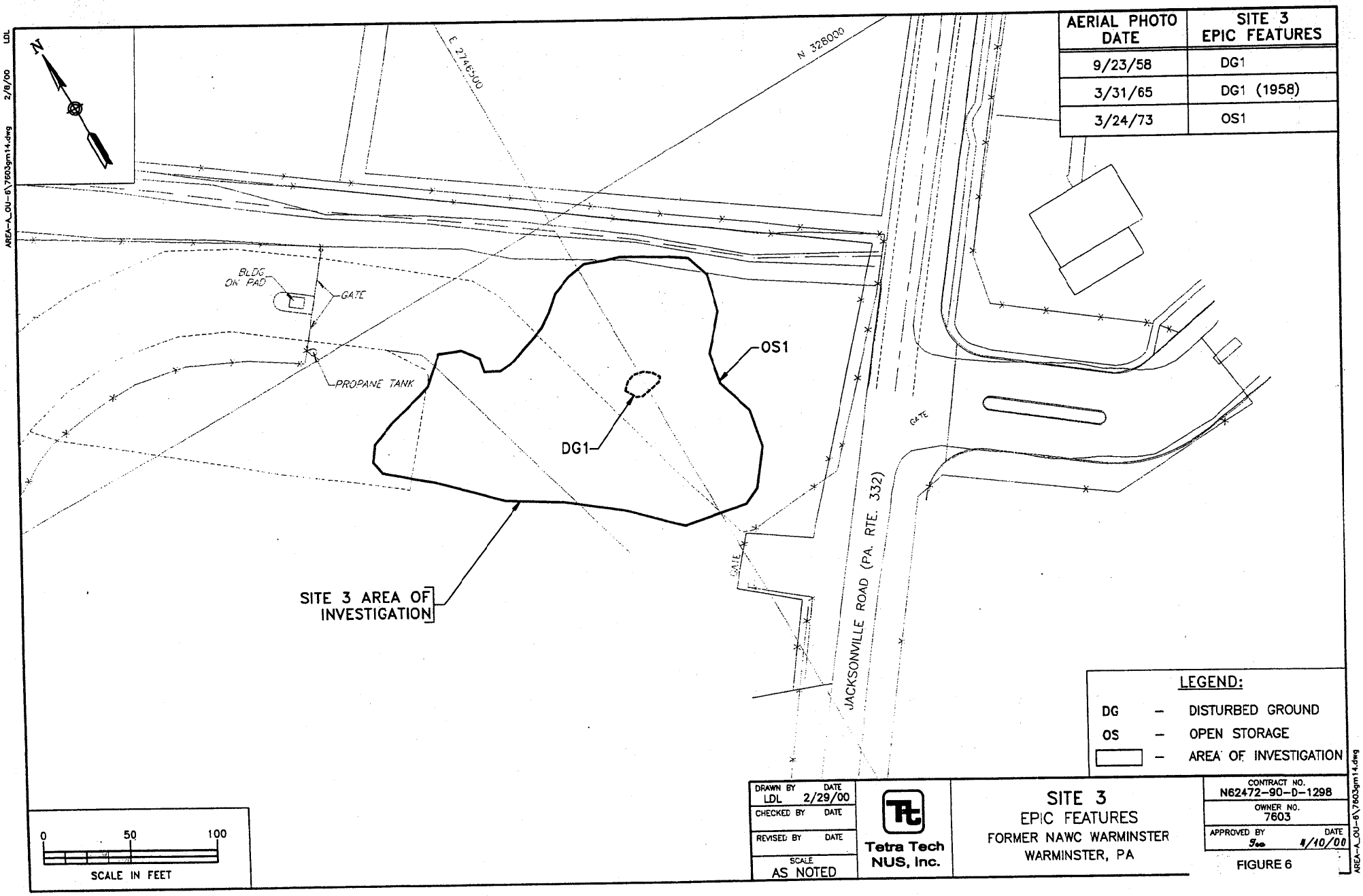
Tetra Tech NUS, Inc.

SITE 2
EPIC FEATURES
FORMER NAWC WARMINSTER
WARMINSTER, PA

CONTRACT NO. N62472-90-D-1298
OWNER NO. 7603
APPROVED BY DATE 4/10/00
REV. 1

FIGURE 5

AREA-A_OU-6\7603gm13.dwg 2/8/00 LDL



AERIAL PHOTO DATE	SITE 3 EPIC FEATURES
9/23/58	DG1
3/31/65	DG1 (1958)
3/24/73	OS1

LEGEND:

DG – DISTURBED GROUND
OS – OPEN STORAGE
▭ – AREA OF INVESTIGATION

DRAWN BY LDL	DATE 2/29/00
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

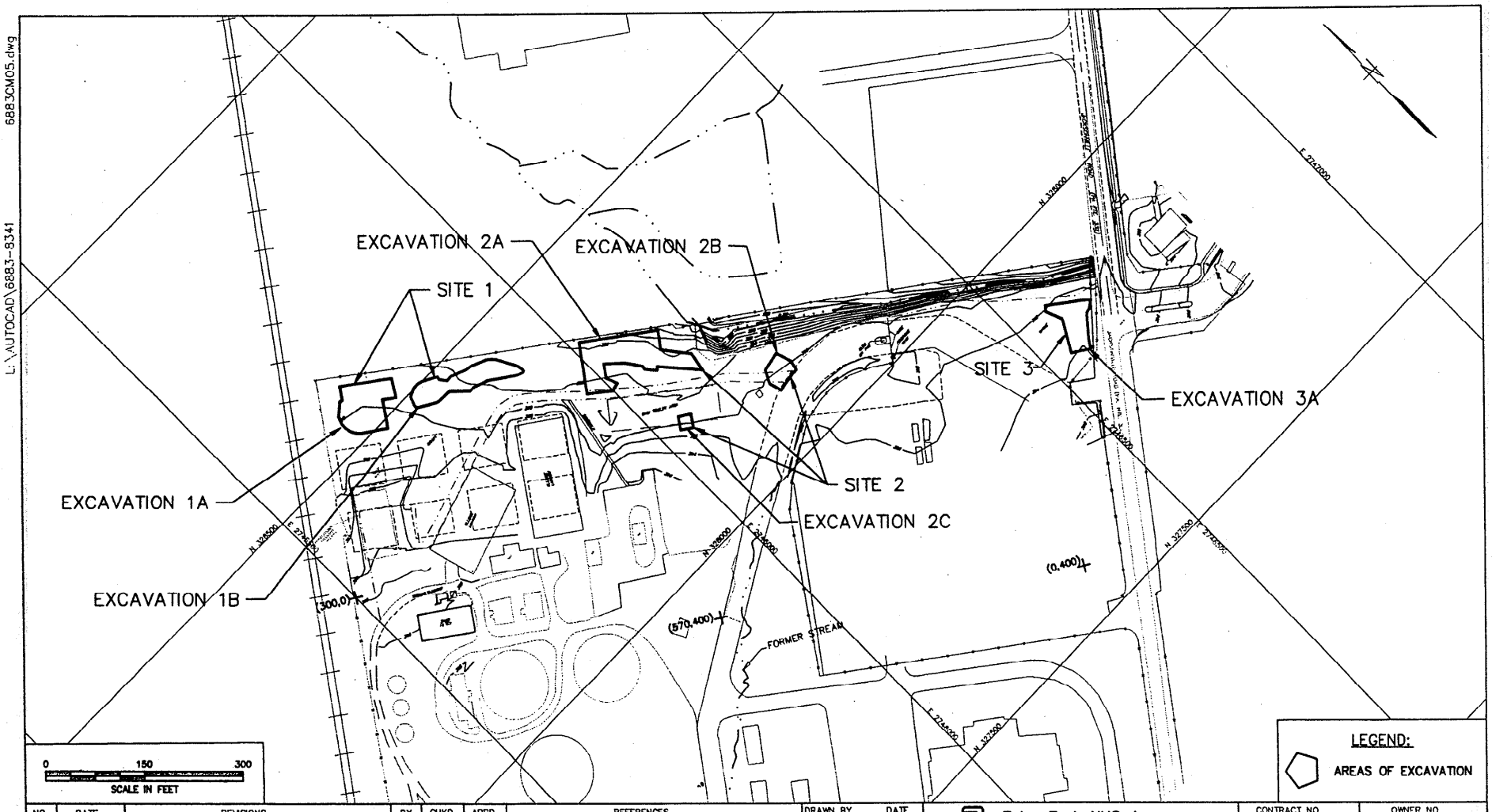
SITE 3
EPIC FEATURES
FORMER NAWC WARMINSTER
WARMINSTER, PA

CONTRACT NO. N62472-90-D-1298
OWNER NO. 7603
APPROVED BY DATE 4/10/00

FIGURE 6

LDL 2/8/00 AREA-A_OU-6\7603gm14.dwg

AREA-A_OU-6\7603gm14.dwg



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY LDL DATE 4/9/99
CHECKED BY DATE
COST/SCHED-AREA
SCALE 1" = 150'

Tetra Tech NUS, Inc.

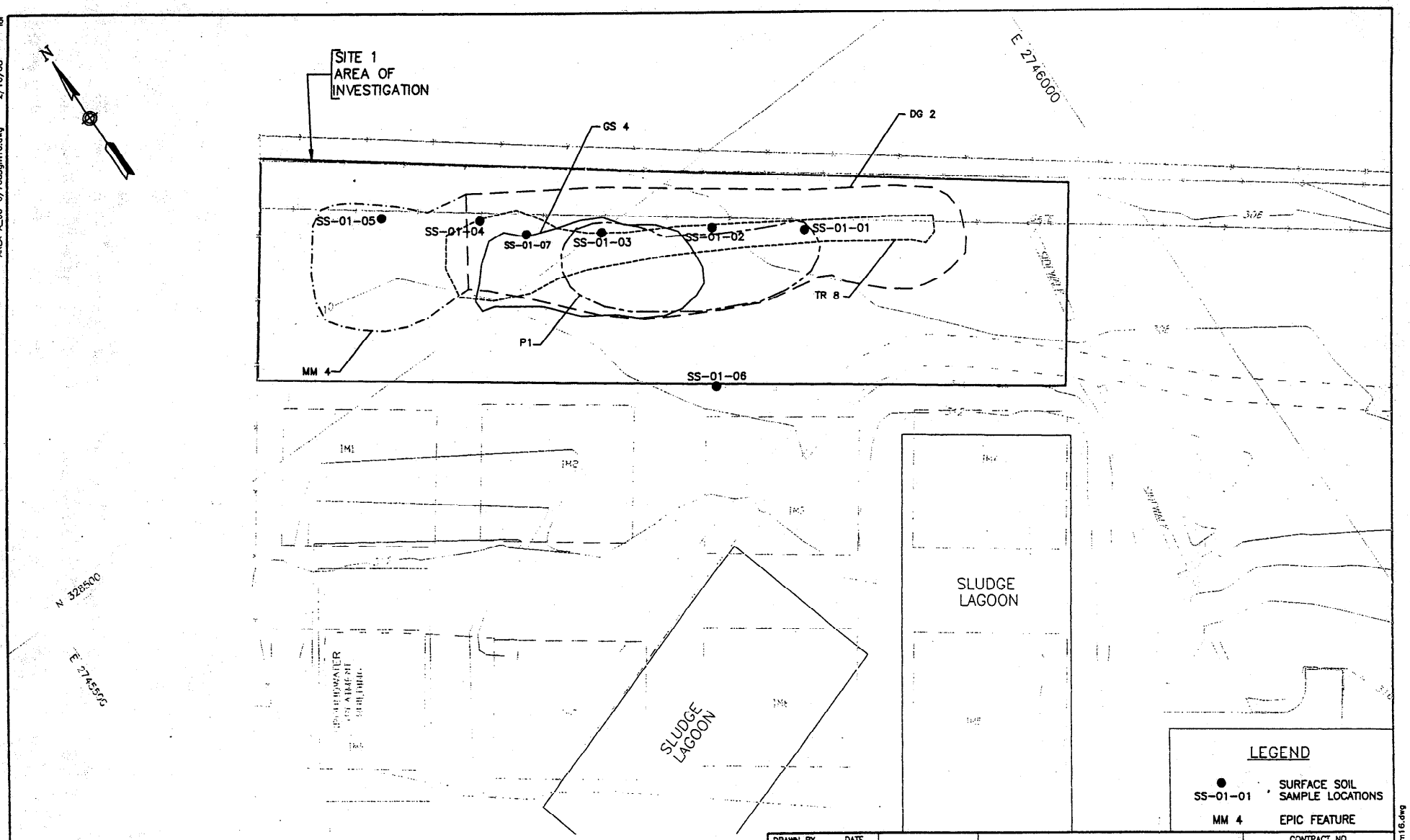
AREA A
REMOVAL ACTIONS LAYOUT
NAWC, WARMINSTER, PA

CONTRACT NO. 6883
OWNER NO. 8341
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 7
REV.

FORM CADD NO. L:\ACAD14\BLOCKS\BORDERS\TtNUS_BH3.DWG

6883CM05.dwg

L:\AUTOCAD\6883-8341



DRAWN BY LDL	DATE 2/16/00	Tetra Tech NUS, Inc.	SURFACE SOIL SAMPLE LOCATION MAP AREA A – SITE 1 FORMER NAWC WARMINSTER WARMINSTER, PENNSYLVANIA
CHECKED BY	DATE		CONTRACT NO. 7603
REVISED BY	DATE		OWNER NO. 0601
SCALE AS NOTED			APPROVED BY / DATE / REV.

