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Site Screening Process Report

for

Site 32 – Suspected Tool Burial
Site 33 – Scrap Metal Pit
Site 34 – Tool Burial
Site 36 – Closed Landfill
Site 37 – Causeway
Site 51 – Building 101 Dry Well
Site 52 – Building 102 Dry Well

Indian Head Division
Naval Surface Warfare Center

Indian Head, Maryland

Engineering Field Activity Chesapeake
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0803

March 2003

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SITE SCREENING PROCESS REPORT
FOR
SITE 32 – SUSPECTED TOOL BURIAL
SITE 33 – SCRAP METAL PIT
SITE 34 – TOOL BURIAL
SITE 36 – CLOSED LANDFILL
SITE 37 – CAUSEWAY
SITE 51 – BUILDING 101 DRY WELL
SITE 52 – BUILDING 102 DRY WELL

INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MARYLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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LIST OF ACRONYMS/ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/dL	micrograms per deciliter
AET	Adverse Effects Threshold
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirements
ATV	all-terrain vehicle
AWQC	Ambient Water Quality Criteria
B&R Environmental	Brown and Root Environmental
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BI	background investigation
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	chain-of-custody
COPC	chemical of potential concern
CSM	conceptual site model
CTO	Contract Task Order
DON	Department of the Navy
EEQ	ecological effects quotient
EM	electromagnetic
EOD	explosive ordnance disposal
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentrations
ERT	Earth Resources Technology, Inc.
FFA	Federal Facilities Agreement
FS	feasibility study
GC/MS	gas chromatography/mass spectrometry
GPR	ground penetrating radar
HI	Hazard Index
HQ	Hazard Quotient
HSA	hollow-stem auger
IAS	Initial Assessment Study

ICP	inductively coupled plasma
ID	inside diameter
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IHDIV-NSWC	Indian Head Division, Naval Surface Warfare Center
ILCR	Incremental Lifetime Cancer Risk
IHIRT	Indian Head Installation Restoration Team
IR	Installation Restoration
LEL	Lowest Effects Level
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
mg/L	milligrams per liter
msl	mean sea level
mS/m	millisiemens/meter
NAD	North American Datum
NCP	National Oil and Hazardous Substances Contingency Plan
NFESC	Naval Facilities Engineering Service Center
NGVD	North American Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NOEL	no observed effect level
NSWC	Naval Surface Warfare Center
NTU	nephelometric turbidity units
OSHA	Occupational Safety and Health Administration/Act
OSWER	Office of Solid Waste and Emergency Response
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	Probable Effects Concentration
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control

RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	remedial investigation
RPM	remedial project manager
SARA	Superfund Amendments and Reauthorization Act
SERA	Screening Level Ecological Risk Assessment
SOP	Standard operating procedure
SOW	Statement of Work
SSA	Site Screening Area
SSL	soil screening level
SSP	Site Screening Process
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TtNUS	Tetra Tech NUS, Inc.
UCL	upper confidence limit
USDA	United Sates Department of Agriculture
USGS	United States Geological Survey
UTL	upper tolerance limit
VOC	volatile organic compound
WP	work plan
WQC	water quality criteria

EXECUTIVE SUMMARY

This Site Screening Process (SSP) report for seven sites at Indian Head Naval Surface Warfare Center (IHDIV-NSWC) Indian Head, Maryland was prepared by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0803.

The objective of the SSP investigation was to collect sufficient data for the seven sites to determine for each site whether the site requires additional investigation (e.g., remedial investigation/feasibility study), or whether it can be closed with no further action. EPA Region 3 human health residential risk-based concentrations (RBCs) were used to evaluate human health risk. A screening level ecological risk assessment was used to evaluate ecological risk. The seven sites and the recommended dispositions are as follows:

Site 32 – Suspected Tool Burial

No samples were collected at this site based on the results at Site 34, a similar site. No action is recommended.

Site 33 – Scrap Metal Pit

Six subsurface soil samples and three groundwater samples were collected. Based on the laboratory results and a preliminary human health risk evaluation, a supplemental sampling investigation is recommended to verify the results of a single turbid groundwater sample before determining if an RI is justified.

Site 34 – Tool Burial

One subsurface soil sample and three groundwater samples were collected. Based on comparison of the laboratory results to screening levels, no action is recommended.

Site 36 – Closed Landfill

A geophysical investigation was performed, but no samples were collected. Because the geophysical investigation identified the presence of buried material, and because of the anticipated level of effort needed to evaluate this type of site, a remedial investigation/feasibility study is recommended.

Site 37 – Causeway

Five subsurface soil samples, three groundwater samples, three surface water samples, and three sediment samples were collected. Based on the laboratory results and a preliminary human health risk

evaluation, a remedial investigation/feasibility study is recommended. The RI should also include further evaluation of ecological COPCs.

Site 51 – Building 101 Dry Well

Two subsurface soil samples were collected and trace concentrations of benzene and toluene were detected. Only one dry well was found in an area where two dry wells were suspected (see Site 52, below). Based on the laboratory results and site conditions, no action is recommended.

Site 52 – Building 102 Dry Well

Only one dry well was found, and it was designated as Site 51. No second dry well was found, so Site 52 does not exist. No action is recommended.

1.0 INTRODUCTION

This Site Screening Process (SSP) report for seven sites at Indian Head Naval Surface Warfare Center (IHDIV-NSWC) Indian Head, Maryland was prepared by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0803.

1.1 PURPOSE

The purpose of the SSP is to determine whether operations at seven sites have resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern. Five of the seven sites are among the 37 Site Screening Areas (SSAs) identified in Appendix B of the Federal Facilities Agreement (FFA). SSAs are those geographical areas with suspected contamination that will require some level of investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program. The other two sites of the seven sites were not among the list of SSAs and are being investigated to confirm previous evaluations.

1.2 OBJECTIVE AND SCOPE

The objective of the SSP investigation was to collect sufficient data to determine whether each of the sites requires additional investigation [i.e., supplemental SSP investigation or remedial investigation (RI)/feasibility study (FS)], designation as an accelerated operable unit, or if the site can be closed with no action (NA). The general scope of this SSP investigation was agreed upon by the Indian Head Installation Restoration Team (IHIRT) in the Site Screening Investigation Work Plan (TtNUS, 2001). The following sites were investigated under this SSP:

- Site 32 – Suspected Tool Burial (SSA)
- Site 33 – Scrap Metal Pit (SSA)
- Site 34 – Tool Burial (SSA)
- Site 36 – Closed Landfill (SSA)
- Site 37 – Causeway (SSA)
- Site 51 – Building 101 Dry Well (not an SSA)
- Site 52 – Building 102 Dry Well (not an SSA)

The investigative process consisted of research, limited geophysical investigations, media sampling, and analytical data evaluation. The research consisted of a review of historical facility documents as related

to the operations at the individual sites, and interviews with Base personnel. Geophysical surveys were conducted at Sites 33, 34, 36, 51, and 52 to more accurately identify sample locations, site boundaries, and buried utility lines. Environmental media sampling was conducted at six of the seven sites. Samples were collected from soil, groundwater, surface water, and/or sediment locations, as appropriate, based on site history and possible containment transport pathways. Analytical data were evaluated via a formal data validation process, background comparisons, and human health and ecological risk screening analyses.

1.3 REPORT ORGANIZATION

Section 1.0 of this report presents the purpose, scope, and objectives of this report. Section 2.0 provides background information for IHDIV-NSWC. Section 3.0 describes the investigative procedures that were used to implement the fieldwork at the SSP sites. A discussion of the general data evaluation methods used in this SSP report is provided in Section 4.0. Sections 5.0 through 11.0 provide the background, physical characteristics, summaries of field activities, analytical data, risk screening analyses, conclusions, and recommendations for each SSP site.

Support documentation for the SSP investigation is appended to this report. The field forms associated with the field investigation are contained in Appendices A through F. The entire analytical database (including nondetect and positive analytical results) for the SSP sites and a data validation report for the associated chemical analyses are provided in Appendices G and H. Appendix I contains support documentation for the human health risk screening analyses.

2.0 BACKGROUND INFORMATION

This section presents the facility location and history, a discussion of previous environmental investigations at IHDIV-NSWC, physical characteristics of the facility, demography and land use, and ecology.

2.1 FACILITY LOCATION

The IHDIV-NSWC is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. The IHDIV-NSWC is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. The Main Area is bounded by the Potomac River to the northwest, west, and south, Mattawoman Creek to the south and east, and the town of Indian Head to the northeast (Figure 2-1). Stump Neck Annex is located across Mattawoman Creek. The Stump Neck Annex is not contiguous with the main area. It has a separate United States Environmental Protection Agency (EPA) identification number, and is operated by a tenant. Sites 32, 33, 34, 36, and 37 are located within the Stump Neck Annex. Sites 51 and 52 are located within the main base area. The locations of the seven sites are shown on Figures 2-2 and 2-3.

2.2 PREVIOUS INVESTIGATIONS

The following provides brief descriptions of past investigations at IHDIV-NSWC, which were conducted to address some or all of the Installation Restoration (IR) sites and that specifically relate to the seven sites included in this report.

In 1983, the Navy completed an initial assessment study (IAS) of IHDIV-NSWC. This study identified and examined 29 sites in the Main Area and 9 sites in the Stump Neck Annex. Sites 32, 33, 34, 36, and 37 were included in this study. In 1996, the Navy, EPA, and Maryland Department of the Environment (MDE) decided to perform RIs at eight sites in the Main Area and postpone further investigation of the balance of the sites to the Site Screening Process (EPA and DON, 2000).

In 1992, the Navy completed a supplemental preliminary assessment (PA). This PA was an addendum to the IAS and examined 17 additional sites in the Main Area. Sites 51 and 52 were included in this study. At that time, no action was recommended for Sites 51 and 52.

In 1988, the EPA completed a Resource Conservation and Recovery Act (RCRA) solid waste management unit (SWMU) Investigation of the Main Base Area. This document included 78 SWMUs and

12 areas of concern. In 1990, the EPA completed a RCRA SWMU Investigation of the Stump Neck Annex. This document included 24 SWMUs. Sites 32, 33, 34, 36, and 37 were identified as SWMUs.

Since 1983, additional site-specific investigations, studies, and removal actions have been performed at other sites throughout IHDIV-NSWC. Information on these studies can be found in other reports. In addition, Sites 51 and 52 are encompassed by the RI that is currently underway in the Lab Area (Sites 14, 15, 16, 49, 50, 53, 54, and 55).

A basewide Background Investigation (BI) was performed in 1997 (B&R Environmental, 1997). This study was expanded and revised in February 2002 (TtNUS, 2002). The purpose of the BI was to establish a basewide background database for IHDIV-NSWC that would be used as a tool to evaluate analytical results for soil and groundwater samples collected during future investigations. In particular, the data contained in the BI would be used to determine whether environmental samples collected at IHDIV-NSWC contain contaminants at concentrations that exceed naturally occurring background concentrations. Section 4.2 contains a more detailed discussion of the BI and its applicability to the SSP.

2.3 PHYSICAL SETTING

General descriptions of the physical setting at IHDIV-NSWC are provided below.

2.3.1 Topography, Surface Water, and Drainage

Indian Head consists of two areas: the Indian Head NSWC and the Stump Neck Annex. Indian Head lies within the Atlantic Coastal Plain Physiographic Province, approximately 8 to 10 miles east of the Fall Line that marks the western extent of the Atlantic Coastal Plain Physiographic Province. The two facilities have gently rolling to undulating topography with elevations ranging from sea level to 111 feet above mean sea level (msl). The higher elevations exist in the northern portion of Indian Head. Generally, the land surface slopes to the east and southeast, with slopes of 5-percent or less. The western side of the base along the Potomac River is characterized by 40- to 50-foot bluffs, and the eastern side along Mattawoman Creek is more gradational, except for a few areas with several 10- to 40-foot bluffs (Hart, 1983).