FIGURE 8

AREA-A_OU-6/7603gm16.dwg 2/16/00 ldl

AREA-A_OU-6/7603gm16.dwg

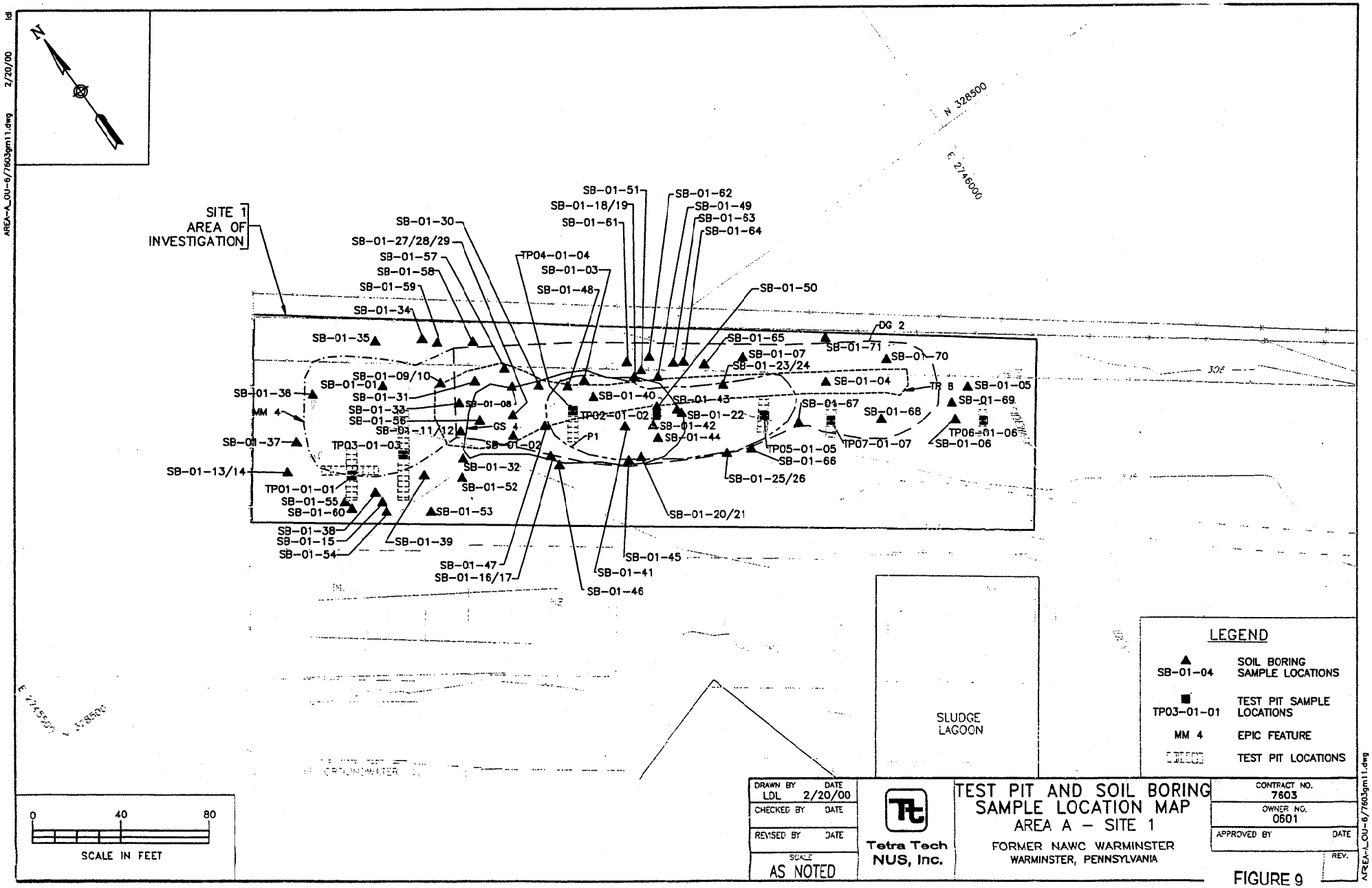

SITE 1
AREA OF
INVESTIGATION
N
N 328500
E 2146000
E 2145500
N 328500
SB-01-51
SB-01-18/19
SB-01-61
SB-01-62
SB-01-49
SB-01-63
SB-01-64
SB-01-30
SB-01-27/28/29
SB-01-57
SB-01-58
SB-01-59
SB-01-34
TP04-01-04
SB-01-03
SB-01-48
SB-01-50
SB-01-35
SB-01-65
SB-01-07
SB-01-23/24
SB-01-71
SB-01-70
DG 2
SB-01-04
TR B
SB-01-05
SB-01-69
SB-01-09/10
SB-01-01
SB-01-36
SB-01-31
SB-01-33
SB-01-56
SB-01-11/12
SB-01-08
GS 4
MM 4
SB-01-40
SB-01-43
TP02-01-02
SB-01-22
SB-01-42
SB-01-44
P1
SB-01-67
SB-01-68
TP06-01-06
SB-01-06
TP07-01-07
TP05-01-05
SB-01-66
SB-01-37
TP03-01-03
SB-01-02
SB-01-32
SB-01-52
SB-01-13/14
TP01-01-01
SB-01-55
SB-01-60
SB-01-53
SB-01-25/26
SB-01-20/21
SB-01-38
SB-01-15
SB-01-54
SB-01-39
SB-01-47
SB-01-16/17
SB-01-45
SB-01-41
SB-01-46
SLUDGE
LAGOON
LEGEND
SB-01-04 SOIL BORING SAMPLE LOCATIONS
TP03-01-01 TEST PIT SAMPLE LOCATIONS
MM 4 EPIC FEATURE
TEST PIT LOCATIONS
0 40 80
SCALE IN FEET
DRAWN BY LDL DATE 2/20/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
TEST PIT AND SOIL BORING SAMPLE LOCATION MAP
AREA A – SITE 1
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA
CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE
REV.
AREA-A_OU-6/7603gm11.dwg
2/20/00
ldl

FIGURE 9

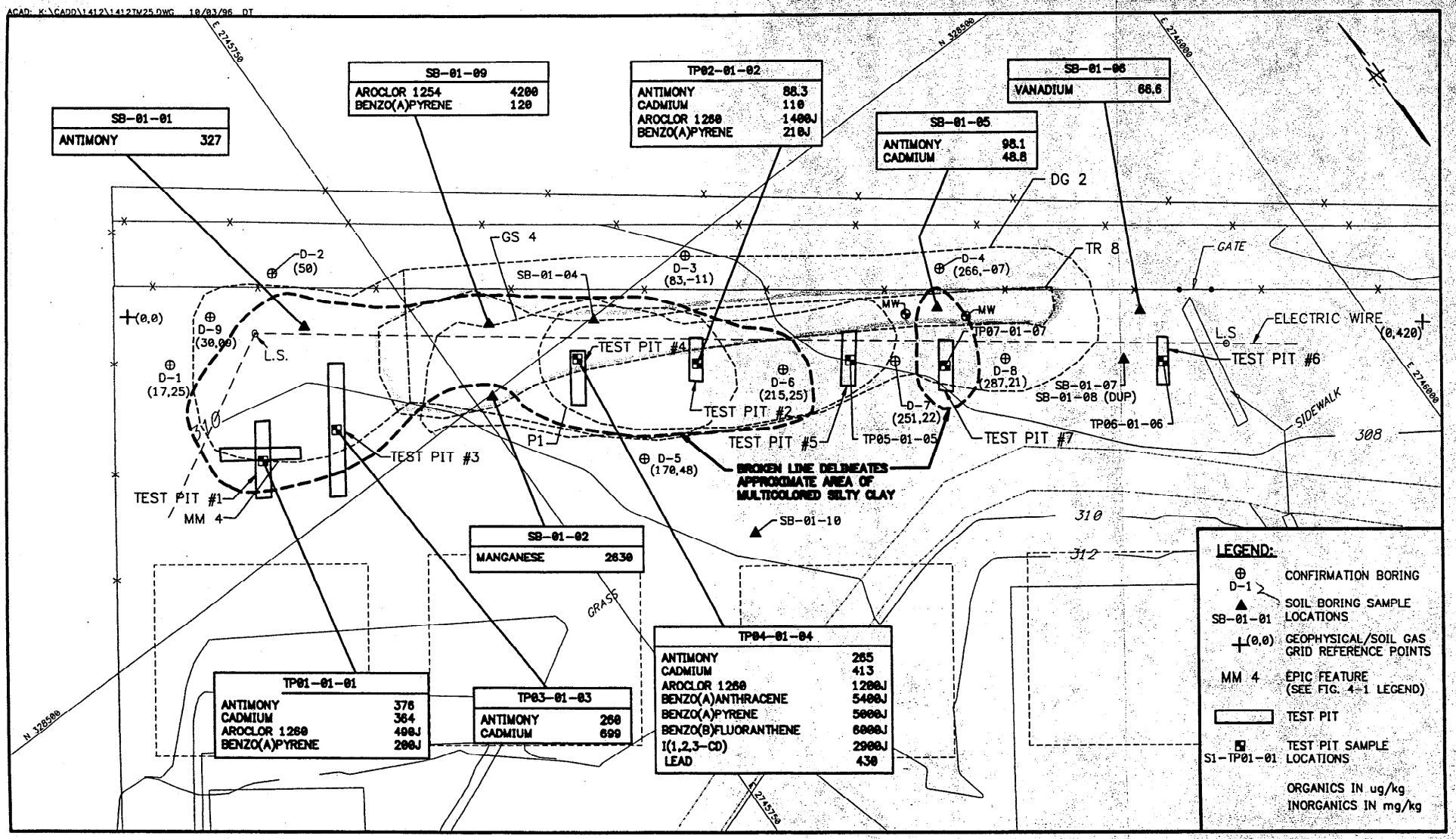
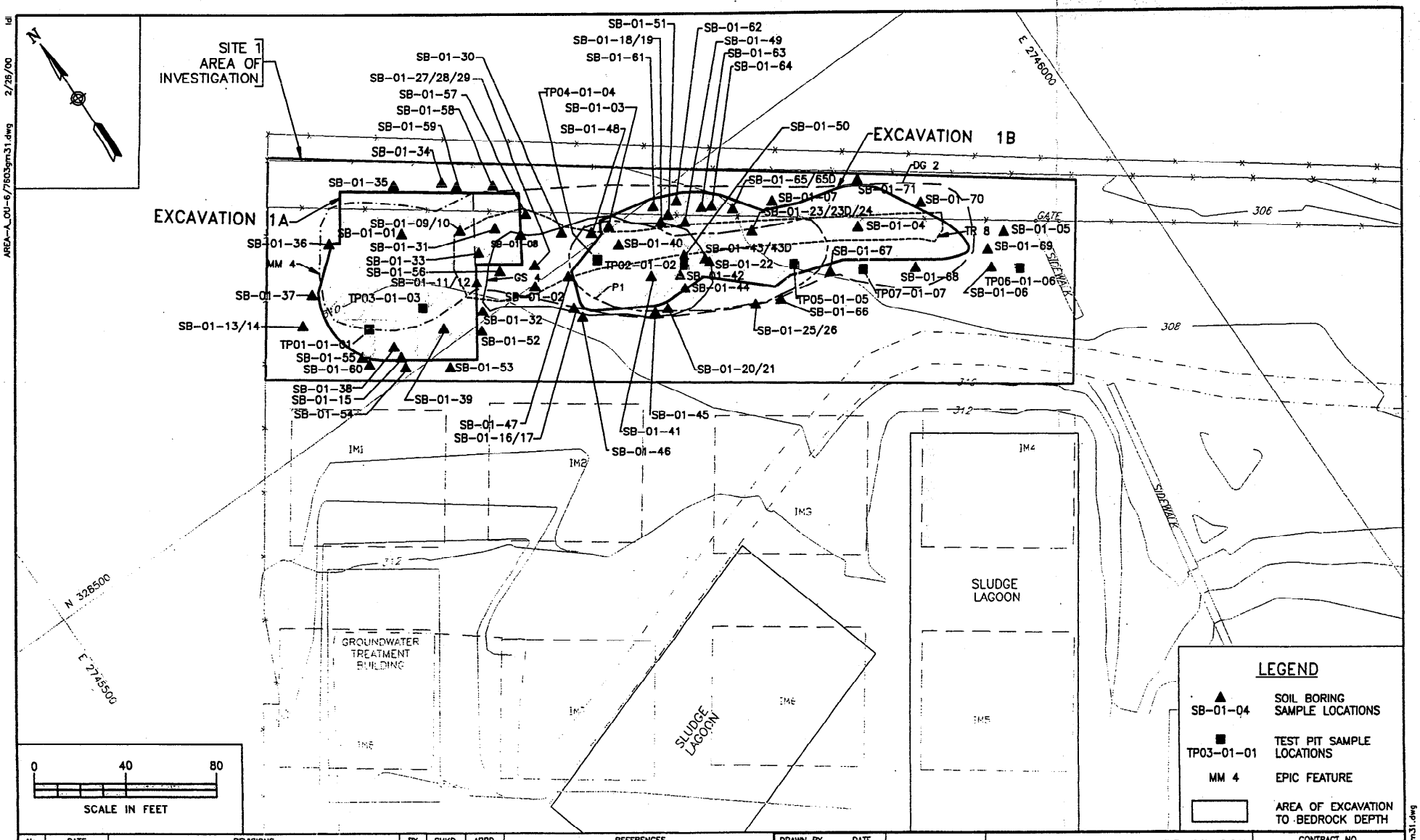


FIGURE 10

CONCENTRATIONS EXCEEDING SCREENING CRITERIA
SUBSURFACE SOIL SAMPLES
AREA A – SITE 1
NAWC, WARMINSTER, PA

Brown & Root Environmental



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/18/00	TITLE AND EXCAVATION AREA REVISED.	LDL			

DRAWN BY LDL DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

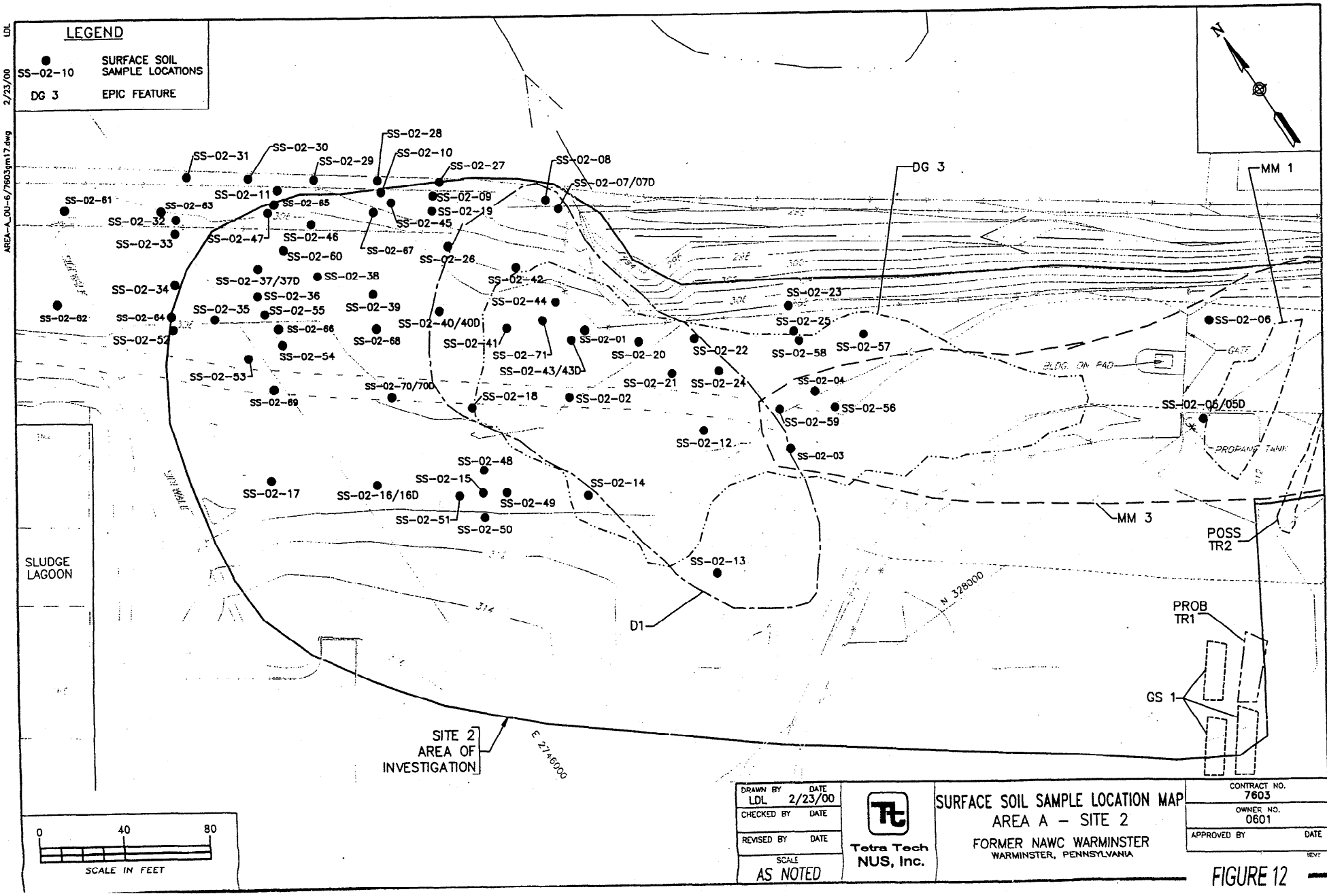
Tetra Tech NUS, Inc.