The three principal waterways in the vicinity of IHDIV-NSWC and Stump Neck Annex are the Potomac River, Mattawoman Creek, and Chicamuxen Creek. The Potomac River is a tidally influenced estuary that is slightly brackish. Mattawoman and Chicamuxen Creeks are tributaries to the Potomac River. Both are also tidally influenced. Tidal marshes exist along Mattawoman Creek and Chicamuxen Creek.

Wastewater from IHDIV-NSWC is discharged directly to the Potomac River or Mattawoman Creek and from outfalls to tributaries of the Potomac River or Mattawoman Creek. The wastewaters consist of industrial, sanitary, and storm effluents or combinations thereof (Hart, 1983).

2.3.2 Geology

The regional geology consists of a sedimentary wedge of Cretaceous to Quaternary, fluvial and marine deposits overlying crystalline Precambrian metamorphic and igneous bedrock. The sedimentary wedge dips and thickens eastward and ranges in thickness from 650 feet in the west to 900 feet in the eastern portion of the Charles County (Vroblesky, 1991). It lies unconformably on the crystalline basement rock surface, which dips to the east.

The geologic units underlying IHDIV-NSWC, in stratigraphically ascending order, are the Lower Cretaceous Potomac Group, the Tertiary age Aquia Formation and Park Hall Formation, and several Quaternary fluvial and estuarine deposits.

The Potomac Group (Lower Cretaceous) consists of three geologic units (in descending stratigraphic order): the Patapsco Formation, the Arundel Formation, and the Patuxent Formation. The lithology of the Potomac Group consists of interbedded clay, silt, sand, and gravel deposited in fluviodeltaic environments (Hiortdahl, 1990) and ranges in thickness from 650 to 750 feet (Vroblesky, 1991; Harsh, 1990). The Patapsco Formation generally consists of clays with interbedded sand units. The Arundel Formation generally consists of a variegated clay. The Patuxent Formation consists of clays with interbedded sand units.

The Aquia Formation (Upper Paleocene) consists of marine deposits of olive black to olive gray, micaceous, glauconitic quartz sand interbedded with sand, silt, and clay. The formation is approximately 0 to 80 feet thick in the IHDIV-NSWC peninsula area.

The Park Hall Formation (upper Pliocene) consists of non-marine, fluvial, and estuarine deposits of sand and clay interbedded with sand with gravel. It is overlain unconformably by Quaternary deposits. The thickness of this formation in the area ranges from 0 to approximately 60 feet.

The Tertiary geologic formations are missing in many locations in the IHDIV-NSWC peninsula area. Where this occurs, the overlying Quarternary deposits come in contact with the underlying Cretaceous formations. The Quarternary fluvial and estuarine deposits in the IHDIV-NSWC peninsula area consist of Pleistocene paleochannel deposits and Holocene alluvial deposits (Hiortdahl, 1990). These deposits consist of gravel, sand, silt, clay, and peat mixtures with irregular bedding. The aggregate thickness may range from 0 to approximately 40 feet.

2.3.3 Hydrogeology

The lower and middle sands of the Patasco Formation and the Patuxent Formation of the Potomac Group are the principal aquifers for domestic use at the IHDIV-NSWC. Potable water wells at IHDIV-NSWC are screened in one or more sand zones to an average depth of 200 to 300 feet. These potable water wells serve an approximate population of 3,350 people, including civilian and enlisted Navy employees and contractor employees. None of these wells supply reserves or residences beyond the facility boundaries. The Upper Sands of the Patasco Formation are poor producers of groundwater in the area and are not considered to be an important aquifer. The Upper Sands are considered to be a confining layer above the underlying Middle and Lower Sand Aquifers in the area and below the shallow, small-scale, surficial water-bearing zones. The Middle Sand aquifer is believed to be hydraulically connected to the Potomac River, where the river has eroded into the aquifer. Potomac River water may be partially recharging the aquifer in this area because of the heavy pumping of supply wells at Indian Head (Hiortdahl, 1990).

Shallow, unconfined to semiconfined groundwater at the IHDIV-NSWC occurs from near surface to approximately 45 feet below ground surface (bgs), with water-table elevations ranging from sea level to approximately 65 feet above msl. Typically, the shallow groundwater occurs in perched water-bearing zones and is recharged from infiltration (Hart, 1983; Slaughter and Otton, 1968). In some lowland areas, surface water intrusion may be an additional source of recharge of the shallow aquifer along the edge of water bodies and during periods of high tide. It is assumed that shallow groundwater flow follows topography and discharges into local water bodies.

2.3.4 Climate

IHDIV-NSWC is located in the Atlantic Coastal Plain on the eastern bank of the Potomac River, midway between the rigorous climate of the north and the mild climate of the south. Since IHDIV-NSWC is located in the middle latitudes where the general atmospheric flow is from west to east across North America, it has a continental-type climate with four well-defined seasons. However, the proximity of the Potomac River and its tributaries has a considerable modifying effect on the climate, especially in moderating extreme temperatures.

Indian Head experiences a modified moist, humid continental climate with warm and wet summers and cool winters. The Appalachian and Blue Ridge Mountain ranges to the west obstruct cold, continental air in the winter, and the Potomac River and Atlantic Ocean contribute to more moderate temperatures and higher humidity.

The annual normal temperature (1971 to 2000) is 56ºF (UMD, 2002). The warmest month is typically July, with a normal temperature of 76ºF, and January is the coldest month, with a normal temperature of 35ºF. The normal annual precipitation is approximately 44 inches, normal monthly precipitation varying from 2.25 (February) to 4.60 (August) inches.

Prevailing surface winds are from the west-northwest to northwest except during the warm months of the year, when they become more southerly. The periods with most wind occur in late winter and early spring. The growing season is approximately 187 days long.

More detailed data are presented in Tables 2-1, 2-2, and 2-3.

2.4 SOILS

The following discussion is a brief description of the soil types as classified by the United States Department of Agriculture (USDA) Soil Survey of Charles County, Maryland, 1974. The dominant soil series in the Indian Head area are the Beltsville, Keyport, and Elkton Silt Loams (Hart, 1983). Additional soil types commonly found on the Stump Neck Annex and surrounding area are Alluvial Land, Exum, Gravelly Land, Mattawan, and Westphalia.

The Beltsville Silt Loam is found primarily in the upland elevations of the northern portion of the Indian Head facility. The Beltsville series soils consist of silt and sand with moderate amounts of clay. They are nearly level to moderately sloping and slowly permeable but well drained.

Areas of cut-and-fill soils are found in the northern portion of IHDIV-NSWC. Cut-and-fill lands are areas where the native soils have been removed and graded or filled with other material or soil.

The Keyport and Elkton Silt Loams are found in the lower elevations of the southern portion of IHDIV-NSWC. They are both clayey silt loam soils. Both series are slowly permeable; however, the Elkton series is less permeable than the Keyport series.

The Gravelly Land soils consist of gravelly deposits with soil types unidentifiable due to erosion.

Alluvial Land is nearly level and consists of soils formed by material recently eroded from uplands and deposited on flood plains or other low-lying areas. The predominant soil is silt, which generally drain poorly. However, in areas where the soil is sandier, it drains well.

The Exum Series consists of gently sloping to moderately sloping, deep, moderately draining soils on uplands. These soils are silty loams, with moderate amounts of clay and minor amounts of sand.

The Mattawan Series consists of soils that are nearly level to gently sloping and moderately well drained to well drained. These soils formed on uplands in a sandy mantle over loamy sediment.

Westphalia series soils are gently sloping to strongly sloping, very deep, well-drained soils on uplands. They are sandy loams formed in old deposits containing well-sorted sands.

2.5 DEMOGRAPHY AND LAND USE

The main area of IHDIV-NSWC on Cornwallis Peninsula covers approximately 2,300 acres and is bounded by the Potomac River to the north and west, Mattawoman Creek to the south and east, and the town of Indian Head to the east. The Stump Neck Annex covers approximately 1,100 acres and is bounded by the Potomac River to the north, Chicamuxen Creek to the south, and private residential property to the east.

The population of IHDIV-NSWC is approximately 4,050. This includes approximately 2,200 civilian employees, 500 military personnel, 800 contractor personnel, and 550 military dependants. Based on the 2000 U.S. Census Bureau estimates, the population of the town of Indian Head is approximately 3,422, and the total population of Charles County is 120,546. The town of Indian Head is primarily residential, with a business corridor located along Maryland Route 210. Tourism comprises a significant portion of the local commerce, because Indian Head is located near some of the best fishing locations on Mattawoman Creek.

2.6 ECOLOGY

The information in this section was extracted from the IAS report (Hart, 1983), except where noted.

2.6.1 Flora

Approximately 35 percent of IHDIV-NSWC is wooded. The forests consist of hardwoods, including oak and hickory, and loblolly and Virginia pines. The upland areas are characterized by older growth of pine and oaks, and the lower elevations are composed of sycamore, ash, elm, and sweet gum.

About 53 percent of IHDIV-NSWC is open field and shrub vegetation. Loblolly pine, sweet gum, red cedar, and black locust are typical of these communities.

Along the shoreline and beaches of the Potomac River, black persimmon, false indigo, poison ivy, sea myrtle, grape, and Virginia creeper are present, along with phlox, gama grass, panic grass, Bermuda

grass, or finger grass. Marsh areas predominate along the shores of Mattawoman Creek. They are characterized by jewelweed, alger, marsh cattail, weedgrass, sedge, three square bulrush, wild rice, saltmarsh cordgrass, smartweek, and marsh mallow.

2.6.2 Wildlife

The ecosystem at IHDIV-NSWC supports a variety of animal life, including an abundant white-tailed deer population. Other common mammals include possum, bats, squirrels, mice, raccoon, woodchuck, rabbits, skunks, and other burrowing rodents, such as voles and shrews. The birds found within Charles County include grebes, herons, ducks, geese, hawks, kestrels, osprey, eagles, owls, gulls, and perching birds, such as robins, warblers, and jays. Common reptiles and amphibians of Charles County include lizards, snakes, turtles, salamanders, frogs, and toads.

2.6.3 Aquatic Life

The area of the Potomac River adjacent to IHDIV-NSWC is part of the spawning and nursery area for striped bass, white perch, herrings, and shad. Bay anchovies and three species of silversides also spawn and nurse within this area. The area is the upstream limit of the nursery area for estuarine-dependent species, including the Atlantic menhaden and Atlantic croaker. Mattawoman Creek is a spawning area for blueback herring, white and yellow perch, and gizzard shad.

2.6.4 Threatened and Endangered Species

Several rare, threatened, and endangered species of plants and animals occur on or near IHDIV-NSWC. A rare, threatened, and endangered species and natural protection area (sensitive or rare habitat) survey was performed at IHDIV-NSWC by the Maryland Natural Heritage Program in 1992. A comprehensive list of the species observed by Maryland Department of Natural Resources (MDNR) is provided in their survey report (MDNR, 1992).

TABLE 2-1

TEMPERATURE DATA FOR LAPLATA, CHARLES COUNTY, MARYLAND
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Month	Normal(1) Maximum Temperature	Normal(1) Minimum Temperature	Normal(1) Temperature	Normal(1) Monthly Precipitation	Extreme(2) Maximum Temperature	Most Recent Date of Extreme Maximum	Extreme(3) Minimum Temperature	Most Recent Date of Extreme Minimum
January	44	26	35	3.42	79	1/26/1950	-8	1/22/1984
February	48.5	28.4	38.5	2.85	81	2/24/1985	-2	2/18/1979
March	57.8	35.4	46.6	3.96	91	3/30/1998	1	3/11/1960
April	68.4	43.2	55.8	3.11	95	4/18/1976	20	4/7/1982
May	74.6	53.2	63.9	4.13	96	5/20/1996	29	5/9/1956
June	81.2	61.9	71.6	3.81	100	6/26/1952	39	6/2/1966
July	84.8	66.8	75.8	4.12	103	7/31/1954	46	7/1/1988
August	83.4	65.4	74.4	4.6	102	8/31/1953	45	8/29/1986
September	77.9	58.7	68.3	4.31	103	9/10/1983	31	9/21/1956
October	68	47.1	57.6	3.36	96	10/4/1954	19	10/24/1969
November	58.6	38.1	48.4	3.21	86	11/2/1971	9	11/29/1955
December	48.2	30.1	39.2	3.16	77	12/16/1971	1	12/26/1980
Annual	66.3	46.2	56.3	44.04				

1 Normals are calculated using data collected from 1971-2000.
2 Extreme Maximum Temperatures from 1948 through 1998.
3 Extreme Minimum Temperatures from 1948 through 1998.