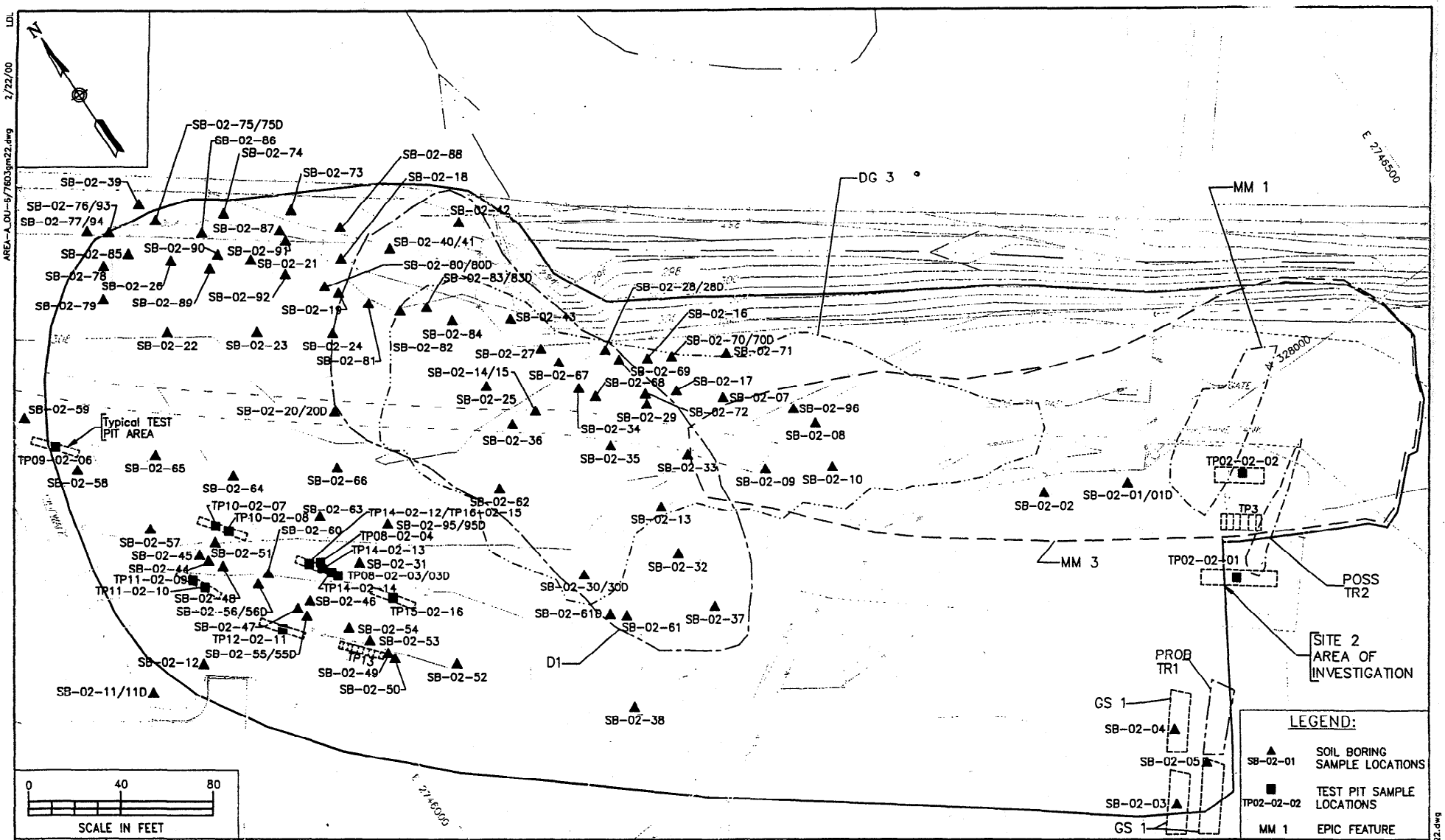
POST-REMOVAL SUBSURFACE SOIL
SOIL EXCAVATION AREA
AREA A – SITE 1
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE 4/13/00
REV. 1

FIGURE 11

AREA-A_OU-6/7603gm31.dwg 2/25/00 ldl


LEGEND
SS-02-10 SURFACE SOIL SAMPLE LOCATIONS
DG 3 EPIC FEATURE
N
SS-02-31
SS-02-30
SS-02-29
SS-02-28
SS-02-10
SS-02-27
SS-02-08
SS-02-07/07D
SS-02-11
SS-02-09
SS-02-19
SS-02-45
SS-02-61
SS-02-63
SS-02-65
SS-02-32
SS-02-33
SS-02-47
SS-02-46
SS-02-60
SS-02-67
SS-02-26
SS-02-37/37D
SS-02-38
SS-02-42
SS-02-44
SS-02-34
SS-02-36
SS-02-39
SS-02-35
SS-02-55
SS-02-62
SS-02-64
SS-02-66
SS-02-40/40D
SS-02-52
SS-02-68
SS-02-41
SS-02-71
SS-02-01
SS-02-20
SS-02-22
SS-02-23
SS-02-25
SS-02-58
SS-02-57
SS-02-06
SS-02-54
SS-02-43/43D
SS-02-53
SS-02-70/70D
SS-02-21
SS-02-24
SS-02-04
SS-02-69
SS-02-18
SS-02-02
SS-02-56
SS-02-05/05D
SS-02-59
SS-02-12
SS-02-03
SS-02-48
SS-02-15
SS-02-14
SS-02-17
SS-02-16/16D
SS-02-49
SS-02-51
SS-02-50
SS-02-13
DG 3
MM 1
MM 3
POSS TR2
PROB TR1
GS 1
D1
SLUDGE LAGOON
SITE 2 AREA OF INVESTIGATION
E 2146000
N 328000
314
0 40 80
SCALE IN FEET
DRAWN BY LDL DATE 2/23/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
SURFACE SOIL SAMPLE LOCATION MAP
AREA A – SITE 2
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA
CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE
REV.
FIGURE 12
LDL 2/23/00
AREA-A_OU-6/7603gm17.dwg



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/20/00	SAMPLE LOCATION NUMBER CORRECTED.	EEH			

DRAWN BY LDL DATE 2/22/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

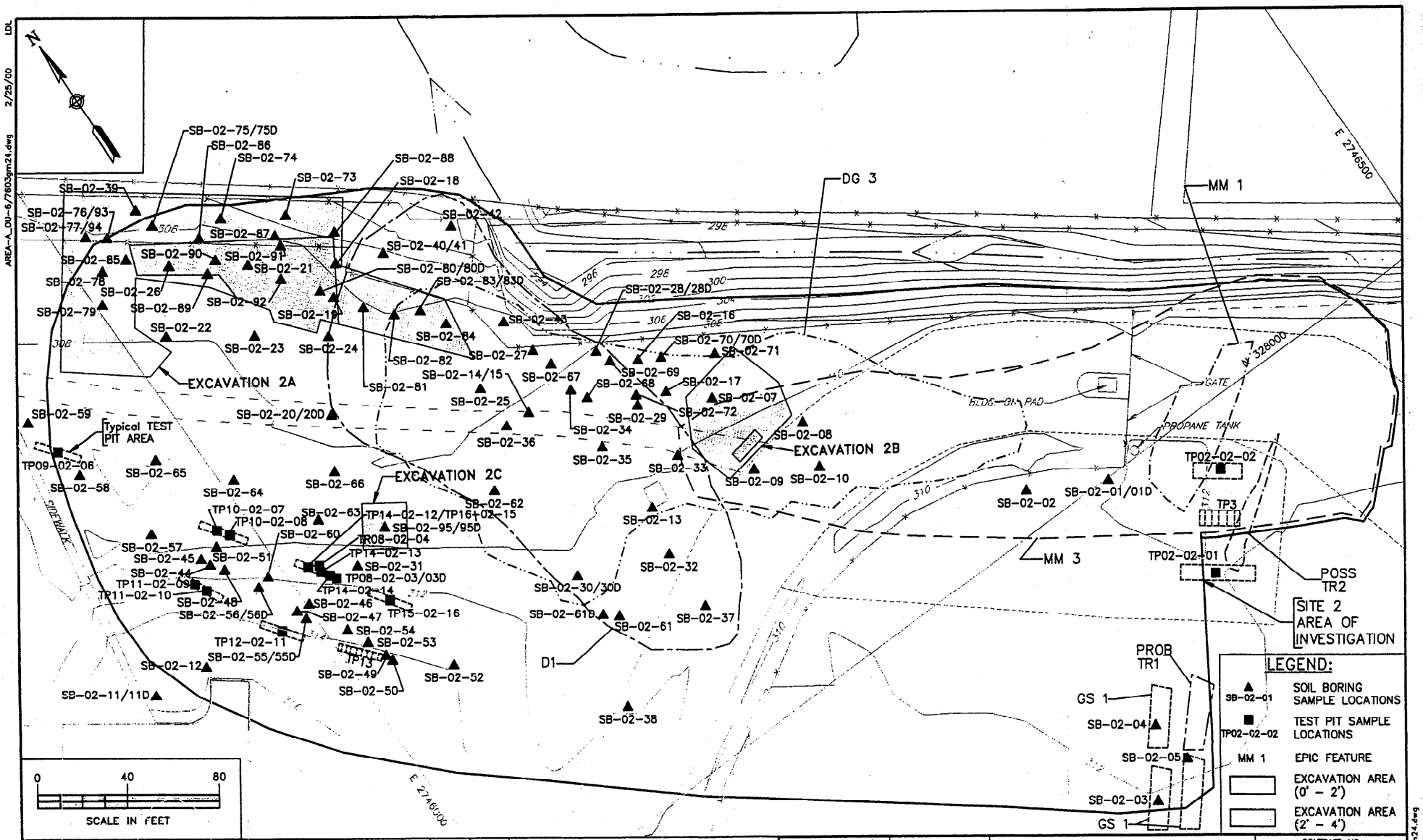
Tetra Tech NUS, Inc.

TEST PIT AND SOIL BORING
SAMPLE LOCATION MAP
AREA A - SITE 2
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE
REV. 1

FIGURE 13

LDL 2/22/00 AREA-A_OU-6/7603gm22.dwg



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/19/00	SOIL BORING LOCATIONS ADDED.	LDL			

DRAWN BY LDL DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

Tetra Tech NUS, Inc.