Source: Maryland State Climatologist Office, University of Maryland Collage Park, Department of Meteorology, November 2002.
http://www.atmos.umd.edu/~climate/

TABLE 2-2

PRECIPITATION DATA FOR LAPLATA, CHARLES COUNTY, MARYLAND
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Month	Normal(1) Monthly Precipitation	Maximum(2) Daily Precipitation	Most Recent Date of Maximum Daily Precipication
January	3.42	2.37	1/27/1976
February	2.85	2.2	2/23/1994
March	3.96	2.38	3/26/1978
April	3.11	2.16	4/14/1970
May	4.13	2.23	5/16/1983
June	3.81	7.49	6/22/1972
July	4.12	4.2	7/13/1975
August	4.6	9.8	8/27/1971
September	4.31	5.21	9/13/1989
October	3.36	5.45	10/14/1955
November	3.21	2.64	11/28/1993
December	3.16	2.4	12/21/1951
Annual	44.04	9.8	8/27/1971

1 Normals are calculated using data collected from 1971-2000.
2 Maximum Daily Precipitation from 1948 through 1998.

Source: Maryland State Climatologist Office, University of Maryland Collage Park, Department of Meteorology, November 2002. http://www.atmos.umd.edu/~climate/

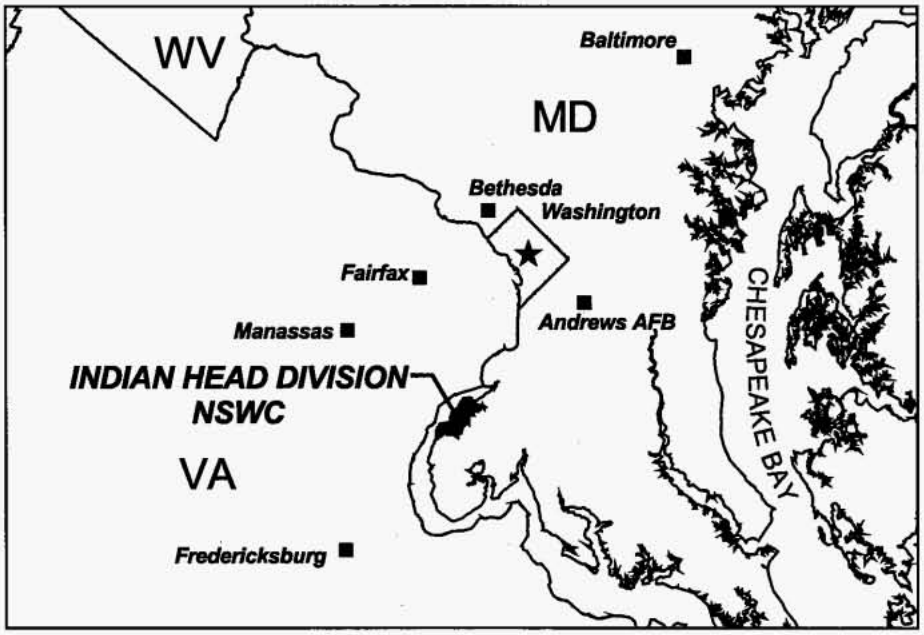
TABLE 2-3

MISCELLANEOUS WEATHER DATA FOR LAPLATA, CHARLES COUNTY, MARYLAND
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

	Average Number of Days	Average Date of First Occurrence	Average Date of Last Occurrence
Minimum Temperature Less Than or Equal to 32 Degrees	96	October 24	April 20
Maximum Temperature Less Than or Equal to 32 Degrees	8	December 21	February 11
Maximum Temperature Greater Than or Equal to 90 Degrees	24	May 25	September 3
Growing Season (1)	187	N/A	N/A

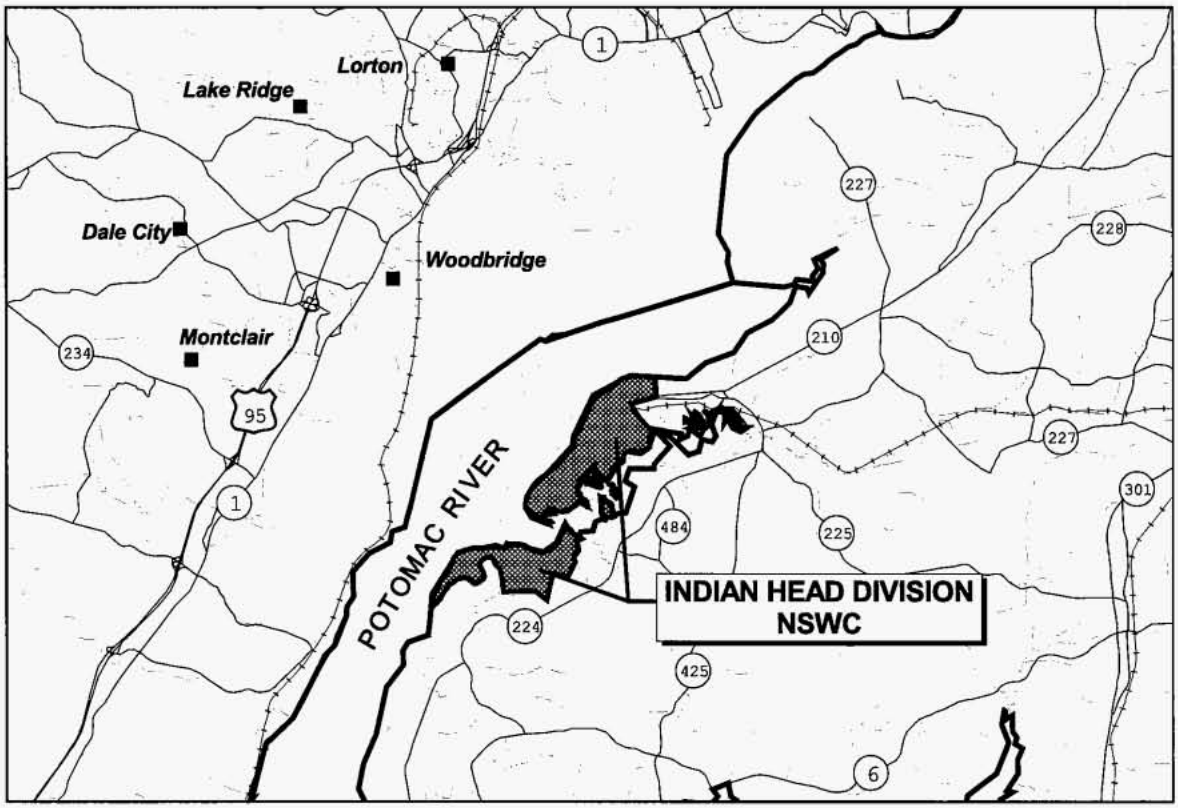
1 The growing season is defined as the number of days between the last 32-degree temperature in the spring and first in the fall.

Source: Maryland State Climatologist Office, University of Maryland Collage Park, Department of Meteorology, November 2002. http://www.atmos.umd.edu/~climate/



LEGEND

- City
- Highway
- Railroad
- River



DRAWN BY J. LAMEY — DATE 8/2/01	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0525	OWNER NO. 0325
CHECKED BY GJL — DATE 8/3/01	FACILITY LOCATION MAP INDIAN HEAD DIVISION, NSWC INDIAN HEAD, MARYLAND	APPROVED BY GJL — DATE 8/3/01	
COST/SCHEDULE-AREA		APPROVED BY — — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-1	REV 0

P:\GIS\NSWC_INDIAN_HEAD\SITE_LOCATION.APR FACILITY LOCATION MAP 2/13/02 KMP

P:\GIS\INDIANHEAD_NSWC\APR\SITE 7 SCREENING REPORT.APR SITE 7 MAIN AREA 11/5/02 KMP

DRAWN BY K. PEILA — DATE 7/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4019	OWNER NUMBER —
CHECKED BY GJL — DATE 7/26/02	SITE LOCATION MAP MAIN AREA IHDIV - NSWC, INDIAN HEAD, MARYLAND	APPROVED BY GJL — DATE 8/8/02	
COST/SCHEDULE-AREA		APPROVED BY — — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV 0

DRAWN BY K. PEILA — DATE 7/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4019	OWNER NUMBER —
CHECKED BY GJL — DATE 7/26/02	SITE LOCATION MAP STUMP NECK ANNEX IHDIV - NSWC, INDIAN HEAD, MARYLAND	APPROVED BY GJL — DATE 8/8/02	
COST/SCHEDULE-AREA		APPROVED BY — — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-3	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\SITE 7 SCREENING REPORT.APR SITE 7 STUMP NECK ANNEX 11/19/02 KMP

3.0 GENERAL INVESTIGATIVE PROCEDURES

Investigation of the sites was conducted in accordance with the Site Screening Investigation Work Plan (TtNUS, 2001). This plan was developed to identify the presence or absence of contaminants at each site.

3.1 GEOPHYSICAL SURVEYS

Earth Resources Technology, Inc. (ERT) performed electromagnetic (EM), magnetic, and ground penetrating radar (GPR) surveys on January 22, 2002 through January 24, 2002. An EM survey was conducted at Site 34 to determine the location of buried beryllium-copper alloy tools and at Site 36 to determine the extent of a closed landfill. A magnetic survey was conducted at Site 33 to determine the location of buried scrap metal. A GPR survey was conducted at Sites 51 and 52 to determine the locations and depths of steam lines entering dry wells. The ERT geophysical report is provided in Appendix D.

3.2 FIELD SAMPLING

3.2.1 Temporary Well Point Construction

Temporary well points were installed by advancing the borehole using hollow-stem auger (HSA) drilling methods. An all-terrain vehicle (ATV) HSA drill rig with minimum 4-1/4-inch inside diameter (ID) augers was used to perform the drilling. The on-site TtNUS geologist determined the total drilling depth.

After the boring was completed, the 1-inch- or 2-inch-diameter, flush-joint, threaded Schedule 40 polyvinyl chloride (PVC) well screen and riser pipe were positioned in the borehole by inserting the PVC casing through the center of the HSA. Well screens were factory slotted with 0.010-inch screen slot size. A sand filter pack was installed between the outside of the well screen and the borehole wall. In most cases, filter sand was added to approximately 2 to 3 feet above the top of the 10-foot well screen. A minimum 2-foot-thick bentonite pellet seal was then added above the top of the sand pack and allowed to hydrate to seal the well from surface infiltration of water. TtNUS well completion forms are provided in Appendix A.

The temporary well points were developed just prior to purging for sample collection. The groundwater from the well was pumped until it was reasonably clear. Stabilization parameters were then measured as part of the purging process. After groundwater sampling was completed, the temporary wells were abandoned by pulling out the PVC riser and screen material and backfilling the borehole with bentonite chips. State of Maryland well abandonment reports and completion reports are provided in Appendix A.

3.2.2 Soil Borings and Subsurface Soil Sampling

Subsurface soil borings were drilled using an ATV HSA rig and utilizing 2- and 3-inch split spoons. Subsurface soil samples were generally collected along continuous 2-foot intervals to the maximum boring depth. A geologist visually classified and logged all split-spoon samples. At the time of extraction, each split-spoon sample was also scanned for volatile organic compounds (VOCs) using the photo-ionization detector (PID). Soil boring logs are provided in Appendix B.

Some subsurface soil samples were collected using a hand auger. At test pits, subsurface soil samples were collected directly from the backhoe bucket.

To minimize possible cross contamination between the drilling and sampling of each boring, the augers and all downhole sampling tools were cleaned with a high-pressure steam cleaner. In addition, the split-spoon samplers were cleaned between sample intervals at a particular boring using non-phosphate detergent and a clean water wash and rinse. Sample log sheets that were generated for each sample are provided in Appendix C.

3.2.3 Groundwater Sampling

Groundwater samples were collected from the wells in accordance with the low-flow sampling procedures detailed in the station standard operating procedures (SOPs) (NSWC, 1996). Stabilization parameters, pH, temperature, dissolved oxygen, and specific conductivity were measured at 5-minute intervals using a flow-through cell in combination with the U-22 water-quality meter. Groundwater sample collection was not initiated until at least one saturated screen length well volume was removed and stabilization of the groundwater parameters was observed. Stabilization was defined as ±0.1 pH units, ±10% for specific conductance, ±0.1°C for temperature, and less than 10 nephelometric turbidity units (NTU) for turbidity. The depth from the top of the well casing to the water level was measured to the nearest 0.01 foot and recorded between each purge volume. Sample log sheets generated for each sample are provided in Appendix C.

A submersible bladder pump was used at Site 33 (2-inch ID wells). The pump and its associated cables were lowered slowly into the well to at least 2 feet above the bottom of the well to minimize agitation. All other wells were sampled using a peristaltic pump. The peristaltic pump purging and sampling apparatus used to collect groundwater samples consisted of a length of ¼ inch Teflon tubing connected to the pump. Silicon tubing was threaded through the pump to connect with the Teflon tubing.

3.2.4 Surface Water Sampling

Surface water samples were collected by slowly immersing the glass collection vial into the water body and allowing the water to gently drain along the inner wall of the vial. The container for VOC analysis was filled so there was no air space; this was accomplished by filling the vial cap with sample water and slowly pouring the water into the vial until the vial was completely full. Sample log sheets generated for each sample are provided in Appendix C.

3.2.5 Sediment Sampling

Sediment samples were collected from the top 0 to 6 inches of the streambed using disposable and dedicated plastic pre-cleaned hand trowels. However, the volatile organics analysis aliquot was obtained using an Encore sampler. The remaining material was homogenized and distributed into the remaining sample containers. Sample log sheets generated for each sample are provided in Appendix C.

3.2.6 Quality Control Samples

Quality assurance/quality control (QA/QC) samples were collected in accordance with the work plan (TtNUS, 2001) and included field duplicates, trip blanks, and equipment (rinsate) blanks. Five field duplicates, three trip blanks, and two rinsate blanks were collected. One field duplicate was collected per ten samples per medium. One field blank was collected for the entire sampling event. One trip blank was analyzed per cooler containing VOC samples. For rinsate blanks, rinsate was batched and sampled each day; blanks were submitted for analysis every other day. Matrix spike and matrix spike duplicate samples were collected once for every 20 samples. Since QA/QC samples were only collected once for every 10 or 20 samples, some of the sites may not have any site-dedicated QA/QC samples.

3.2.7 Water-Level Measurements

One complete round of water level measurements was collected from nine temporary monitoring wells on February 12, 2002. The synoptic groundwater level measurement was performed to determine the groundwater flow pattern at each site. Measurements were taken with an electronic water-level indicator (M-scope) using the top of the well riser pipe as the reference point for determining depths to water. Groundwater-level measurements were recorded on a groundwater-level measurement form to the nearest 0.01 foot. The groundwater level data are provided in Appendix E.

3.3 LABORATORY ANALYSES

Samples were analyzed by some or all of the following methods:

- Target Compound List (TCL) VOCs [Contract Laboratory Program (CLP) Statement of Work (SOW) OLM04.2 or CLP SOW OLC02.1)]
- TCL Semivolatile Organic Compounds (SVOCs) (CLP SOW OLM04.2 or CLP SOW OLC02.1)
- TCL Pesticides/polychlorinated biphenyls (PCBs) (CLP SOW OLM04.2 or CLP SOW OLC02.1)
- Target Analyte List (TAL) Metals (CLP ILM04.1)
- Explosives (SW-846 8330)

3.4 INVESTIGATION DERIVED WASTE HANDLING

Purge water, decontamination water, and development water generated during field operations were collected and containerized in a 1000-gallon plastic tank in an area across the street from Building D-21C. Drill cuttings were placed in a lined and covered roll-off box in the same area.

A plastic-lined decontamination pad constructed near Building D-21C was used to collect the water when the drilling rig and equipment were steam cleaned. The water was pumped out of the lined pad into 55-gallon drums. The water was subsequently transferred from the drums to the 1000-gallon plastic tank.

Bay Associates, Inc. was contracted to profile and dispose of the investigation-derived waste (IDW). The IDW was removed from the site on March 19, 2002 and transported to an off-site disposal facility.

3.5 SURVEYING

A licensed Maryland land surveyor determined the horizontal and vertical coordinates of all sample locations. Existing base control points within IHDIV-NSWC were used as reference points. The horizontal locations of all points were surveyed to the ± 0.1 foot. The tops of PVC riser pipe and ground surface elevations were surveyed to the ± 0.01 foot for the monitoring well locations. Horizontal positioning was referenced to 1983 North America Datum (NAD), and vertical elevations were referenced to the North American Geodetic Vertical Datum (NGVD) 1929. In addition to sampling locations, two benchmark monuments (brass cap) were installed at each site. Survey data are included in Appendix F.

4.0 GENERAL DATA EVALUATION METHODS

4.1 DATA EVALUATION

All samples were subjected to data validation. Data validation is an objective, systematic process in which analytical data are reviewed to ascertain the validity of the reported results and to identify for the data user the possible limitation of these results. This section summarizes the various aspects of the data validation process. Appendix G contains the data validation memoranda for all samples, and Appendix H includes the entire database.

4.1.1 General Data Validation Procedures

Validation of data generated for samples collected during the field effort was completed in accordance with the Navy Installation Restoration Laboratory Quality Assurance Guide [Naval Facilities Engineering Service Center (NFESC), 1996] and the EPA Region 3 Modifications to the Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review (EPA, 1993 and 1994c).

During data validation activities, the SSP sample results were evaluated for data completeness; holding time compliance; calibration compliance; laboratory and field blank contamination; surrogate spike recovery; matrix spike recovery; laboratory control sample recovery; matrix spike, laboratory, and field duplicate precision; internal standard response; inductively coupled plasma (ICP) interferences; serial dilution; sample quantitation; and detection limits. Hard-copy data deliverables and electronic data files received from the analytical laboratory(s) were reviewed for completeness and accuracy.

Calibration standards were evaluated to assess compliance with the analytical method. An evaluation of the calibration standards aided in the elimination of false negatives. An assessment of calibration non-compliance also was used to qualify all analytical results (positive and nondetect results).

Evaluation of laboratory and field blank analyses aided in the elimination of false positive results. Laboratory artifacts and contaminants present in method blanks were used to establish action levels and were correlated to associated environmental samples. Positive results in environmental samples less than the established blank action level for an associated group of environmental samples were considered to be false positives.

Laboratory control sample recoveries were evaluated to assess the accuracy of laboratory operations. Surrogate and matrix spike recoveries were evaluated to assess the accuracy of laboratory operations as affected by sample matrix. Matrix spike duplicate, laboratory duplicate, and field duplicate results were

used to evaluate the precision of the data. Internal standard responses were evaluated for gas chromatography/mass spectrometry (GC/MS) methods to ensure that instrument sensitivity and response were stable during the analysis of samples. ICP interference check standards were used to verify the laboratory's interelement and background correction factors for spectral interference. Serial dilution results were evaluated to determine whether significant physical or chemical interferences existed for the sample matrix.

The overall determination of data utility or reliability was based upon laboratory compliance with specified methods and adherence to quality control requirements. Noncompliances observed during the validation process typically resulted in qualification of the associated analytical data. The qualifiers alert the data user to imprecise or estimated results and, in the worst case, unreliable and unusable data.

The net results of the validation process were summarized in sample-delivery-group-specific technical reports consisting of a memorandum, a section of qualified analytical results, results as reported by the laboratory, and a supporting documentation section that provided the rationale for changes and/or qualification of the data. These memoranda provide detailed explanations of the results of the data validation review and are kept on file at the TtNUS Pittsburgh, Pennsylvania office.

4.1.2 Data/Validation Qualifiers

Various qualifiers are attached to analytical data by the laboratory and as a result of the data validation process. As mentioned previously, qualification of analytical data during the validation process (i.e., application of B, J, K, L, R, UJ, UL, and UR qualifiers) was conducted as required by EPA Region 3 guidance (EPA, 1993 and 1994c). The attachment of the data qualifiers to analytical results signifies the occurrence of quality control noncompliances that were noted during the course of data validation. The various data qualifiers are defined as follows:

- B - This qualifier is added to a positive result (reported by the laboratory) during the data validation process if the detected concentration reported by the laboratory is determined to be attributable to contamination introduced during field sampling or laboratory analysis. The result is considered to be a false positive.

- J - Indicates that the chemical was detected. However, based on laboratory noncompliances noted during the data validation process, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The laboratory-reported concentration is considered to be an estimated value. The bias (high or low) of this result cannot be determined.

- K - Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The laboratory-reported concentration is considered to be biased high based on laboratory noncompliances noted during the data validation process.

- L - Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The laboratory-reported concentration is considered to be biased low based on laboratory noncompliances noted during the data validation process.

- R - Indicates that the chemical may or may not be present. The positive analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied during the data validation process when gross laboratory technical deficiencies are observed.

- U - Indicates that the chemical was not detected at the numerical detection limit (sample-specific quantitation limit) noted. Nondetect results are reported in this manner by the laboratory.

- UJ - Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be estimated based on problems encountered during laboratory analysis, as noted during the data validation process. The associated numerical detection limit is regarded as inaccurate or imprecise. The bias (high or low) of this result cannot be determined.

- UL - Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be biased low based on problems encountered during laboratory analysis, as noted during the data validation process. The associated numerical detection limit is regarded as inaccurate or imprecise.

- UR - Indicates that the chemical may or may not be present. The nondetect analytical result reported by the laboratory is considered to be unreliable and unusable. During the data validation process, this qualifier is applied in cases of gross laboratory technical deficiencies (i.e., holding times missed by a factor of two times the specified time limit, severe calibration noncompliances, and extremely low quality control recoveries).

The preceding data qualifiers added during the data validation process may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data, qualified with R and UR data validation qualifiers. These data are considered invalid and are not used for the risk screening analysis and decision-making purposes. Minor problems are defined as issues

resulting in the estimation of data, qualified with B, J, K, L, UJ, and UL data validation qualifiers. Analytical results qualified as estimated or biased are suitable for the risk screening analysis and decision-making purposes.

4.2 BACKGROUND DATABASE

A basewide background investigation (BI) was conducted at IHDIV-NSWC between June 18, 1997 and September 17, 1997 (B&R Environmental, 1997). Additional background samples were collected, and the BI was revised in 2002 (TtNUS, 2002). The purpose of the BI was to establish a basewide background database that would be used as a tool to evaluate analytical results for soil, groundwater, and sediment samples collected during future IHDIV-NSWC investigations. In particular, the data contained in the BI would be used to determine whether environmental samples collected at IHDIV-NSWC contain contaminants at concentrations that exceed naturally occurring background concentrations.

The following conclusions were developed from the analysis of the data generated during the BI:

With few exceptions, the inorganic concentrations reported in the surface and subsurface soils are within the range of background concentrations reported for surface soils in the eastern United States (Shacklette and Boerngen, 1984). With few exceptions, the concentrations reported are also within the range of values reported for surface soils of the state of Maryland (Dragun, 1991).