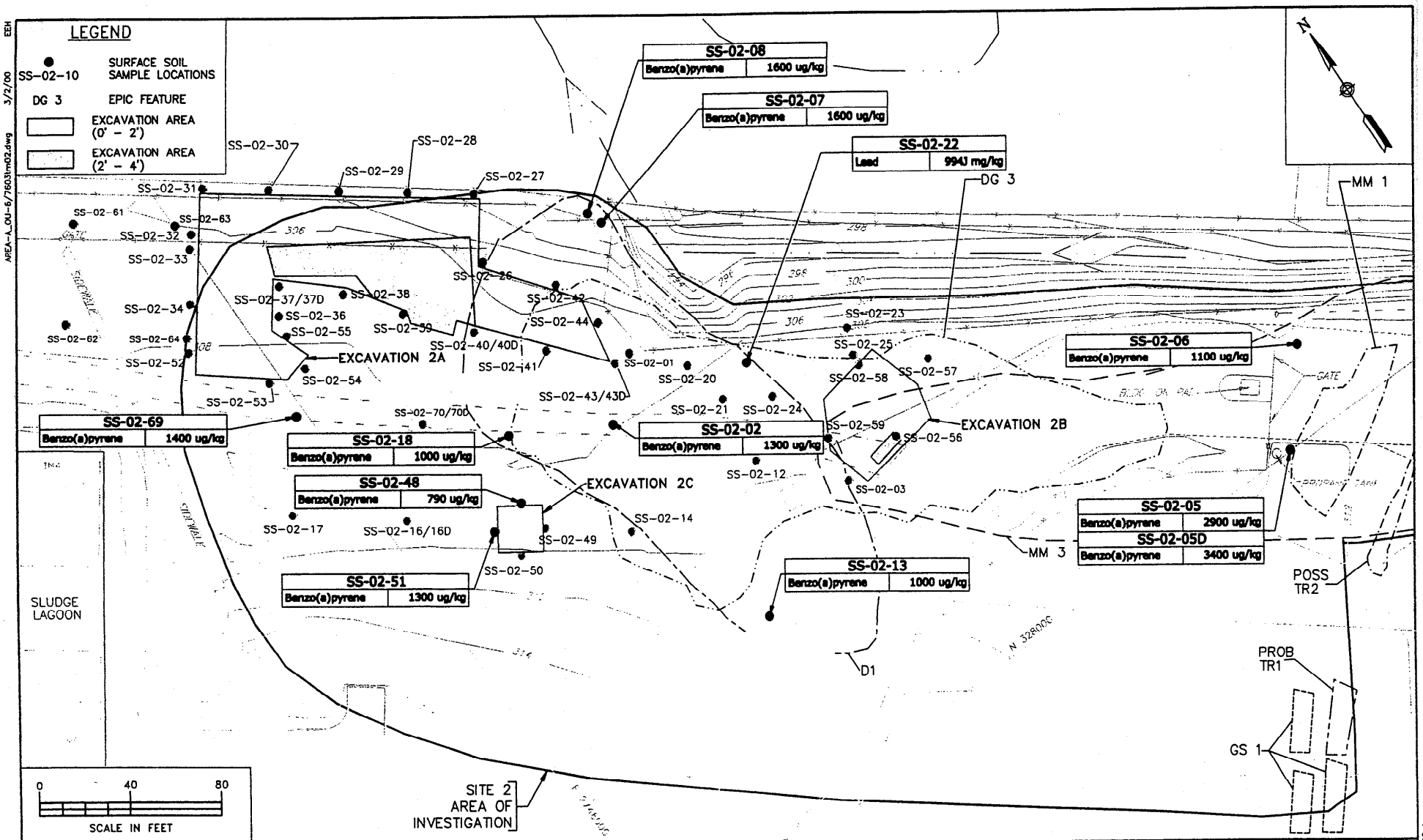
SOIL EXCAVATION AREAS

AREA A – SITE 2
FORMER NAWC WARMINSTER
WARMNSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE 4/21/00

FIGURE 14

AREA-A_OU-6/7603gm24.dwg 2/25/00 LDL



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/19/00	SURFACE SOIL SAMPLE SS-02-59 LOCATION UPDATED.	LDL			

DRAWN BY LDL DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

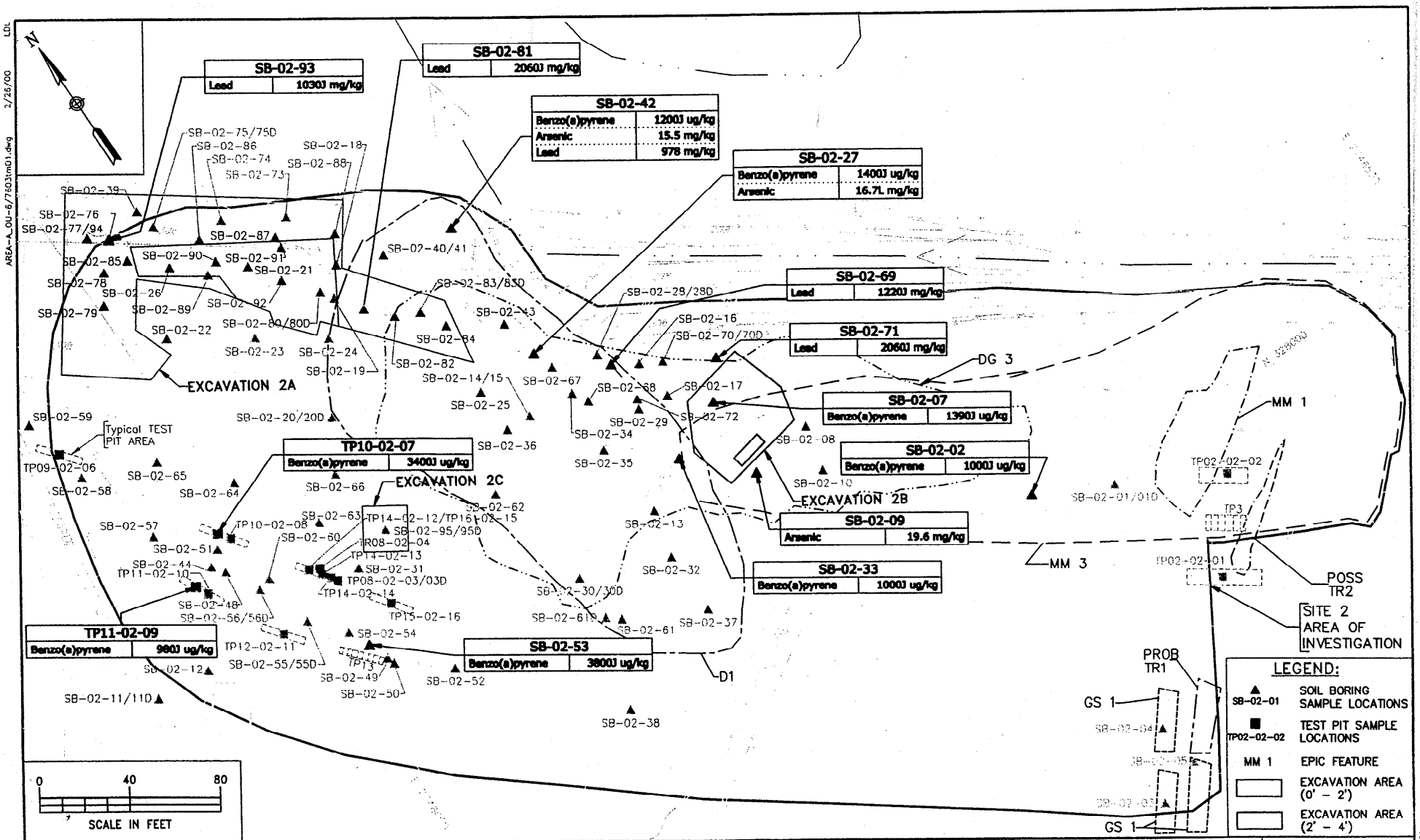
Tetra Tech NUS, Inc.

POST-REMOVAL SURFACE SOIL CONCENTRATIONS
SCREENING CRITERIA EXCEEDANCES
AREA A – SITE 2
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY HPa DATE 4/21/00
REV. 1

FIGURE 15

EEH 3/2/00 AREA-A_OU-6/7603tm02.dwg



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/19/00	SOIL BORING SAMPLE LOCATIONS ADDED.	LDL			

DRAWN BY LDL DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

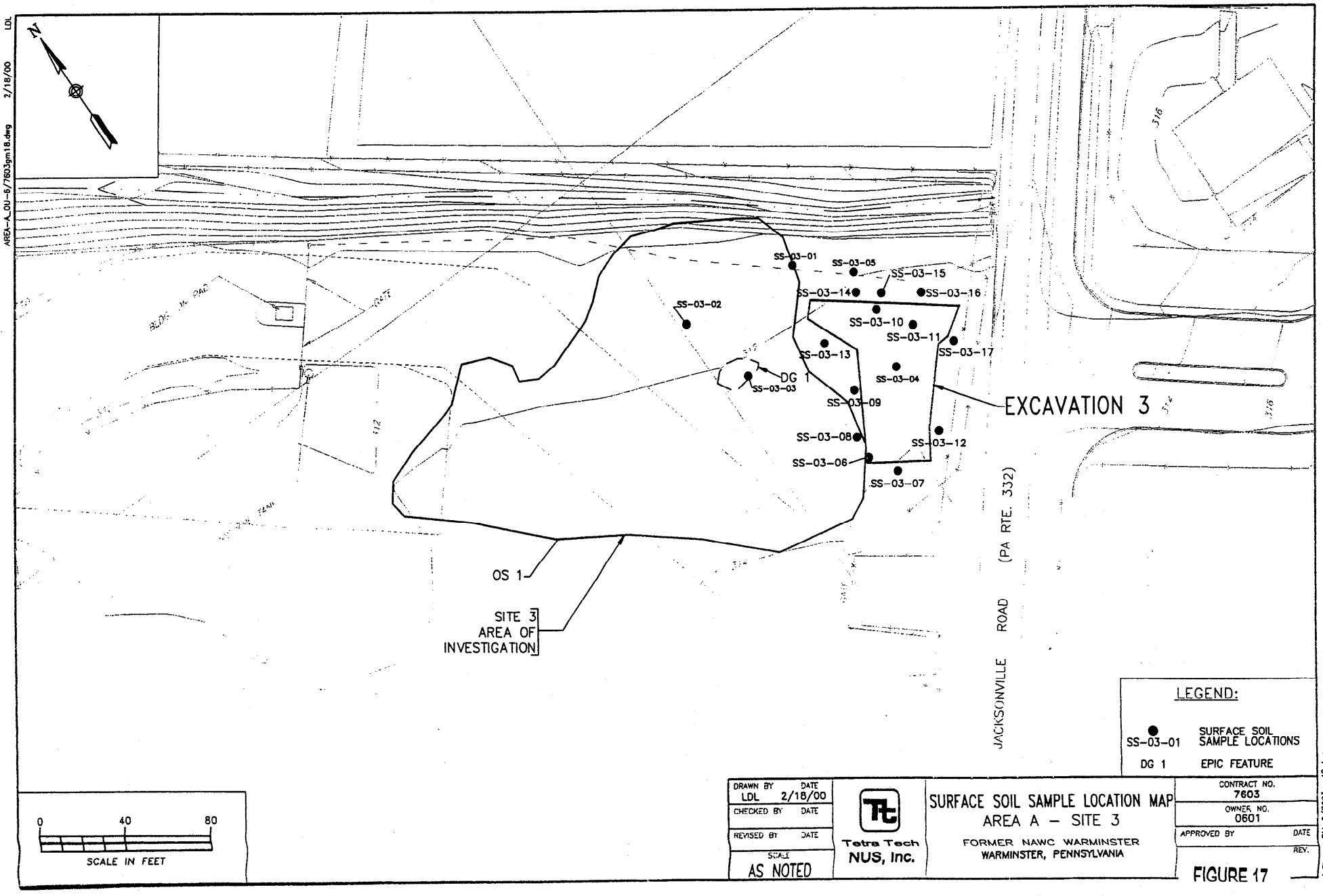
Tetra Tech NUS, Inc.

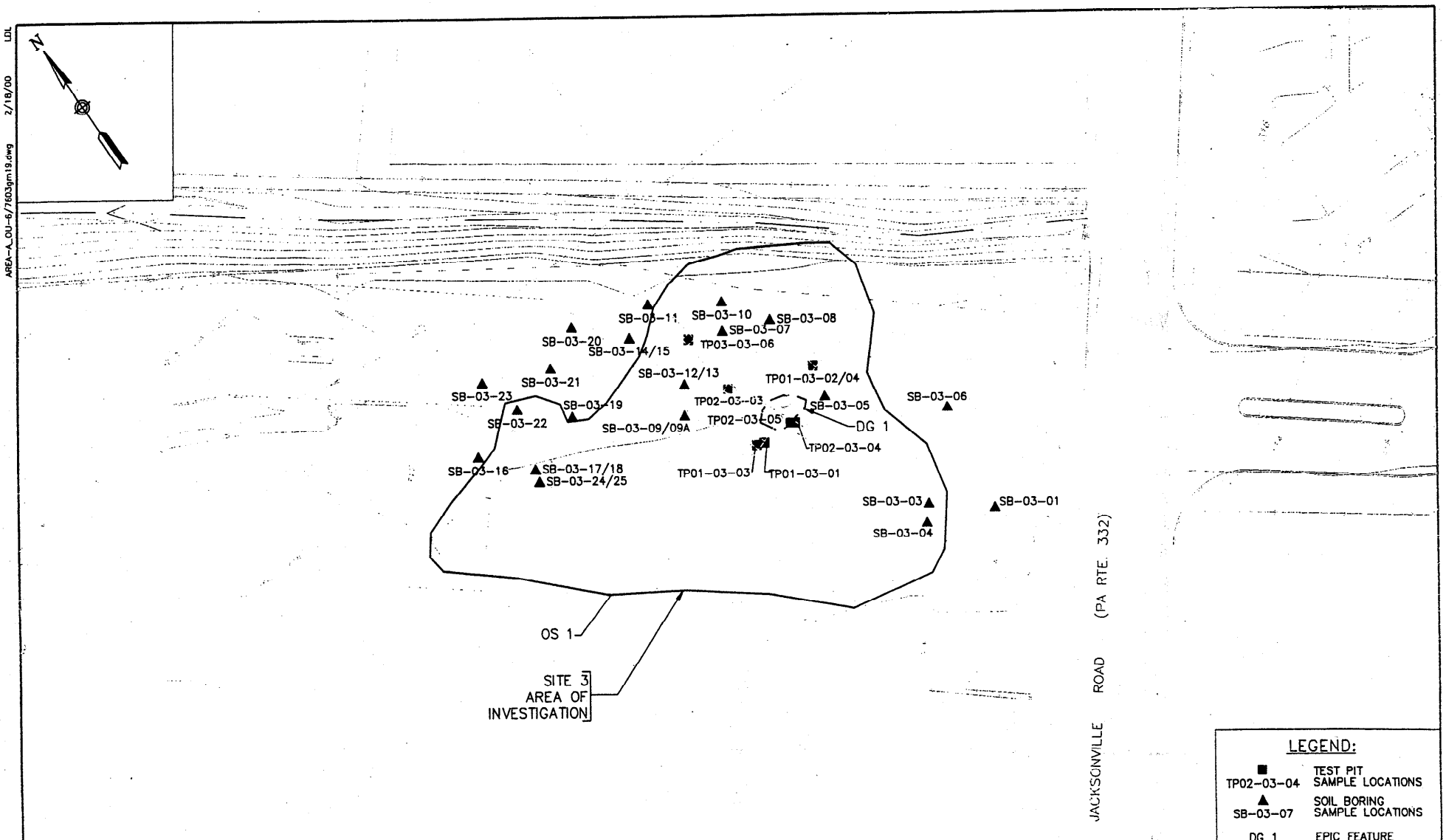
POST-REMOVAL SUBSURFACE SOIL CONCENTRATIONS SCREENING CRITERIA EXCEEDANCES
AREA A – SITE 2
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
DWG NO. 0601
APPROVED BY DATE 4/10/00
SHT. 1

FIGURE 16

LDL 2/26/00 AREA-A_OU-6/7603tm01.dwg


N
SS-03-01
SS-03-05
SS-03-15
SS-03-14
SS-03-16
SS-03-02
SS-03-10
SS-03-11
SS-03-17
SS-03-13
SS-03-04
DG 1
SS-03-03
SS-03-09
EXCAVATION 3
SS-03-08
SS-03-12
SS-03-06
SS-03-07
OS 1
SITE 3
AREA OF
INVESTIGATION
JACKSONVILLE ROAD (PA RTE. 332)
316
LEGEND:
SS-03-01 SURFACE SOIL SAMPLE LOCATIONS
DG 1 EPIC FEATURE
0 40 80
SCALE IN FEET
DRAWN BY LDL DATE 2/18/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
SURFACE SOIL SAMPLE LOCATION MAP
AREA A – SITE 3
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA
CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE
REV.
FIGURE 17
AREA-A_OU-6/7603gm18.dwg 2/18/00 LDL
A:FIG\-LOU-6/7603gm18.dwg



LEGEND:

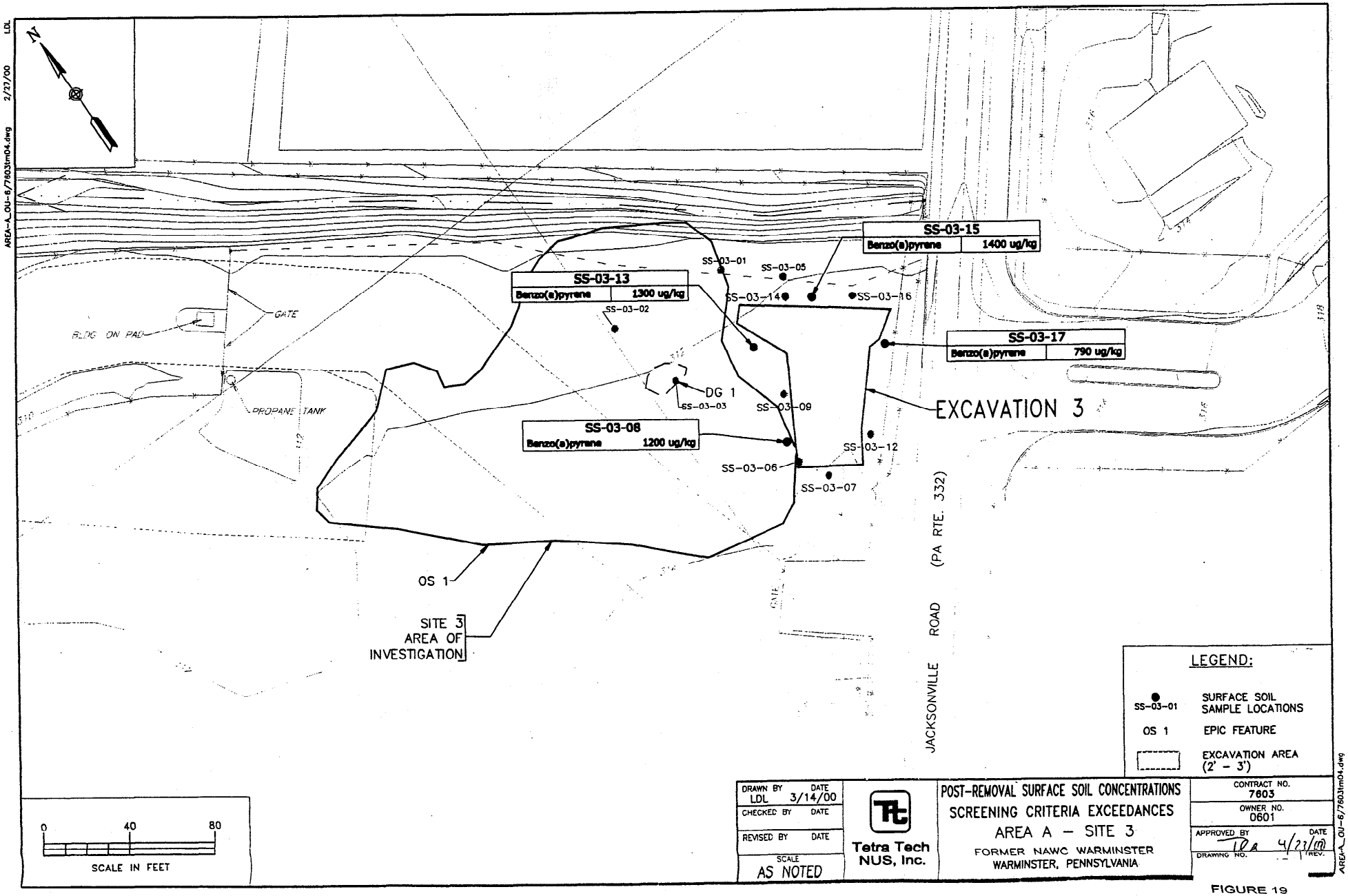
■ TP02-03-04	TEST PIT SAMPLE LOCATIONS
▲ SB-03-07	SOIL BORING SAMPLE LOCATIONS
DG 1	EPIC FEATURE

0 40 80
SCALE IN FEET

DRAWN BY LDL	DATE 3/14/00	Tetra Tech NUS, Inc.	TEST PIT AND SOIL BORING SAMPLE LOCATION MAP AREA A – SITE 3 FORMER NAWC WARMINSTER WARMINSTER, PENNSYLVANIA
CHECKED BY	DATE		CONTRACT NO. 7603
REVISED BY	DATE		OWNER NO. 0601
SCALE AS NOTED			APPROVED BY / DATE / REV.

FIGURE 18

AREA-A_OU-6/7603gm19.dwg 2/18/00 LDL



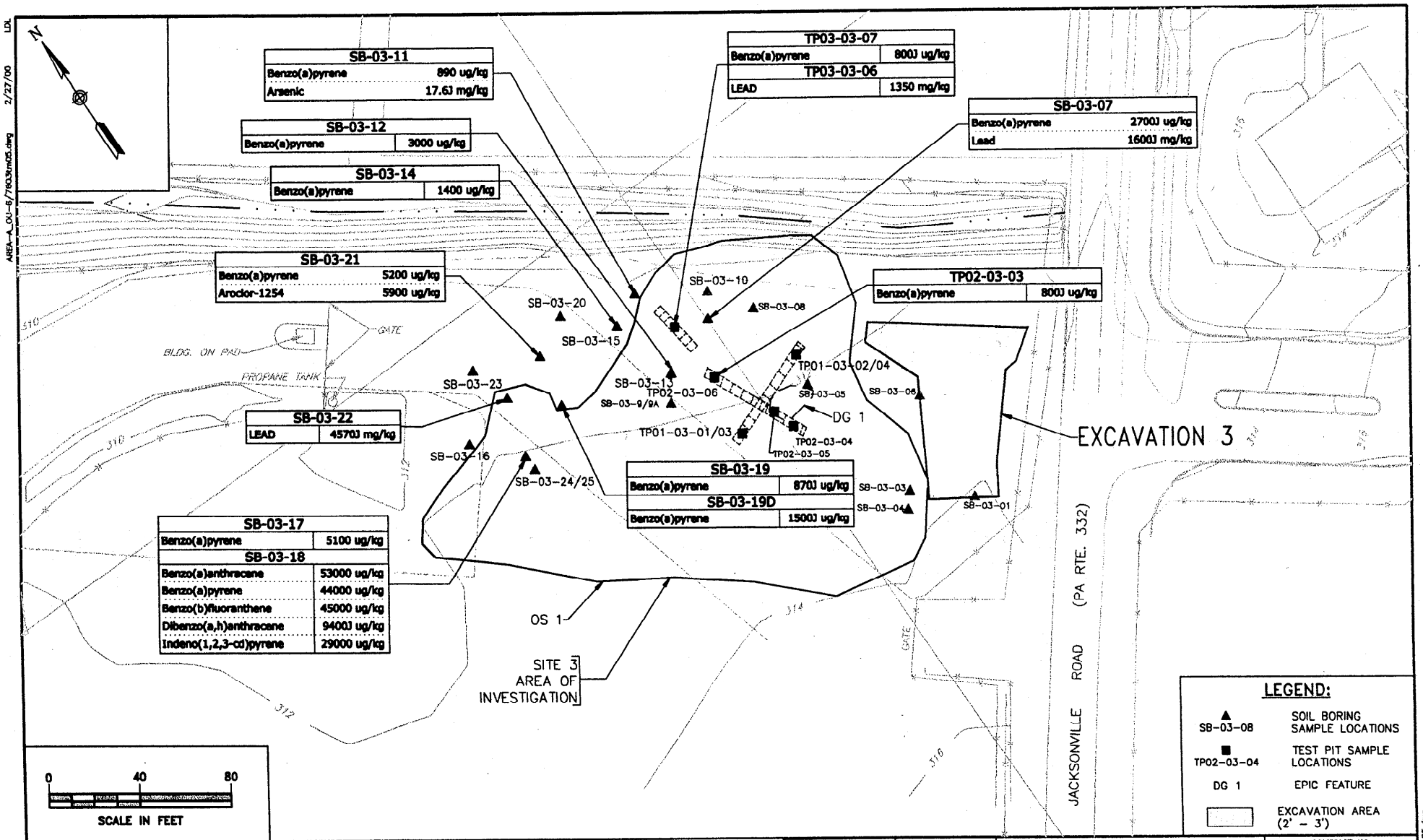
DRAWN BY LDL	DATE 3/14/00	Tetra Tech NUS, Inc.	POST-REMOVAL SURFACE SOIL CONCENTRATIONS SCREENING CRITERIA EXCEEDANCES AREA A – SITE 3 FORMER NAWC WARMINSTER WARMINSTER, PENNSYLVANIA
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY TBA DATE 4/27/00
DRAWING NO. REV.

AREA-A_OU-6/7603tm04.dwg

FIGURE 19

AREA-A_OU-6/7603tm04.dwg 2/27/00 LDL



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/19/00	SOIL BORING SAMPLE LOCATIONS REVISED.	LDL			

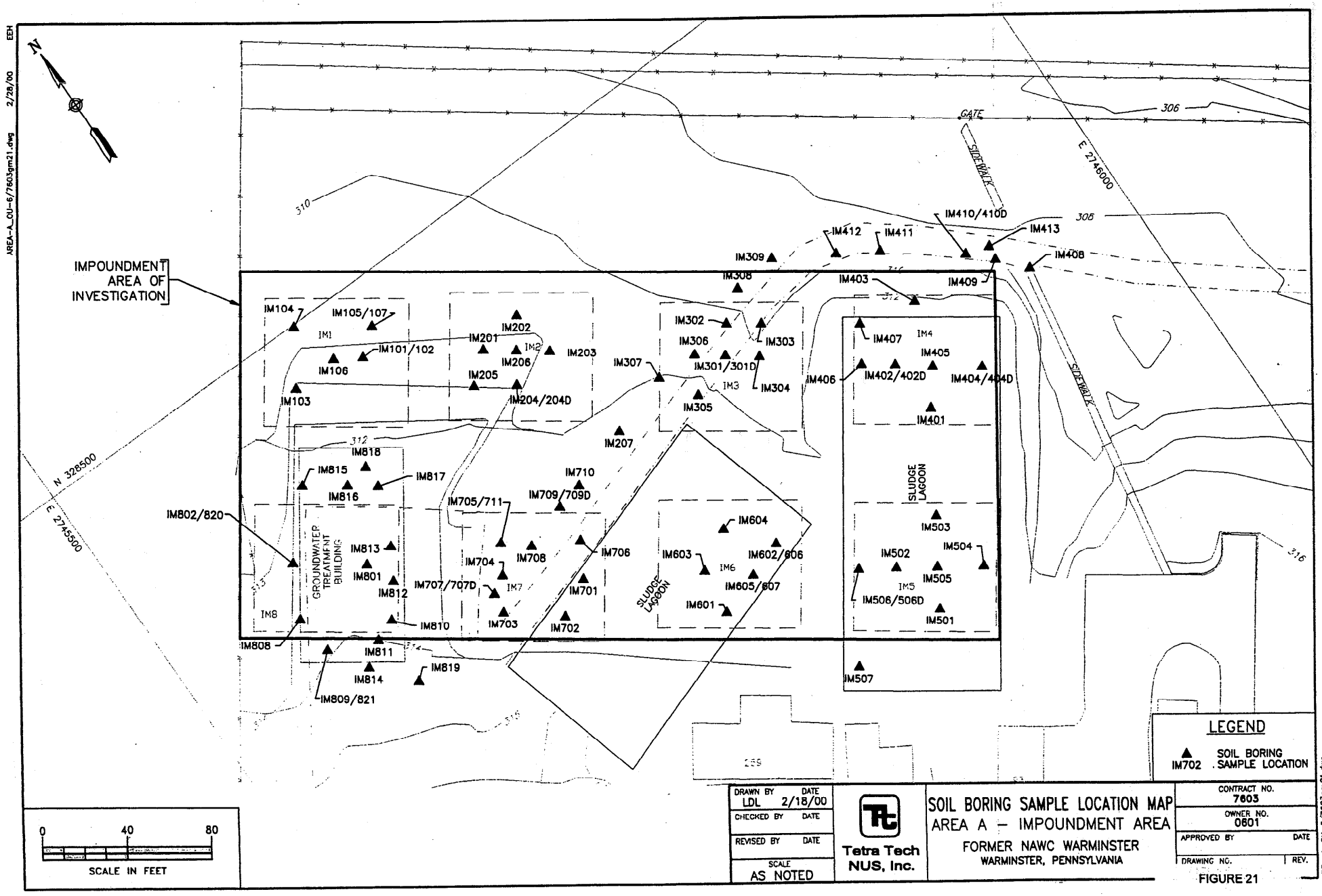
DRAWN BY LDL DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

Tetra Tech NUS, Inc.

POST-REMOVAL SUBSURFACE SOIL CONCENTRATIONS
SCREENING CRITERIA EXCEEDANCES
AREA A – SITE 3
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY DATE
DRAWING NO. REV. 1

FIGURE 20



DRAWN BY	DATE
LDL	2/18/00
CHECKED BY	DATE
REVISED BY	DATE
SCALE	
AS NOTED	

Tetra Tech NUS, Inc.

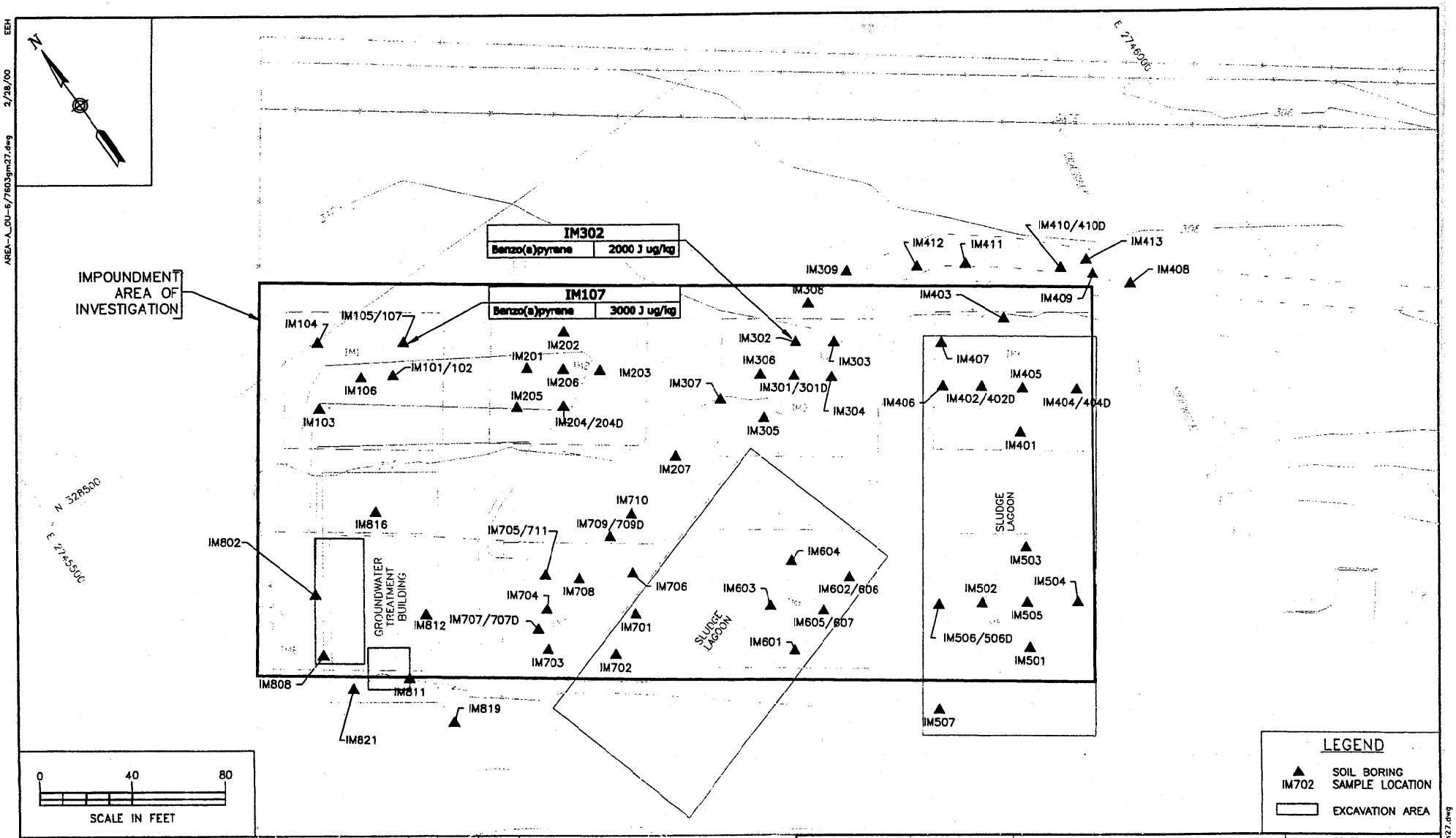
SOIL BORING SAMPLE LOCATION MAP
AREA A – IMPOUNDMENT AREA
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO.	
7603	
OWNER NO.	
0601	
APPROVED BY	DATE
DRAWING NO.	REV.