The inorganic profile for background surface and subsurface soils is not the same. Generally, metals concentrations are greater in subsurface soil samples than surface soil samples collected from the same locations. The inorganic concentrations for the "clayey" (low-grain size) subsurface soil samples are generally greater than inorganic concentrations detected in the "non-clayey" (high grain size) subsurface soil samples. This relationship between grain size and metal concentrations was not evident in the background surface soil samples.

The background soils dataset was subdivided into three soil datasets based on the visual inspection of the data, the results of four different statistical analyses, and the soil type descriptions provided by the field geologist for the BI:

- Surface soil samples
- Clayey subsurface soil samples
- Non-clay subsurface soil samples

Table 4-1 summarizes the background values. Because of the limited number of sample locations (three or fewer per medium) collected at each site, the 95 percent upper tolerance limit (UTL) was used as a

threshold background level. This approach is somewhat conservative since it may lead to false positives; that is, a chemical may be identified as a chemical of potential concern (COPC) when it is actually a background chemical. As additional samples are collected in subsequent sampling rounds, more rigorous statistical evaluations can be performed that may show that a chemical is at background concentrations. Any site sample concentrations that were less than the background values were not considered as COPCs. The background values are also included in the data evaluation tables in the subsequent sections.

For the site screening process, background threshold values (95 percent UTLs) were used for soils and groundwater samples.

4.3 HUMAN HEALTH RISK SCREENING METHODOLOGY

The purpose of the human health risk screening in this document is to conservatively estimate the potential risk to human health so that management decisions can be made for a site (for example, should the site be recommended for an RI/FS or removed from further study). Note that, if the human health risk is determined to be unacceptable, and therefore, requires further investigation, then an abbreviated ecological risk screening evaluation will be performed in the SSP since a more thorough ecological risk valuation will be performed during the later investigation.

The risk screening analysis conducted for the SSP sites consists of steps similar to those used in a baseline human health risk assessment. The steps include

- Data evaluation (i.e., selection of COPCs)
- Exposure assessment
- Toxicity assessment
- Risk characterization

The risk screening analysis is based on the methodologies used to calculate EPA Region 3 risk-based concentrations (RBCs) (which are updated semi-annually) to conservatively assess potential exposure and toxicity to human receptors. The RBCs for soil are based on a lifetime resident for carcinogens and a child resident for noncarcinogens. The RBCs for tap water are based on a lifetime resident for carcinogens and an adult resident for noncarcinogens. The steps for performing the risk screening analysis are described below.

Note that the activities at the sites that were sampled were all subsurface (burial pits and dry wells). If contamination was present, it would most likely to be found in the subsurface rather than in the surface soil. Therefore, no surface soil samples were proposed or collected..

4.3.1 Selection of Chemicals of Potential Concern

The following factors were considered in the selection of COPCs for human receptors:

- Occurrence and distribution of chemicals in the environmental media
- Chemical toxicity
- Comparisons of site-specific concentrations with representative Basewide background concentrations

4.3.1.1 Occurrence and Distribution

The initial list of COPCs for the SSP sites included any chemical detected at least once in environmental samples collected for a site. Essential human nutrients, not otherwise known to be associated with the sites (magnesium, potassium, calcium, and sodium) and present at low concentrations and toxic only at high doses, were not included in the initial list of COPCs.

4.3.1.2 Chemical Toxicity

After the initial list of COPCs was completed, the data were further screened on the basis of chemical toxicity. The maximum concentration of a chemical detected in an environmental medium was compared to the most recent EPA Region 3 RBC (EPA, 2002) and other applicable criteria identified in this section. For the purposes of this report, the values used to select COPCs based on chemical toxicity were referred to as "risk screening levels." In general, if the maximum detected concentration at a site was greater than a risk screening level, the chemical was identified as a COPC. Because of the additive noncarcinogenic effects of some chemicals (i.e., some noncarcinogenic chemicals impact the same target organs or exhibit similar mechanisms of action), one-tenth of the RBC for noncarcinogenic effects was used as the risk screening level to select COPCs.

For soil and sediment, the following risk screening levels were used to select COPCs:

- EPA Region 3 RBCs for soil ingestion under residential land use (EPA, 2002).
- EPA Region 3 soil screening levels (SSLs) for the migration of chemicals from soil to groundwater (EPA, 2002).
- Federal (generic) SSLs for inhalation (transfers from soil to air) (EPA, 1996).

EPA Region 3 SSLs for migration to groundwater have not been developed for all constituents. For constituents lacking EPA Region 3 SSLs, federal SSLs for migration to groundwater were used, if available. For this report, the federal SSLs were used for mercury and nickel.

The following risk screening levels were used to select COPCs for groundwater:

- EPA Region 3 RBCs for tap water ingestion under residential land use (EPA, Region 3, 2002).
- Federal drinking water standards, including Primary and Secondary Maximum Contaminant Levels (MCLs) and Action Levels (EPA, 2000).

The surface water criteria presented in the remainder of this section were used to identify a conservative list of COPCs for groundwater. This criteria were used to address groundwater that is expected to impact nearby surface water bodies via groundwater discharge.

COPCs for surface water were selected using the following risk screening levels:

- EPA Region 3 RBCs for tap water ingestion under residential land use (EPA, 2002).
- Federal Recommended Water Quality Criteria (WQC) for the protection of human health (EPA, 1999).

Because federal and Maryland water quality criteria are only available for a limited number of chemicals, EPA Region 3 RBCs for tap water ingestion were also used to select COPCs for surface water. Tables 4-2 and 4-3 summarize the risk screening levels for soil and water, respectively.

4.3.1.3 Background

COPCs for inorganics in soil and groundwater were also selected based on a comparison of site concentrations to representative Basewide background concentrations, as described in the revised BI report (TtNUS, 2002). If the maximum detected concentration of a chemical at a site exceeded the risk screening levels and the representative background concentration, the chemical was retained as a COPC for further risk evaluation.

4.3.2 Exposure Assessment

The human health exposure assessment defines and evaluates, quantitatively or qualitatively, the type or magnitude of human exposure to COPCs identified in environmental media at the SSP sites. The general conceptual site model (CSM) for the SSP sites is presented as Figure 4-1. A general discussion of potential exposure and human receptors is contained in Section 4.3.2.1. The methodologies used to estimate exposure for the purposes of this risk screening analysis are provided in Appendix I.

4.3.2.1 Potential Exposure/Human Receptors

Potential exposure to environmental media at the SSP sites is expected to be limited. Given the current and anticipated future land use and the locations of the sites, military personnel, civilian employees, contractors, and trespassers are the most likely individuals exposed to COPCs at the SSP sites.

Three of the sites (Sites 33, 34, and 36) are relatively distant from buildings, limiting exposure to base personnel. Of the remaining sites, Site 32 is under a parking lot, Site 37 is a roadway, and Sites 51 and 52 are adjacent to buildings, so exposure to these sites is somewhat more likely. Access to the SSP sites is not physically restricted (i.e., chain-link fences are not present); therefore, civilians may trespass on the sites. However, civilian exposure is expected to be limited because the base is patrolled by security police.

In order to evaluate the sites on a conservative basis, risks at each site will be based on a residential scenario.

4.3.2.2 Estimation of Exposure

For purposes of this risk screening analysis, maximum detected site concentrations and exposure assumptions used to derive the EPA Region 3 RBCs (for soil and tap water ingestion under residential land use) were used to assess potential exposure to environmental media at the SSP sites. The RBCs consider the following exposure pathways under residential land use:

- Soil ingestion
- Tap water ingestion
- Inhalation of vapors from tap water exposure

4.3.3 Risk Characterization

The equations and exposure factors used by EPA Region 3 to calculate the RBCs are provided in Appendix I and are based on residential land use. For carcinogens, incremental lifetime cancer risks (ILCRs) were calculated and compared to the EPA target risk range of 10^{-6} to 10^{-4}. If the ILCR is within or less than this range, then no action is needed at the site based on the presence of a potential carcinogenic risk. For non-carcinogens, Hazard Quotients (HQs) and Hazard Indices (HIs) were calculated and compared to the EPA target level HI of 1.0. If the HI is less than this value, then no action is needed based on the presence of a potential non-carcinogenic risk.

4.4 ECOLOGICAL RISK ASSESSMENT METHODOLOGY

A Screening Level Ecological Risk Assessment (SERA) consists of the first two of eight steps required under EPA guidance (EPA, 1997 and 1998a) and Navy Policy for Conducting Ecological Risk Assessments (DON, 1999). Steps 1 and 2 of the Navy's tiered approach consist of a site visit, pathway identification/problem formulation, toxicity evaluation, exposure estimation, and risk calculation. Step 3a of the process consists of the refinement of COPCs. Refining the initially selected list of COPCs consists of reexamining the list on a less conservative, more site-specific basis which frequently results in a reduced list of COPCs. Step 3b through Step 8 are conducted as part of the Baseline Ecological Risk Assessment (BERA) if there are COPCs remaining after Step 3a. Note that, if the human health risk was determined to be unacceptable, then an abbreviated ecological risk screening evaluation was be performed since a more thorough ecological risk evaluation will be performed during a later investigation.

The goal of this SERA was to conduct an initial screening of the analytical data using conservative screening values and assumptions to determine whether portions of Site 33, Site 34, and Site 37 need to be further evaluated as part of a BERA under the RI/FS process.

In the first phase in the ecological risk assessment process, conservative exposure estimates are made for grouped or individual ecological receptors, and these exposures are compared to screening levels. The following steps were completed for the ERA for Sites 33, 34, and 37:

- Problem Formulation
- Exposure Assessment
- Ecological Effects Assessment
- Risk Characterization

4.4.1 Problem Formulation

Problem formulation is the first phase of an ERA and discusses the goals, breadth, and focus of the assessment. It includes general descriptions of the site with emphasis on the habitats and ecological receptors present. This phase also involves characterization of site-related contaminants, contaminant sources, migration routes, and an evaluation of routes of contaminant exposure. Assessment and measurement endpoints that are evaluated are also selected. Finally, a preliminary conceptual model is developed that describes how contaminants associated with the sites in question may come into contact with ecological receptors. The following sections provide more detailed descriptions of the steps completed as part of problem formulation.

4.4.1.1 Site Characterization

The site characterization describes likely contaminant sources, release mechanisms, migration pathways, and the fate of chemicals resulting from site-related activities, as well as ecological resources that could be adversely affected by contaminants. Descriptions of the general base habitat and potential ecological receptors within the seven sites are presented in Section 2.6 of this Screening Report. The site characterization involves the identification of chemicals potentially present and the identification of exposure pathways and potential receptors for analysis. The chemicals that are potentially present at the sites are present as a result of site history and activity and are presented in the work plan. The ecological conceptual site model for the sites is presented in Figure 4-2. The manner in which a receptor contacts contaminants is generally the result of interactions between a receptor's behavior or lifestyle and an exposure medium. Since the focus of this study is on the evaluation of chemical concentrations in groundwater, surface water and sediment, these are the only media that were evaluated in this SERA. Note that the activities at the sites that were sampled were all subsurface (burial pits and dry wells). If contamination was present, it would most likely to be found in the subsurface rather than in the surface soil. Therefore, no surface soil samples were proposed or collected. The rationale for the sampling of these media only was presented in the work plan.

Ecological receptors may be exposed to chemicals in sediment and surface water through various pathways. Benthic invertebrates and fish may be exposed to chemicals in surface water at the sites and to groundwater when discharged to the surface. Also, wildlife that consume invertebrates and/or fish can be exposed to chemicals that have accumulated in prey species.

4.4.1.2 Identification of Assessment and Measurement Endpoints

Assessment endpoints are an explicit expression of the environmental value that is to be protected (EPA, 1997). The selection of these endpoints is based on the habitats present, the migration pathways of probable contaminants, and the routes that contaminants may take to enter receptors. Measurement endpoints are estimates of biological impacts (i.e., mortality, reproduction) that are used to evaluate the assessment endpoints. The selection of measurement endpoints for this report was based on the data that were available to evaluate the assessment endpoints (i.e., chemical data only).