FIGURE 21

AREA-A_OU-6/7603gm21.dwg 2/28/00 EEM

AREA-A_OU-6/7603gm21.dwg



No	DATE	REVISIONS	BY	CHKD.	APPD.	REFERENCES
1	4/19/00	SOIL BORING SAMPLE LOCATIONS REVISED, AND EXCAVATED AREAS ADDED.	LDL			

DRAWN BY LDL/EEH DATE 3/14/00
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

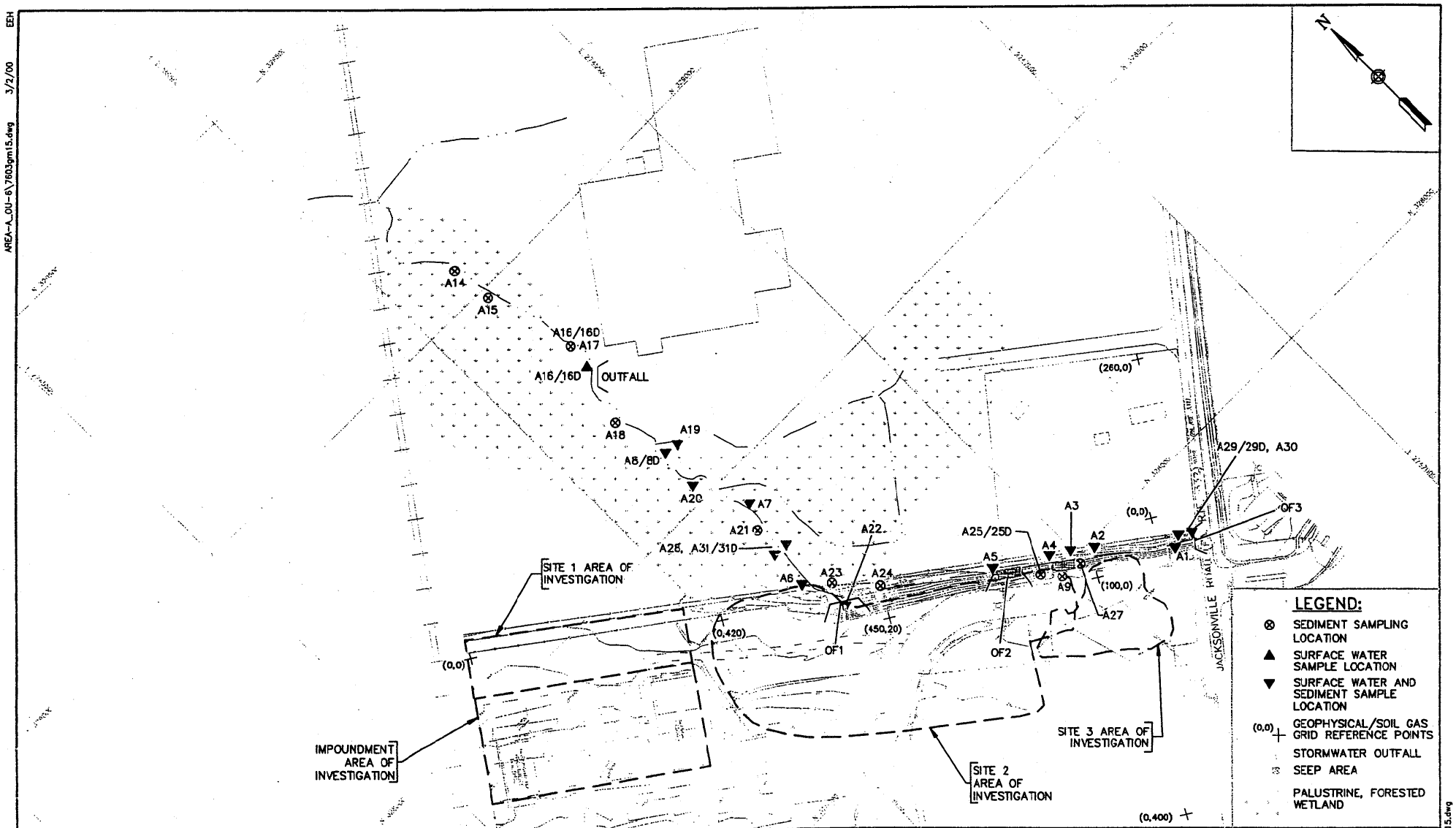
Tetra Tech NUS, Inc.

POST-REMOVAL SUBSURFACE SOIL CONCENTRATIONS SCREENING CRITERIA EXCEEDANCES
AREA A – IMPOUNDMENT AREA
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY TPa DATE 4/23/00
DRAWING NO. REV. 1

FIGURE 22

AREA-A_OU-6/7603gm27.dwg 2/28/00 EEH



0 150 300
SCALE IN FEET

DRAWN BY LDL\EEH	DATE 2/29/00
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

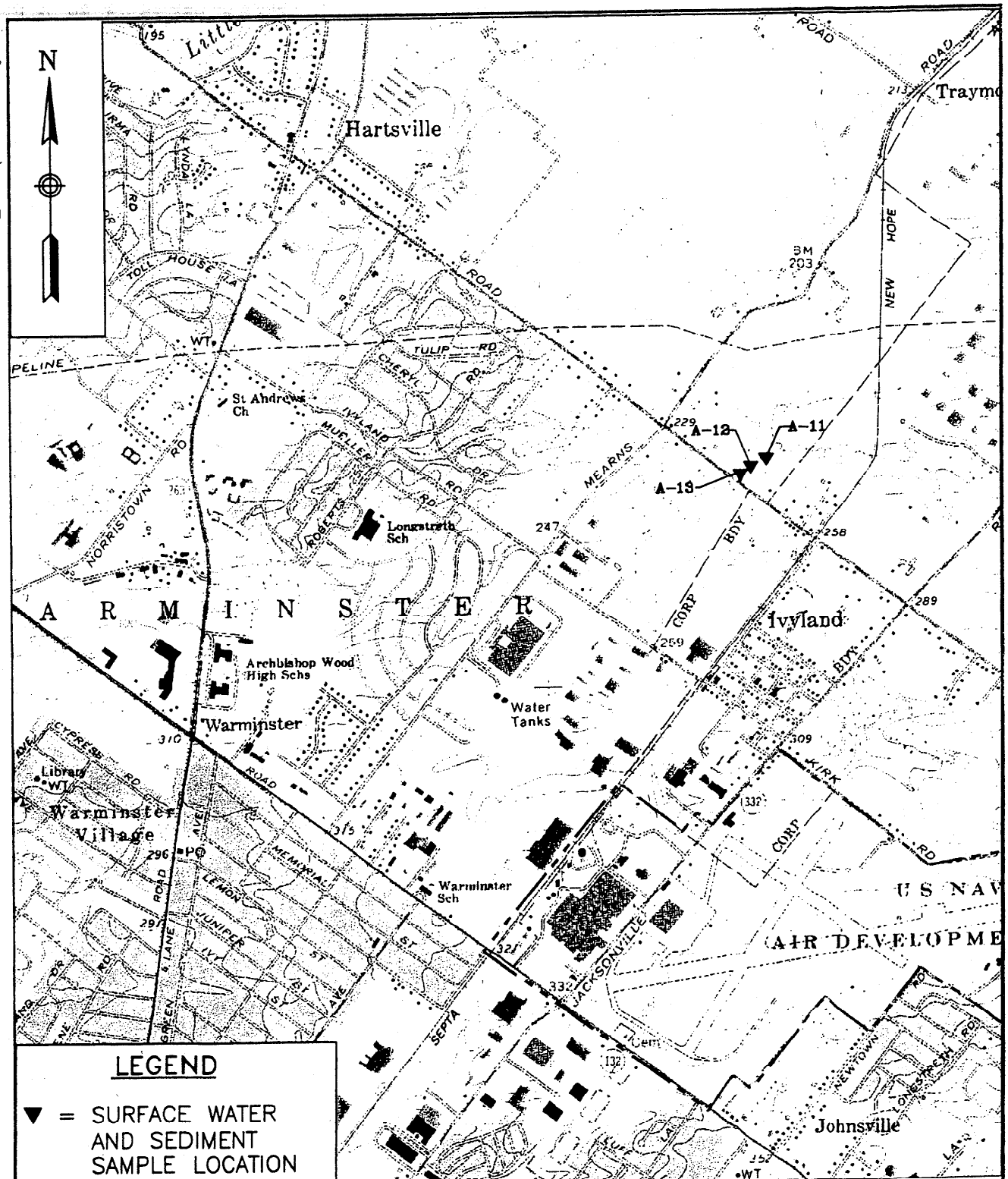
SURFACE WATER/SEDIMENT SAMPLING LOCATIONS
AREA A
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603	
OWNER NO. 0601	
APPROVED BY	DATE
DRAWING NO.	REV.

FIGURE 23

AREA-A_OU-6\7603gm15.dwg 3/2/00 EEH

AREA-A_OU-6\7603gm15.dwg



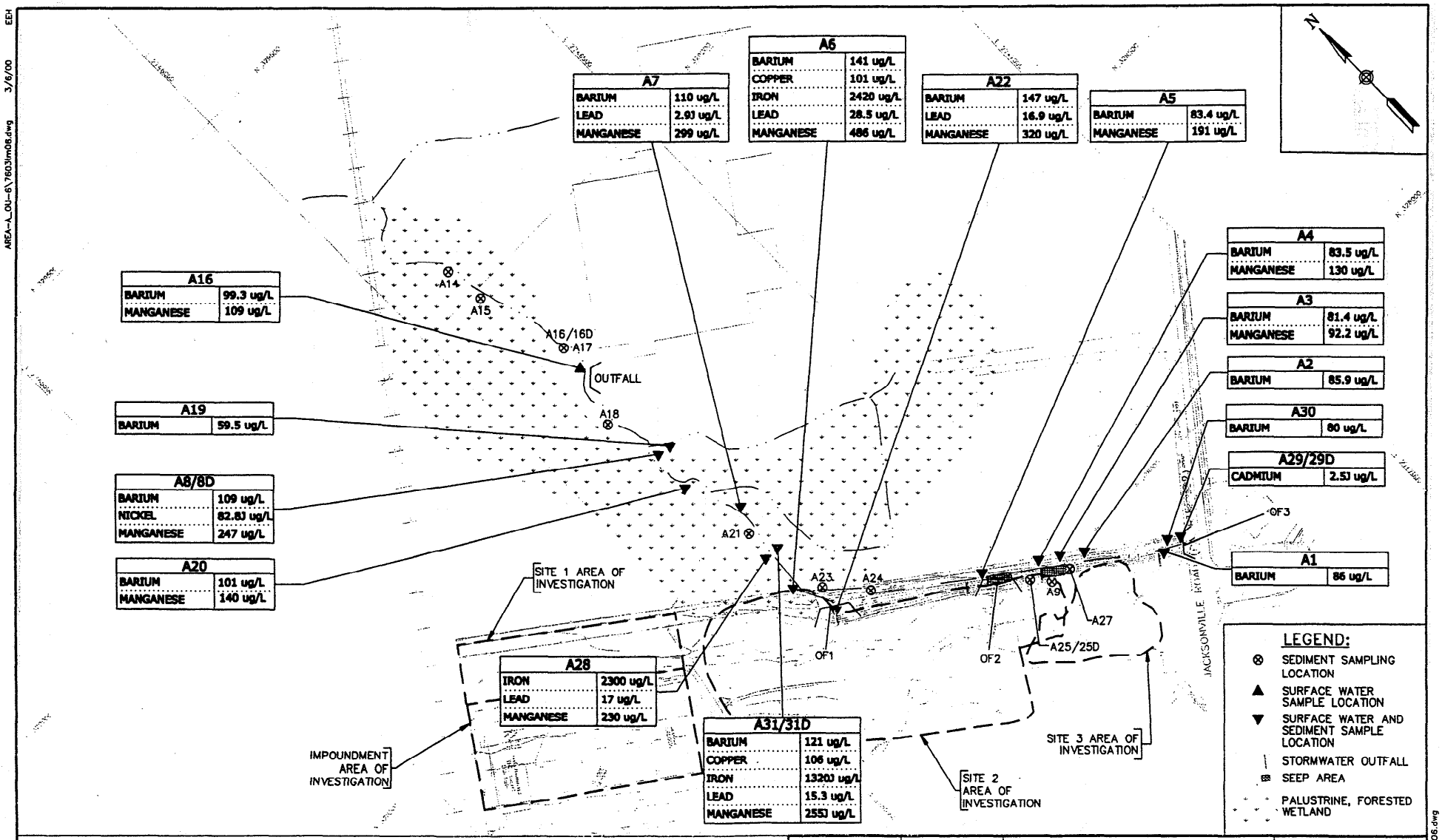
DRAWN BY LDL DATE 2/11/00	Tetra Tech NUS Inc.	CONTRACT NO. N62472-90-D-1298	OWNER NO. 7603
CHECKED BY DATE	AREA A FAR DOWNSTREAM SURFACE WATER/SEDIMENT SAMPLING LOCATIONS FORMER NAWC WARMINSTER WARMINSTER, PENNSYLVANIA	APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE 1"=2000'		DRAWING NO.	REV.

FIGURE 24

SOURCE: (7.5 MINUTE SERIES) U.S.G.S. HATBORO, PA QUADRANGLE

AREA-A_OU-6\7603bm01.dwg

AREA-A_OU-6\7603bm01.dwg



DRAWN BY	DATE
LDL\EEH	2/29/00
CHECKED BY	DATE
REVISED BY	DATE
SCALE	AS NOTED

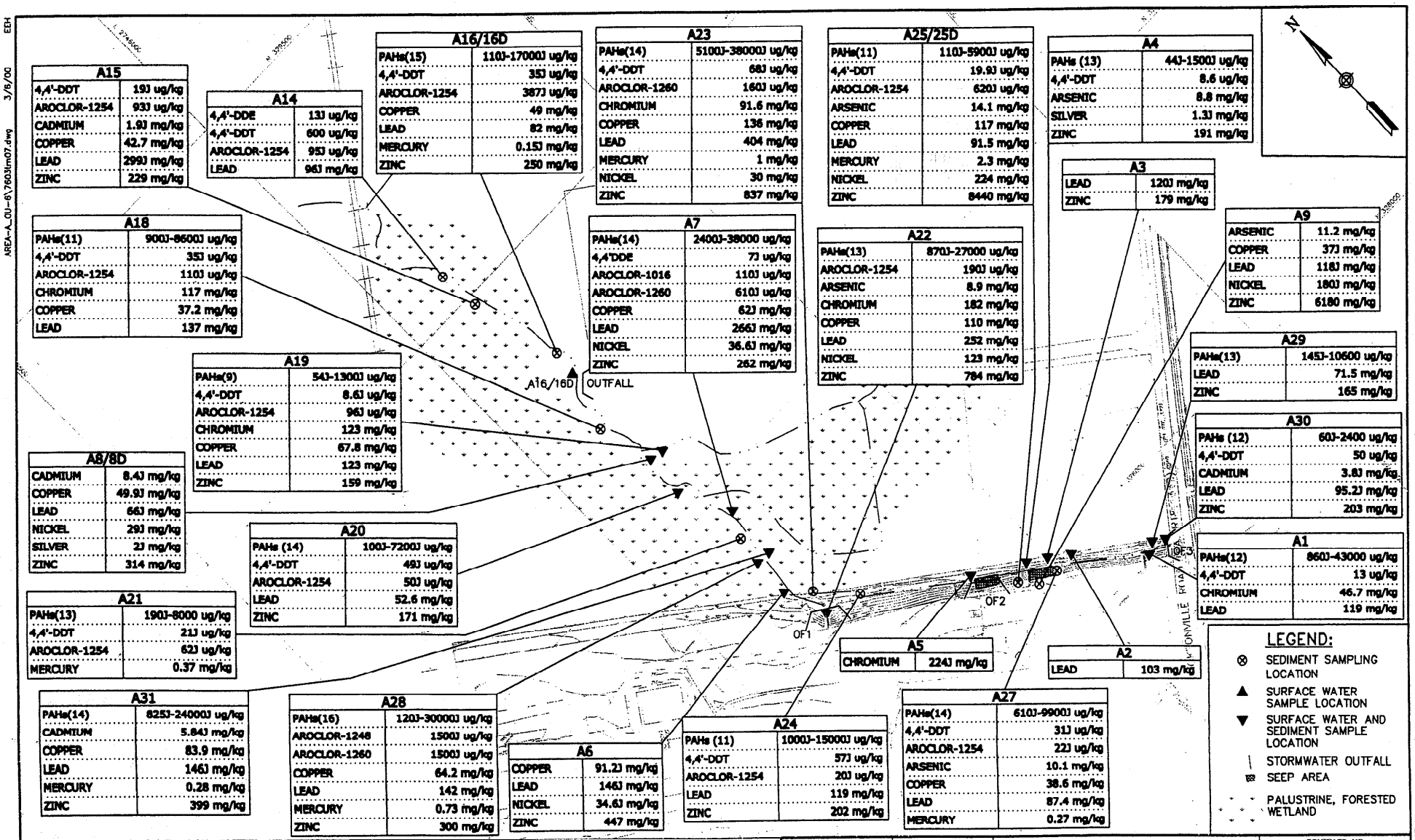
Tetra Tech NUS, Inc.

SURFACE WATER CONCENTRATIONS
SCREENING CRITERIA EXCEEDANCES
AREA A
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY RDA DATE 4/23/00
DRAWING NO. REV.

FIGURE 25

AREA-A_OU-6\7603\m06.dwg 3/6/00 EEH



A15	
4,4'-DDT	19J ug/kg
AROCLOR-1254	93J ug/kg
CADMIUM	1.9J mg/kg
COPPER	42.7 mg/kg
LEAD	299J mg/kg
ZINC	229 mg/kg

A14	
4,4'-DDE	13J ug/kg
4,4'-DDT	600 ug/kg
AROCLOR-1254	95J ug/kg
LEAD	96J mg/kg

A16/16D	
PAHs(15)	110J-17000J ug/kg
4,4'-DDT	35J ug/kg
AROCLOR-1254	387J ug/kg
COPPER	49 mg/kg
LEAD	82 mg/kg
MERCURY	0.15J mg/kg
ZINC	250 mg/kg

A23	
PAHs(14)	5100J-38000J ug/kg
4,4'-DDT	68J ug/kg
AROCLOR-1260	160J ug/kg
CHROMIUM	91.6 mg/kg
COPPER	136 mg/kg
LEAD	404 mg/kg
MERCURY	1 mg/kg
NICKEL	30 mg/kg
ZINC	837 mg/kg

A25/25D	
PAHs(11)	110J-5900J ug/kg
4,4'-DDT	19.9J ug/kg
AROCLOR-1254	620J ug/kg
ARSENIC	14.1 mg/kg
COPPER	117 mg/kg
LEAD	91.5 mg/kg
MERCURY	2.3 mg/kg
NICKEL	224 mg/kg
ZINC	8440 mg/kg

A4	
PAHs (13)	44J-1500J ug/kg
4,4'-DDT	8.6 ug/kg
ARSENIC	8.8 mg/kg
SILVER	1.3J mg/kg
ZINC	191 mg/kg

A3	
LEAD	120J mg/kg
ZINC	179 mg/kg

A18	
PAHs(11)	900J-8600J ug/kg
4,4'-DDT	35J ug/kg
AROCLOR-1254	110J ug/kg
CHROMIUM	117 mg/kg
COPPER	37.2 mg/kg
LEAD	137 mg/kg

A7	
PAHs(14)	2400J-38000 ug/kg
4,4'DDE	7J ug/kg
AROCLOR-1016	110J ug/kg
AROCLOR-1260	610J ug/kg
COPPER	62J mg/kg
LEAD	266J mg/kg
NICKEL	36.6J mg/kg
ZINC	262 mg/kg

A22	
PAHs(13)	870J-27000 ug/kg
AROCLOR-1254	190J ug/kg
ARSENIC	8.9 mg/kg
CHROMIUM	182 mg/kg
COPPER	110 mg/kg
LEAD	252 mg/kg
NICKEL	123 mg/kg
ZINC	784 mg/kg

A9	
ARSENIC	11.2 mg/kg
COPPER	37J mg/kg
LEAD	118J mg/kg
NICKEL	180J mg/kg
ZINC	6180 mg/kg

A19	
PAHs(9)	54J-1300J ug/kg
4,4'-DDT	8.6J ug/kg
AROCLOR-1254	96J ug/kg
CHROMIUM	123 mg/kg
COPPER	67.8 mg/kg
LEAD	123 mg/kg
ZINC	159 mg/kg

A29	
PAHs(13)	145J-10600 ug/kg
LEAD	71.5 mg/kg
ZINC	165 mg/kg

A30	
PAHs (12)	60J-2400 ug/kg
4,4'-DDT	50 ug/kg
CADMIUM	3.8J mg/kg
LEAD	95.2J mg/kg
ZINC	203 mg/kg

A8/8D	
CADMIUM	8.4J mg/kg
COPPER	49.9J mg/kg
LEAD	66J mg/kg
NICKEL	29J mg/kg
SILVER	2J mg/kg
ZINC	314 mg/kg

A20	
PAHs (14)	100J-7200J ug/kg
4,4'-DDT	49J ug/kg
AROCLOR-1254	50J ug/kg
LEAD	52.6 mg/kg
ZINC	171 mg/kg

A1	
PAHs(12)	860J-43000 ug/kg
4,4'-DDT	13 ug/kg
CHROMIUM	46.7 mg/kg
LEAD	119 mg/kg

A21	
PAHs(13)	190J-8000 ug/kg
4,4'-DDT	21J ug/kg
AROCLOR-1254	62J ug/kg
MERCURY	0.37 mg/kg

A5	
CHROMIUM	224J mg/kg

A2	
LEAD	103 mg/kg

A31	
PAHs(14)	825J-24000J ug/kg
CADMIUM	5.84J mg/kg
COPPER	83.9 mg/kg
LEAD	146J mg/kg
MERCURY	0.28 mg/kg
ZINC	399 mg/kg

A28	
PAHs(16)	120J-30000J ug/kg
AROCLOR-1248	1500J ug/kg
AROCLOR-1260	1500J ug/kg
COPPER	64.2 mg/kg
LEAD	142 mg/kg
MERCURY	0.73 mg/kg
ZINC	300 mg/kg

A6	
COPPER	91.2J mg/kg
LEAD	146J mg/kg
NICKEL	34.6J mg/kg
ZINC	447 mg/kg

A24	
PAHs (11)	1000J-15000J ug/kg
4,4'-DDT	57J ug/kg
AROCLOR-1254	20J ug/kg
LEAD	119 mg/kg
ZINC	202 mg/kg

A27	
PAHs(14)	610J-9900J ug/kg
4,4'-DDT	31J ug/kg
AROCLOR-1254	22J ug/kg
ARSENIC	10.1 mg/kg
COPPER	38.6 mg/kg
LEAD	87.4 mg/kg
MERCURY	0.27 mg/kg

LEGEND:

- ⊗ SEDIMENT SAMPLING LOCATION
- ▲ SURFACE WATER SAMPLE LOCATION
- ▼ SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- \| STORMWATER OUTFALL
- SEEP AREA
- PALUSTRINE, FORESTED WETLAND

0 150 300
SCALE IN FEET

DRAWN BY	DATE
LDL\EEH	2/29/00
CHECKED BY	DATE
REVISED BY	DATE
SCALE	
AS NOTED	

Tetra Tech NUS, Inc.

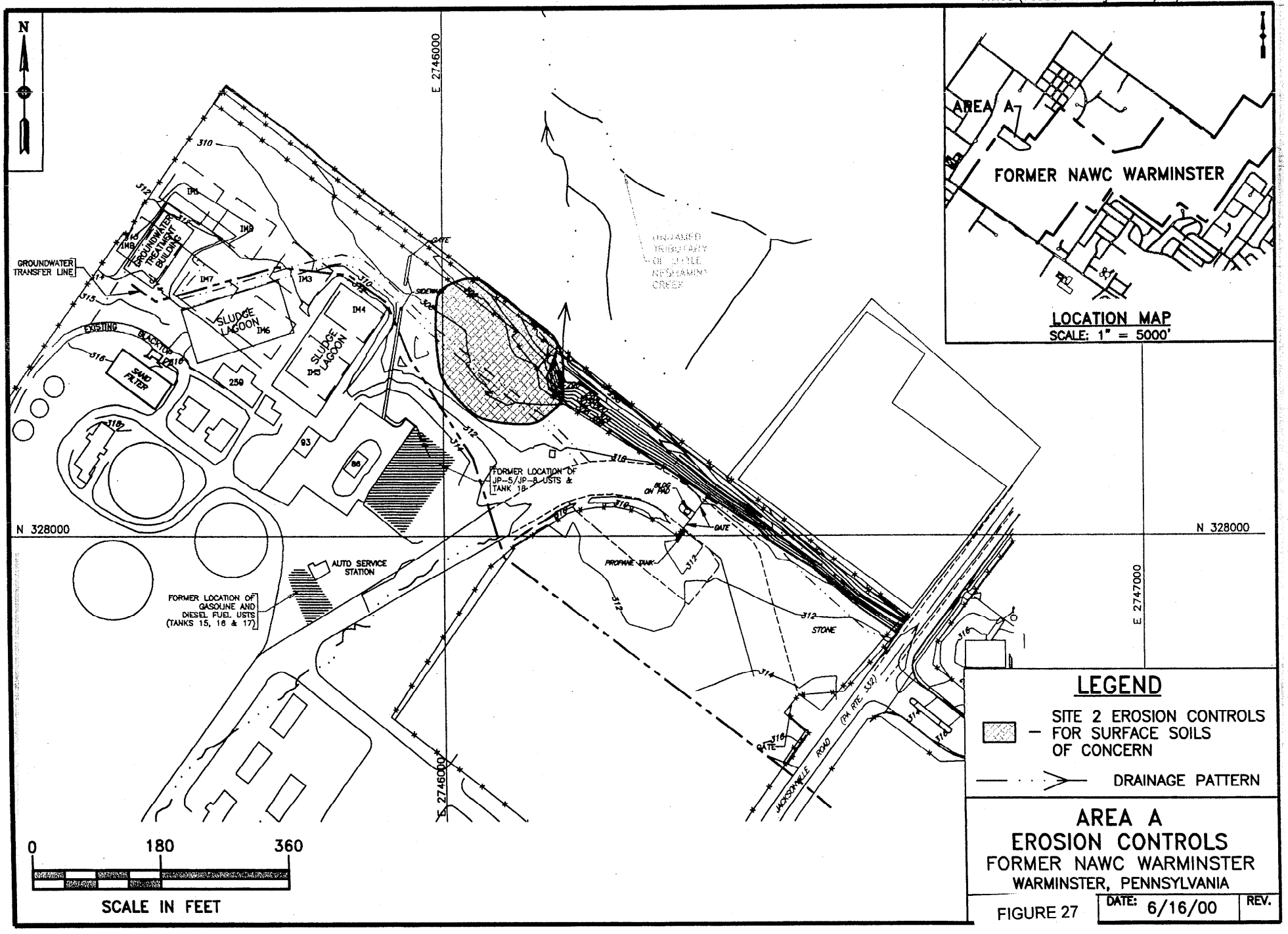
SEDIMENT CONCENTRATIONS
SCREENING CRITERIA EXCEEDANCES
AREA A
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

CONTRACT NO. 7603
OWNER NO. 0601
APPROVED BY Tea DATE 4/23/00
DRAWING NO. REV.