Based on the habitat at the site, the assessment endpoints include protection of the following groups of receptors from adverse effects of contaminants on growth, survival, and reproduction:

- Benthic invertebrates
- Fish
- Amphibians and reptiles

Measurement endpoints are estimates of biological impacts that are used to evaluate the assessment endpoints. The following measures of effects were used to evaluate the assessment endpoints in this SERA:

- Mortality and other adverse effects (i.e., growth, feeding rates, behavioral changes) of benthic macroinvertebrates was evaluated by comparing the measured concentrations of chemicals in the sediment to screening values designed to be protective of ecological receptors.

- Mortality and other adverse effects (i.e., growth, feeding rates, behavioral changes) of aquatic organisms were evaluated by comparing the measured concentrations of chemicals in the surface water to screening values designed to be protective of ecological receptors.

4.4.2 Exposure Assessment

This portion of the SERA includes identification of contaminant concentration data used to represent ecological exposure in various media, and the selection of Exposure Point Concentrations (EPCs) from the data. For each exposure pathway selected for quantitative evaluation, maximum concentrations at the exposure point were estimated and the receptor-specific exposure was quantified. EPCs were estimated using environmental sampling data.

4.4.3 Ecological Effects Assessment

In the ecological effects assessment, screening levels for toxicity of the chemicals to terrestrial and aquatic organisms were compiled. The Region III Biological Technical Assistance Group (BTAG) screening levels (EPA, 1995) were used to screen the parameters for COPCs. The BTAG values were supplemented with other values including Lowest Effects Levels (LELs) (OMOE, 1993), Probable Effects Concentrations (PECs) (EPA, 1996), and Adverse Effects Thresholds (AETs) (Cubbage et al., 1997) for sediment and Tier II values (Suter and Tsao, 1996) and the NAWQC (EPA, 1999) for surface water and groundwater, when necessary. Tables 4-4 and 4-5 present a summary of the screening values used in the ecological COPC selection for sediment and water data, respectively.

4.4.4 Risk Characterization

The risk characterization compares measured or calculated EPCs to ecological effect levels. An ecological effects quotient (EEQ) approach was used to characterize the risk to potential ecological receptors. When EEQ values are less than 1.0, it is an indication that ecological receptors are not at risk. However, when EEQ values are greater than 1.0, additional evaluation or data are necessary to confirm

with greater certainty whether ecological receptors are actually at risk, especially since most benchmarks are developed using conservative exposure assumptions and/or studies. The EEQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an EPC exceeds or is less than a benchmark.

EEQs for aquatic receptors were calculated as follows:

$$EEQ = \frac{C_{sw}}{SwSL} \text{ or } \frac{C_{sd}}{SSL}$$

where:

EEQ	= Ecological effects quotient (unitless)
C_{sw}	= Contaminant concentration in surface water (µg/L)
C_{sd}	= Contaminant concentration in sediment (µg/kg or mg/kg)
SwSL	= Surface water (or groundwater) screening level (µg/L)
SSL	= Sediment screening level (µg/kg or mg/kg)

Ecological COPCs were selected using comparisons to risk screening levels. Chemicals with EEQs greater than 1.0 were retained as COPCs for further evaluation because they have a potential to cause risk. Calcium, magnesium, potassium, and sodium will be excluded as COPCs in all media because they are essential nutrients that can be tolerated by living systems even at high concentrations. Therefore, these chemicals will not be discussed in the ERA. Finally, contaminants without screening levels will be retained as COPCs but only evaluated qualitatively.

TABLE 4-1

BACKGROUND THRESHOLD CONCENTRATIONS
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Surface Soil (mg/kg)	Subsurface Soil (clayey) (mg/kg)	Subsurface Soil (nonclayey) (mg/kg)	Groundwater (ug/L)
Aluminum	19700	35400	21400	286545198
Arsenic	14.9	18.9	28.7	NA
Barium	80.4	134	66.5	254
Beryllium	1.1	3.3	1.5	NA
Cadmium	2.5	0.61	0.61	2.8
Calcium	2060	2590	1270	599450
Chromium	33.4	60.1	59.1	20.9
Cobalt	22.3	133	14.7	39.6
Copper	20.3	48.6	47.6	22.4
Iron	38500	83100	35200	57199
Lead	62.5	40.5	38.6	NA
Magnesium	1620	2640	2940	31254
Manganese	1390	4130	155	28160
Mercury	0.16	0.18	0.14	0.13
Nickel	15.4	18.2	15.9	39
Potassium	1470	2610	3440	83058
Selenium	1.2	13.3	3.8	NA
Silver	0.84	11.4	1.1	NA
Sodium	120	258	461	79585
Thallium	2.3	21.8	4.1	NA
Vanadium	53.3	194	102	24.1
Zinc	37.5	70.4	49.7	45.2

Notes:
1 - Values are 95 percent UTL values from BI report.
2 - Groundwater is for non-turbid unfiltered data set.
NA - Data were insufficient to calculate a background value.

Source: Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).

TABLE 4-2

HUMAN HEALTH SCREENING CRITERIA - SOIL AND SEDIMENT
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

CAS Number	Chemical	EPA Region 3 RBC[1]		EPA SSL[2]
		Residential	Soil to Groundwater	Soil to Air
Volatile Organic Compounds (ug/kg)				
67-64-1	Acetone	7800000 N	2500	100000000
108-88-3	Toluene	16000000 N	8800	650000
71-43-2	Benzene	12000 C	1.8	800
Semivolatile Organic Compounds (ug/kg)				
91-57-6	2-Methylnaphthalene	1600000 N	22000	NA
208-96-8	Acenaphthylene	4700000 (8) N	NA	NA
100-52-7	Benzaldehyde	7800000 N	NA	NA
56-55-3	Benzo(a)anthracene	870 C	1500	NA
50-32-8	Benzo(a)pyrene	87 C	370	NA
205-99-2	Benzo(b)fluoranthene	870 C	4500	NA
207-08-9	Benzo(k)fluoranthene	8700 C	45000	NA
191-24-2	Benzo(g,h,i)perylene	2300000 (3) N	NA	NA
218-01-9	Chrysene	87000 C	150000	NA
53-70-3	Dibenzo(a,h)anthracene	87 C	1400	NA
206-44-0	Fluoranthene	3100000 N	6300000	NA
193-39-5	Indeno(1,2,3-cd)pyrene	870 C	13000	NA
91-20-3	Naphthalene	1600000 N	150	NA
85-01-8	Phenanthrene	2300000 (3) N	NA	NA
129-00-0	Pyrene	2300000 N	680000	NA
Pesticides/PCBs (ug/kg)				
72-54-8	4,4'-DDD	2700 C	11000	NA
72-55-9	4,4'-DDE	1900 C	35000	NA
50-29-3	4,4'-DDT	1900 C	1200	NA
Explosives (mg/kg)				
9004-70-0	Nitrocellulose	NA	NA	NA
Inorganics (mg/kg)				
7429-90-5	Aluminum	78000 N	NA	NA
7440-38-2	Arsenic	0.43 C	0.026	750
7440-39-3	Barium	5500 N	2100	690000
7440-41-7	Beryllium	160 N	1200	1300
7440-43-9	Cadmium	39 N	27	1800
7440-70-2	Calcium	NA	NA	NA
7440-47-3	Chromium	230 (4) N	42	270
7440-48-4	Cobalt	1600 N	NA	NA
7440-50-8	Copper	3100 N	11000	NA
7439-89-6	Iron	23000 N	NA	NA
7439-92-1	Lead	400 (5)	NA	NA
7439-95-4	Magnesium	NA	NA	NA
7439-96-5	Manganese	1600 N	950	NA
7439-97-6	Mercury	23 (6) N	2 (7)	10
7440-02-0	Nickel	1600 N	130 (7)	13000
7440-09-7	Potassium	NA	NA	NA
7782-49-2	Selenium	390 N	19	NA
7440-23-5	Sodium	NA	NA	NA
7440-28-0	Thallium	5.5 N	3.6	NA
7440-62-2	Vanadium	550 N	5100	NA
7440-66-6	Zinc	23000 N	14000	NA

Notes:
1 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002.
2 - Soil Screening Levels for Inhalation EPA, May 1996. Soil Screening Guidance.
3- Value is for pyrene.
4 - Value is for hexavalent chromium.
5 - OSWER screening level. EPA,1994a:Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust and Lead-Contaminated Soil.
6 - Value is for mercuric chloride.
7 - Soil screening levels for migration to groundwater. EPA, May 1996. Soil Screening Guidance.
8 - Value is for acenaphthene.
C - Carcinogenic
N - Noncarcinogenic
NA - No criteria available.

TABLE 4-3

HUMAN HEALTH SCREENING CRITERIA - WATER
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

CAS Number	Chemical	EPA Region 3 RBC[1] Tap Water	EPA MCL[2]	EPA NRWQC[3]
Volatile Organic Compounds (ug/L)				
1330-20-7	Total Xylenes	12000 N	10000	NA
Semivolatile Organic Compounds (ug/L)				
91-57-6	2-Methylnaphthalene	120 N	NA	NA
106-44-5	4-Methylphenol	180 N	NA	NA
83-32-9	Acenaphthene	370 N	NA	1200
117-81-7	Bis(2-Ethylhexyl)phthalate	4.8 C	6	1.8
86-73-7	Fluorene	240 N	NA	1300
91-20-3	Naphthalene	6.5 N	NA	NA
98-95-3	Nitrobenzene	3.5 N	NA	17
85-01-8	Phenanthrene	180 (4) N	NA	NA
108-95-2	Phenol	22000 N	NA	21000
Pesticides/PCBs (ug/L)				
72-54-8	4,4'-DDD	0.28 C	NA	0.00083
Inorganics, Total (ug/L)				
7429-90-5	Aluminum	37000 N	50 to 200(5)	NA
7440-38-2	Arsenic	0.045 C	10	0.018
7440-39-3	Barium	2600 N	2000	1000
7440-41-7	Beryllium	73 N	4	NA
7440-43-9	Cadmium	18 N	5	NA
7440-70-2	Calcium	NA	NA	NA
7440-47-3	Chromium	110 (6) N	100	NA
7440-48-4	Cobalt	730 N	NA	NA
7440-50-8	Copper	1500 N	1300 (7)	1300
7439-89-6	Iron	11000 N	300 (5)	300
7439-92-1	Lead	NA	15 (7)	NA
7439-95-4	Magnesium	NA	NA	NA
7439-96-5	Manganese	730 N	50 (5)	50
7440-02-0	Nickel	730 N	NA	610
7440-09-7	Potassium	NA	NA	NA
7782-49-2	Selenium	180 N	50	170
7440-22-4	Silver	180 N	100 (5)	NA
7440-23-5	Sodium	NA	NA	NA
7440-28-0	Thallium	2.6 N	2	1.7
7440-62-2	Vanadium	260 N	NA	NA
7440-66-6	Zinc	11000 N	5000 (5)	9100
Explosives (ug/L)				
606-20-2	2,6-Dinitrotoluene	37 N	NA	0.11 (8)
121-82-4	RDX	0.61 C	NA	NA

Notes:
1 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002.
2 - EPA Drinking Water Regulations and Health Advisories, Summer 2000.
3 - EPA National Recommend Water Quality Criteria (NRWQC), April 1999.
4 - Value is for pyrene.
5 - Secondary MCL.
6 - Value is for hexavalent chromium.
7 - Action level.
8 - Value is for 2,4-dinitrotoluene.
C - Carcinogenic.
N - Noncarcinogenic.
NA - No criteria available.