FIGURE 26

AREA-A_OU-6\7603tm07.dwg 3/6/00 EEH

TTNUS\7603cm02.dwg 6/16/00 LDL

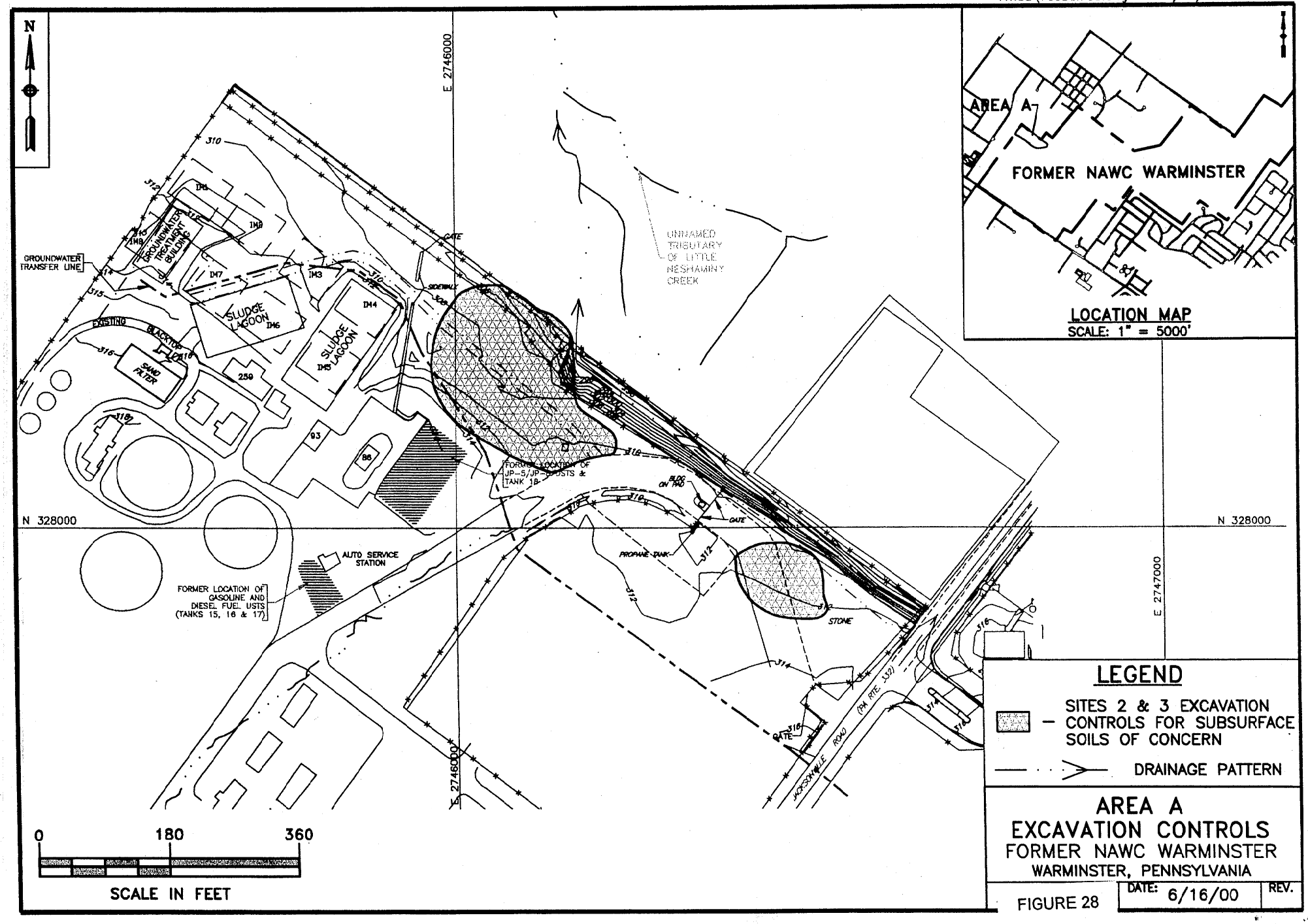


AREA A
EROSION CONTROLS
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

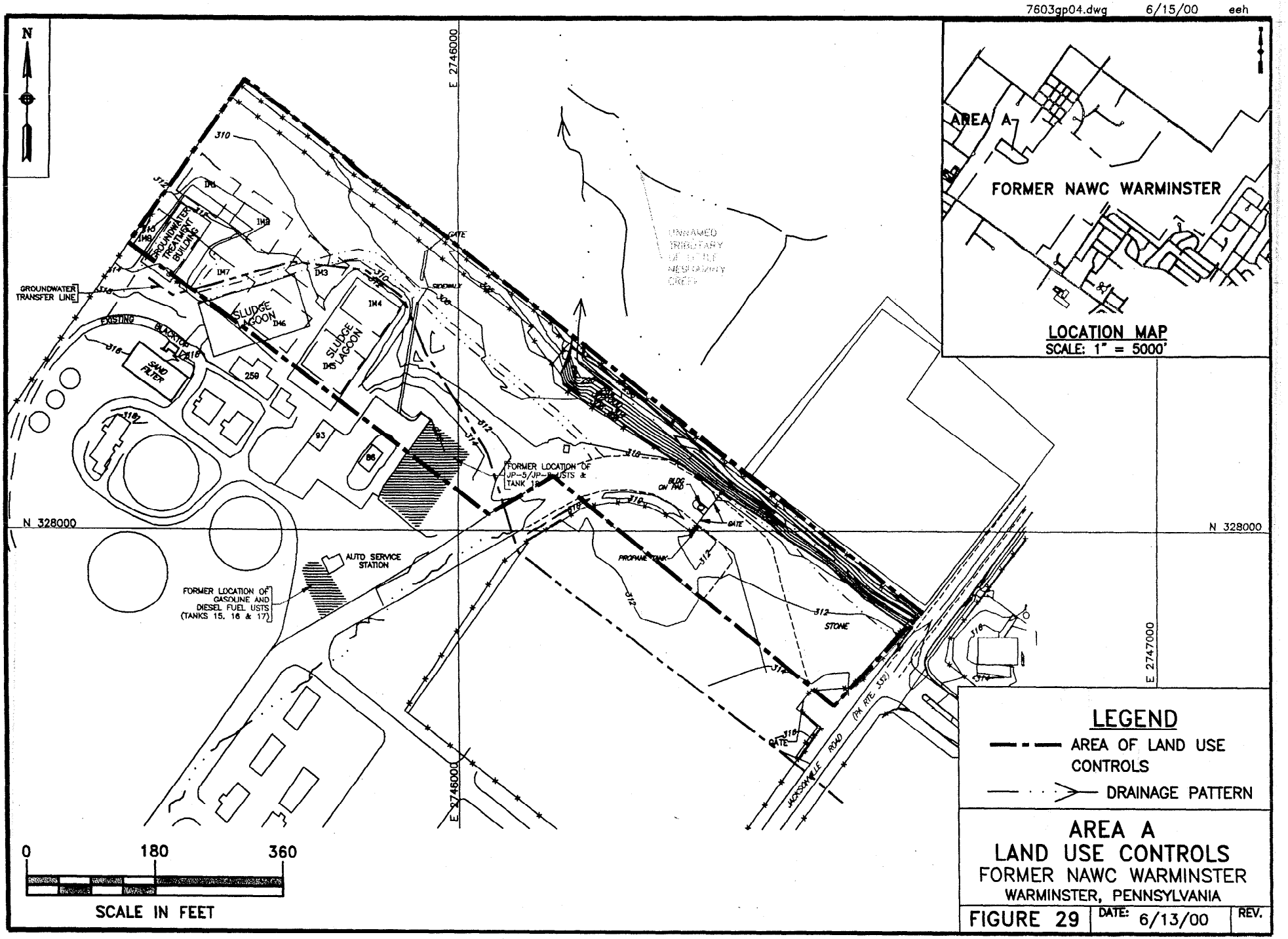
FIGURE 27

DATE: 6/16/00 REV.

TTNUS\7603cm03.dwg 6/16/00 LDL



7603gp04.dwg 6/15/00 eeh



AREA A
LAND USE CONTROLS
FORMER NAWC WARMINSTER
WARMINSTER, PENNSYLVANIA

FIGURE 29 | DATE: 6/13/00 | REV.

APPENDIX C

PADEP CONCURRENCE LETTER

APPENDIX D

COMMENT LETTERS

Earth Data
INCORPORATED
GROUND WATER AND ENVIRONMENTAL CONSULTANTS
ST. MICHAELS, MARYLAND AND EXTON, PENNSYLVANIA

May 31, 2000

Mr. Tom Ames
BRAC Environmental Coordinator
Caretaker Site Office
P.O. Box 2609
Warminster, PA 18974-0061

Re: Former Naval Air Warfare Center (NAWC) Warminster, Pennsylvania
Comments on:
Proposed Plan for Operable Unit-9 (OU-9)
Proposed Plan for Operable Unit-8 (OU-8)
Proposed Final Remedy for Operable Unit-4 (OU-4)

Dear Mr. Ames:

Earth Data Incorporated (Earth Data) is environmental consultant to the Warminster Municipal Authority (WMA). On behalf of WMA, Earth Data has reviewed the above-referenced documents. The following comments are provided.

These comments do not represent a legal statement of position regarding any possible contamination of any of WMA's water supply wells, the groundwater resource from which WMA obtains its supply or other property under the control of WMA now or in the future.

Comments on Proposed Plan for OU-9

Historically at NAWC Warminster, sanitary wastewater was treated at an on base treatment plant. The plant, which was constructed in 1945, had a history of not meeting permitted discharge criteria. The plant has been taken out of operation and the current waste stream discharges to the WMA wastewater treatment facility.

Under the current base reuse strategy, the Navy will transfer land in the vicinity of Site 1 (including the former on-base treatment plant) to WMA as part of a public benefit conveyance through the U.S. Department of Health and Human Services. The former treatment plant will be demolished and WMA will construct a new state-of-the-art facility in its place.

The remedial alternative for OU-9 preferred by the Navy and the EPA (Alternative 2) contemplates the protection of human health through the implacement of institutional controls to prevent excavation and construction activities.

As presented in the plan, the description of Alternative 2 is incomplete as it provides no specific details as to where the institutional controls will be required. This is an important consideration given that the building of the new wastewater treatment plant will necessarily involve excavation and construction activities.

Given WMA's planned use of the area, which is essential to base reuse, institutional controls are not adequately protective of public health or safety. WMA believes hazardous substances in the area of its proposed construction activities should be excavated and removed to an approved off-site TSD.

Comments on Proposed Plan for OU-8

No Comments

Comments on Proposed Final Remedy for OU-4

- The Navy's interpretation of three continuous hydrogeologic units (A, B, and C) oversimplifies the complex hydrogeology in Area D.

- The historical contamination seen in base supply wells SW-1 and SW-2 does not support the Navy's conclusion that groundwater in Unit C does not contain concentrations of contaminants that present a risk to human health and the environment. Further, the contamination of SW-1 and SW-2 is inconsistent with the interpretation that vertical intermixing among the hydrologic units is limited and controlled by the presence of semi-confining geologic units.

- The first version of the RI/FS, which was provided to WMA to review, stated that the released portion of the TCE plume attributable to NAWC Warminster will continue to migrate in a north northwestern direction where it will be intercepted by WMA's Well 26 as part of the Area D groundwater remedy.

  The current version of the RI/FS does not discuss the migration of Area D related contamination toward Well 26. Rather, the remedy for the offsite plume attributable to the Navy will be natural attenuation.

  It is the Navy's interpretation that the distribution of contaminants in groundwater and groundwater flow data point to a source of contamination near Area D not related to NAWC Warminster. In response, the EPA has initiated an independent investigation. To date, EPA's investigation is incomplete. As a result, the Navy's conclusion can't be supported.

EARTH DATA INCORPORATED

The selection of a final remedy based on perceived third party liability issues is inconsistent with the decision making criteria specified in the NCP. WMA views alternatives 3a and 3b as being consistent with the NCP by providing better overall protection of human health and the environment.

WMA appreciates the opportunity to provide these comments. If you have any questions please contact me at (610) 524-9466.

Sincerely.

Pennoni

PENNONI ASSOCIATES INC.
CONSULTING ENGINEERS

One Drexel Plaza
3001 Market Street, Suite 200
Philadelphia, PA 19104-2897
Tel: 215•222•3000
Fax: 215•222•3588

May 30, 2000

WARM-9608.002.01

Mr. Lonnie Monaco
Naval Facilities Engineering Command (NAVFACENGCOM)
Northern Division
Environmental Contracts Branch, Mail Stop No. 82
10 Industrial Highway
Lester, Pennsylvania 19113

RE: RI/FS Report for OU-9 (Area A: Media other than groundwater). Former NAWC Warminster

Dear Mr. Monaco:

Pennoni Associates Inc. ("Pennoni"), on behalf of Warminster Township, has reviewed the "*Remedial Investigation/Feasibility Study Report for Operable Unit 9*" prepared by Tetra Tech NUS and dated April 2000. Based on our review of the above referenced report, we offer the following comments.

1. The surface and subsurface post-excavation concentrations for lead exceed the PADEP soil to groundwater pathway standard. The lead levels do exceed the clean-up goal of 1000 mg/kg, which contradicts the first bullet in Section 4.9. The potential to impact groundwater and surface water needs to be addressed.

2. The report discusses detections of various contaminants in surface water but does not compare them to the PADEP surface water criteria (Chapter 16). A review of the surface water data reveals that there were several exceedances of the PADEP human health criteria, including tetrachloroethene, benzo(a)anthracene, and pyrene. The risk assessment concluded that there was no unacceptable risk to humans because of the industrial land use. It was not clear in the report how far downstream the impacts extend and where the PADEP criteria are met. An evaluation of downstream impacts should be provided.

3. Several organic and inorganic parameters were found with elevated concentrations posing ecological risks in the stream sediments. The apparent source is Area A and the storm sewer outfalls. The origin of the stormwater is not clearly delineated. Although ecological risks are present, no remediation alternatives for the sediments are proposed.

05/31/00 08:44 ☎215442200 May.30. 2000 5:29PM PENNONI ASSOC.ENV / TRANS No.3036 P. 4

4. The only alternative evaluated in the FS is *Institutional Controls and Environmental Monitoring*. Alternatives that would have included remediation or capping of impacted soils or sediments were excluded in the screening process. Based on our review, we believe that there are feasible remediation alternatives that should be evaluated in the normal analysis process.

If you have any questions, please do not hesitate to contact us.

Very Truly Yours,

PENNONI ASSOCIATES, INC.

J. Anthony Sauder, P.E., P.G.
Senior Hydrogeologist

(FOR)
Kevin J. Davis, P.E.
Associate Vice President

cc: Robert Camarata, Warminster Township

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