TABLE 4-4

ECOLOGICAL SCREENING CRITERIA - SEDIMENT
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

PARAMETER	Screening Value	SOURCE
Volatile Organics (ug/kg)		
Acetone	NA	
Semi-Volatile Organics (ug/kg)		
2-Methylnaphthalene	70	BTAG
Acenaphthylene	44	BTAG
Benzaldehyde	NA	
Benzo(a)anthracene	261	BTAG
Benzo(a)pyrene	430	BTAG
Benzo(b)fluoranthene	3200	BTAG
Benzo(g,h,i)perylene	670	BTAG
Benzo(k)fluoranthene	240	LEL
Chrysene	384	BTAG
Dibenzo(a,h)anthracene	63.4	BTAG
Fluoranthene	600	BTAG
Indeno(1,2,3-cd)pyrene	600	BTAG
Naphthalene	160	BTAG
Phenanthrene	240	BTAG
Pyrene	665	BTAG
Pesticides/PCBs (ug/kg)		
4,4'-DDD	16	BTAG
4,4'-DDE	2.2	BTAG
Inorganics (mg/kg)		
Aluminum	58030	PEC
Arsenic	8.2	BTAG
Barium	48	AET
Beryllium	NA	
Cadmium	1.2	BTAG
Calcium	NA	
Chromium	81	BTAG
Cobalt	50	LEL
Copper	34	BTAG
Iron	20000	LEL
Lead	46.7	BTAG
Magnesium	NA	
Manganese	460	LEL
Nickel	20.9	BTAG
Potassium	NA	
Silver	1	BTAG
Sodium	NA	
Vanadium	57	AET
Zinc	150	BTAG
Explosives (mg/kg)		
Nitrocellulose	NA	

Notes:
NA = Not Available
AET = Apparent Effects Threshold (Buchman, 1999)
BTAG = EPA Region 3 BTAG Screening Levels (EPA, August 1995)
LEL = Lowest Effects Level (CCME, 1993)
PEC = Probable Effects Concentration (EPA, 1996)

TABLE 4-5

ECOLOGICAL SCREENING CRITERIA - SURFACE WATER / GROUNDWATER
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

PARAMETER	Surface Water / Groundwater Screening Value	Source
Volatile Organics (ug/L)		
Total Xylenes	6000	BTAG
Semivolatile Organics (ug/L)		
2-Mehtylnaphthalene	12	ORNL*
4,Methylphenol	NA	
Acenaphthene	520	BTAG
Bis(2-Ethylhexyl)phthalate	30	BTAG
Fluorene	430	BTAG
Naphthalene	100	BTAG
Nitrobenzene	27000	BTAG
Phenanthrene	6.3	BTAG
Phenol	79	BTAG
Pesticides/PCBs (ug/L)		
4,4'-DDD	0.6	BTAG
Explosives (ug/L)		
RDX	NA	
Inorganics (ug/L)		
Aluminum	25	BTAG
Arsenic	48	BTAG
Barium	10000	BTAG
Beryllium	5.3	BTAG
Cadmium	0.53	BTAG
Calcium	NA	
Chromium (VI)	2	BTAG
Cobalt	35000	BTAG
Copper	6.5	BTAG
Iron	320	BTAG
Lead	3.2	BTAG
Magnesium	NA	
Manganese	14500	BTAG
Nickel	160	BTAG
Potassium	NA	
Selenium	5	BTAG
Silver	0.0001	BTAG
Sodium	NA	
Thallium	40	AWQC
Vanadium	10000	BTAG
Zinc	30	BTAG

Notes:
NA = Not Available

AWQC = Ambient Water Quality Criteria (EPA, 1999)
BTAG = EPA Region 3 BTAG Screening Levels (EPA, August 1995)
ORNL = Oak Ridge National Laboratory (EPA, 1996)
*Naphthalene value was used as surrogate

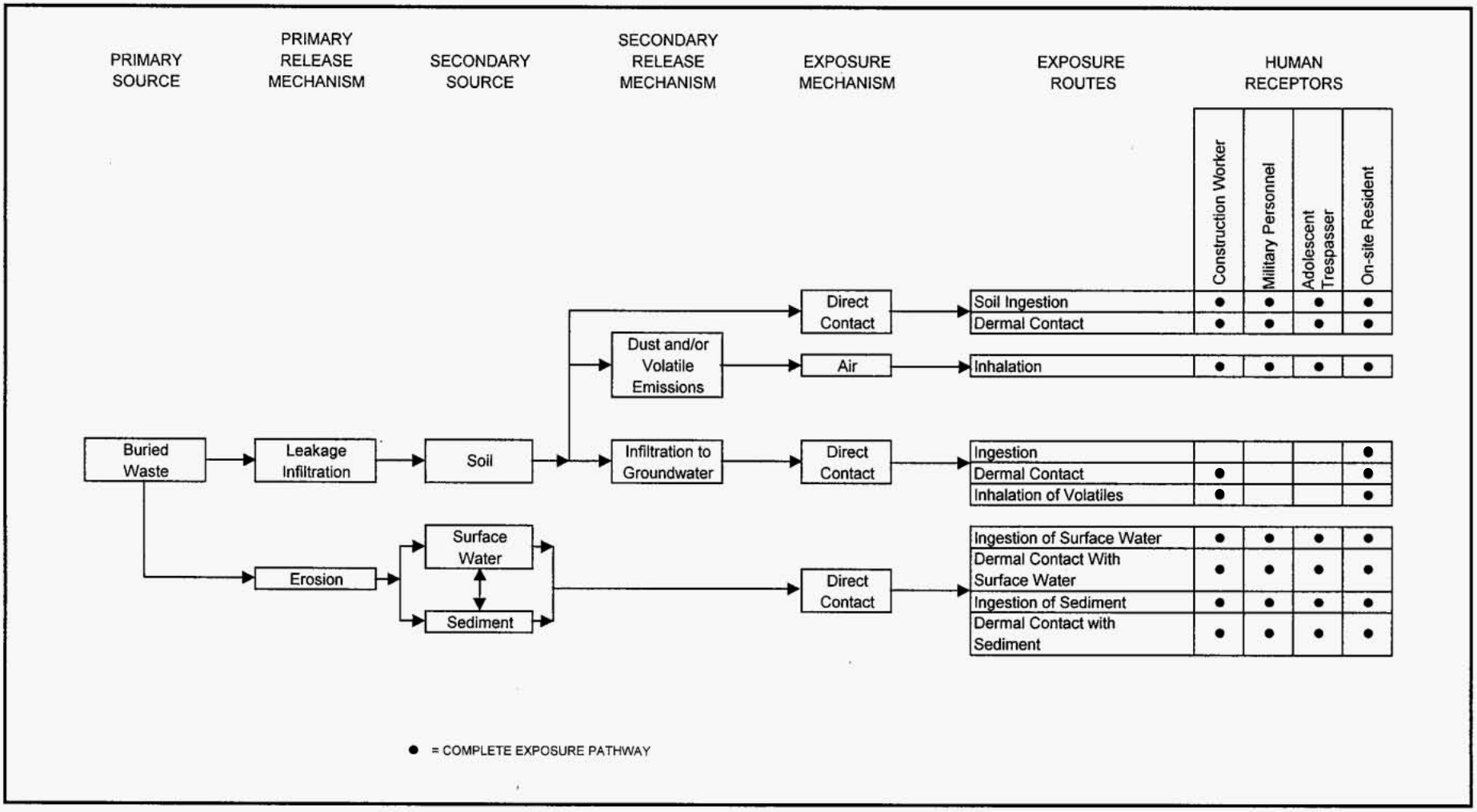


FIGURE 4-1

GENERAL CONCEPTUAL SITE MODEL
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

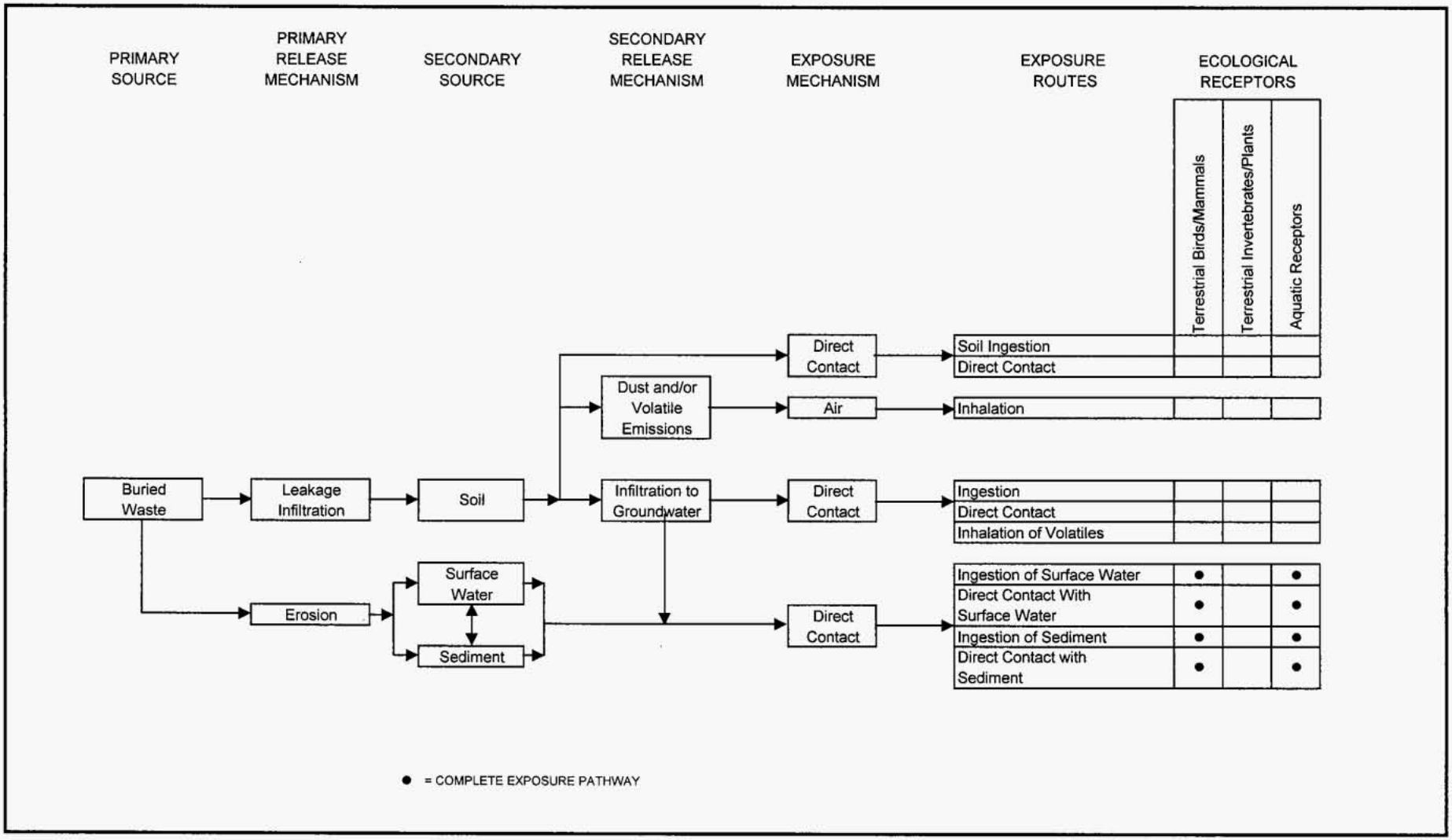


FIGURE 4-2

ECOLOGICAL GENERAL CONCEPTUAL SITE MODEL
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

5.0 SITE 32 – SUSPECTED TOOL BURIAL

5.1 BACKGROUND

During the IAS (Hart, 1983), one person who was interviewed believed that special beryllium-copper alloy hand tools used in explosive ordnance disposal work had been buried in the vicinity of Building 31SN (as shown on Figure 5-1). The area around the building was paved with asphalt. In addition, based on aerial photographs, the suspected burial area may include an area currently occupied by Building 2127. No other information was available to confirm this suspicion; however, another beryllium-copper alloy tool burial site (Site 34) is reported near Building D-21C (see Section 7.0).

5.2 SITE CHARACTERISTICS

5.2.1 Topography

As illustrated on Figure 5-1, the land surface at Site 32 gently slopes to the south.

5.2.2 Surface Water

During a rain event, precipitation either infiltrates the soil or runs off into the surrounding drainage swales, which direct the runoff to the south into Chicamuxen Creek.

5.2.3 Geology/Soils

No subsurface investigation was carried out at Site 32. Because of the findings of the site screening investigation at Site 34, it was determined that further investigation at Site 32 was not necessary.

5.2.4 Hydrogeology

No groundwater monitoring wells were installed at Site 32.

5.3 FIELD INVESTIGATION

No samples were collected at Site 32. Site 32 is similar to Site 34 with respect to the potential source of contamination, and based on the results of the investigation at Site 34 (Section 7.0), no sampling was determined to be necessary at Site 32.

5.4 ANALYTICAL RESULTS

Site 32 and Site 34 are similar with respect to the potential source of contamination, so the investigation of Site 32 was to be based on the results of sampling at Site 34. Because no contamination was detected at Site 34, described in Section 7.0, no samples were collected at Site 32.

5.5 HUMAN HEALTH RISK SCREENING EVALUATION

Because no COPCs were identified at Site 34, there is no reason to expect COPCs at Site 32. The human health risk evaluation of the results from Site 34 are included in Section 7.0, and no unacceptable risk to human health was identified.

5.6 ECOLOGICAL RISK SCREENING EVALUATION

Because no COPCs were identified at Site 34, there is no reason to expect COPCs at Site 32. The ecological risk evaluation of the results for Site 34 is included in Section 7.0, and that evaluation determined that there is no risk to ecological receptors.

5.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

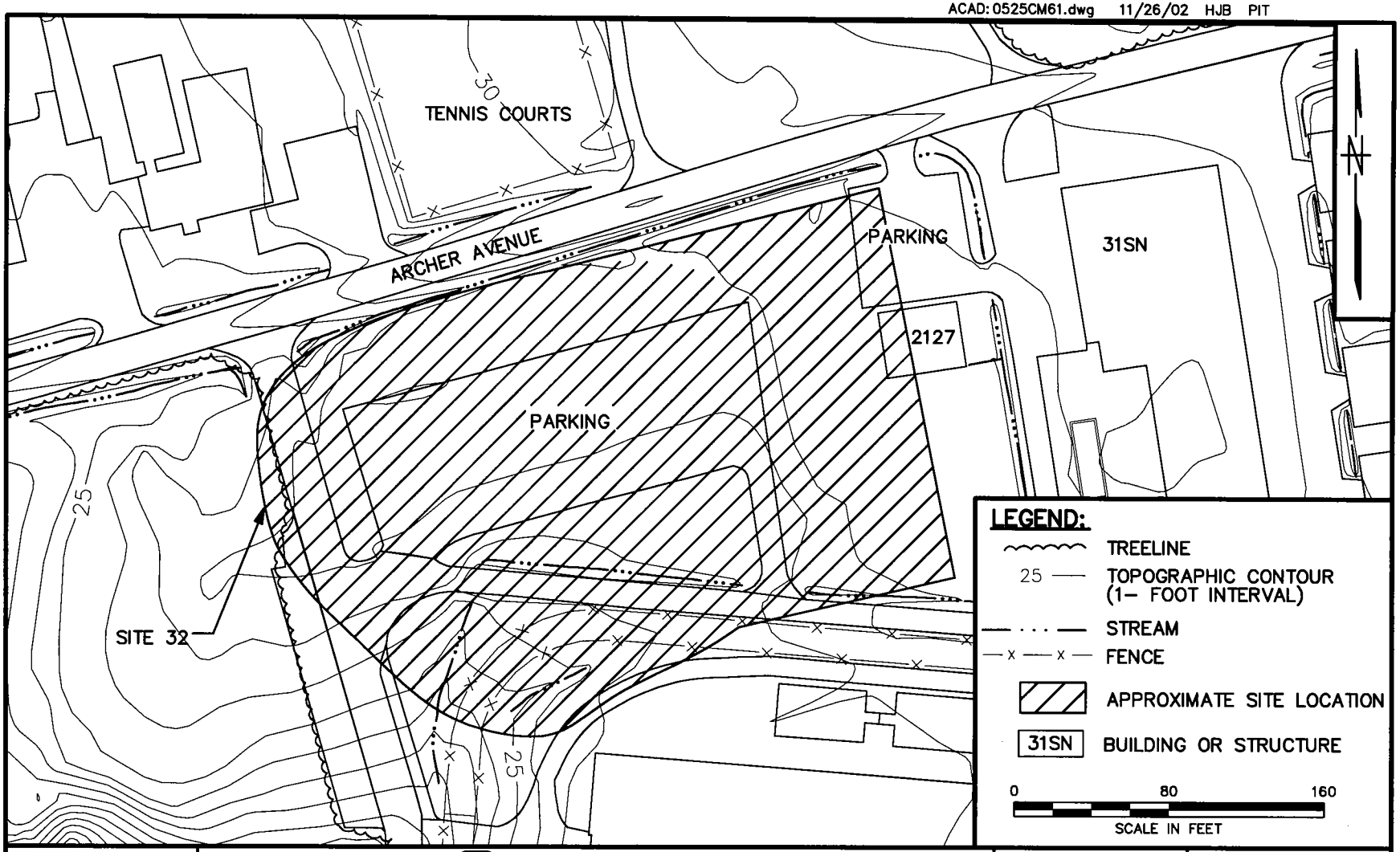
5.7.1 Summary and Conclusions

The evaluation of Site 34 in Section 7.0 shows that there are no risks to human health and ecological receptors from Site 34. Because Site 32 is similar to Site 34, no unacceptable risks to human health and ecological receptors are expected from Site 32. Therefore, no action needs to be taken at Site 32.

5.7.2 Recommendations

No action is required for Site 32, so the site should be removed from additional study under the FFA, and a no action decision document should be prepared for this site in accordance with the FFA.

ACAD: 0525CM61.dwg 11/26/02 HJB PIT



DRAWN BY HJB DATE 5/15/02	Tetra Tech NUS, Inc.	CONTRACT NO. 0525	OWNER NO. 0325
CHECKED BY DATE 11/25/02 COST/SCHED-AREA	SITE LAYOUT SITE 32 – SUSPECTED TOOL BURIAL INDIV–NSWC, INDIAN HEAD, MARYLAND	APPROVED BY	DATE
		APPROVED BY	DATE 11/25/02
SCALE AS NOTED		DRAWING NO. FIGURE 5–1	REV. 0

FORM CADD NO. TtNUS_AH.DWG - REV 0 - 1/22/98

6.0 SITE 33 – SCRAP METAL PIT

6.1 BACKGROUND

Site 33 is located within the Stump Neck Annex, about 100 feet southeast of Buildings 2116 and 2136. An excavation, 10 feet by 10 feet by 30 feet long, reportedly contained scrap metal The location of the site is shown on Figure 6-1. The metal was said to consist of parts of mines, torpedoes, and other explosive-inert items. The location was approximate and no other details were available (Hart, 1983).

6.2 SITE CHARACTERISTICS

6.2.1 Topography

As illustrated on Figure 6-1, the land surface at Site 33 moderately slopes to the northwest. The land surface elevation across the site ranges from approximately 82 feet above msl in the southwestern corner to approximately 95 feet above msl in the northeastern corner.

6.2.2 Surface Water

Precipitation either infiltrates the soil or runs off the ground surface into the intermittent stream that is southwest of Building 2136 and flows to the west.

6.2.3 Geology/Soils

Logs from soil borings and test pits installed at the site indicate that shallow geologic conditions consist primarily of gravelly clay overlying sand and silt mixtures. The gravels are composed of quartz and are well rounded to subrounded. Soil boring and test pit logs are provided in Appendix B.

6.2.4 Hydrogeology

The shallow aquifer beneath the site displays the characteristics of a semi-confined to confined system. Groundwater at the site was encountered at approximately 20 to 22 feet bgs and, after the wells were installed, the water in the well rose and stabilized to approximately 10 feet bgs. The potentiometric surface, shown on Figure 6-4, shows that the groundwater flow direction is to the southwest. The groundwater levels used to generate potentiometric contours were measured on February 12, 2002. The groundwater-level data are provided in Appendix E.

6.3 FIELD INVESTIGATION

A geophysical survey and test pit excavations were completed at the site to locate the scrap metal burial pit and to evaluate the potential presence of contaminants. In addition, groundwater and subsurface soil samples were collected and submitted to a fixed-base laboratory for chemical analysis. The samples and analyses are summarized on Table 6-1.

6.3.1 Geophysical Investigation

A geophysical survey using a magnetometer was performed at the site to locate the scrap metal burial pit. The magnetometer measures the earth's total geomagnetic field at a particular location in units of nano-teslas. The total magnetic field consists of three components: main field, external field, and local variations. The main field and the external field remain fixed over the duration of the survey, and the local variations are attributed to metallic objects at the ground surface or buried in the ground. The effective penetration depth of the instrument is approximately 50 feet, and the horizontal range varies with the size and density of the targets.

As shown on Figure 6-2, the survey was conducted on a reference grid that was 100 feet by 200 feet. The resulting magnetic contour map is presented on Figure 6-2, the anomalies are indicated by the high density of the contour lines in circular patterns. The most significant anomaly is located in the southwestern corner of the grid. Based on the size and intensity of this anomaly, it was believed to be the metal waste burial pit area. The other anomalies noted by the survey were generally small or explained by surface articles such as unused concrete culvert pipe sections reinforced with steel rebar. A detailed report of the geophysical survey results is provided in Appendix D.

6.3.2 Temporary Well Installation and Groundwater Sampling

Three temporary monitoring wells were installed at the site to determine if wastes from the scrap metal burial pit had contaminated shallow groundwater. One well (S33TW003) was installed immediately adjacent to and downgradient of the suspected burial area. Two wells (S33TW001 and S33TW002) were installed upgradient. Well locations are shown on Figure 6-2. The wells were constructed with 2-inch-ID PVC riser and screen material and installed and abandoned as described in Section 3.0. State of Maryland abandonment reports and TtNUS temporary well construction diagrams are presented in Appendix A.

Groundwater samples were collected from the temporary wells as described in Section 3.2.3, and analyzed for TAL metals (total and dissolved) and explosives including nitroguanidine and nitroglycerine (excluding nitrocellulose). Groundwater sample log sheets are provided in Appendix C.

6.3.3 Subsurface Soil Sampling

Six subsurface soil samples were collected; two from each upgradient well boring (S33TW001/SB001 and S33TW002/SB002) and two from S33TP003 (sample location designation as S33SB003). The soil samples were collected using HSA drilling and split-spoon sampling techniques and using a backhoe at the test pit location. Sample locations are shown on Figure 6-2.

Two subsurface soil samples were selected from each location based upon field observations and the depths proposed in the work plan. No elevated PID readings or wastes were encountered during the subsurface investigation. The samples were submitted to a fixed-base laboratory for analysis for TAL metals and explosives including nitroguanidine and nitroglycerine (excluding nitrocellulose). The samples and analyses are summarized on Table 6-1. Soil sample log sheets are provided in Appendix C.

One field duplicate S33SBDUP0101 was collected at the same location as S33SB0030201 and analyzed for TAL metals and explosives excluding nitrocellulose.

6.3.4 Test Pit Activities

Test pit excavations were conducted in suspected areas, as described in Section 6.3.1. The test pit locations are shown on Figure 6-2. The excavation at S33TP001 uncovered a 40-foot section of steel rebar that was 2 inches in diameter. The S33TP001 test pit consisted of two excavations installed at right angles. Both excavations had approximate widths of 3 feet, lengths of 10 feet and depths of 10 feet bgs. Test pits S33TP002 and S33TP003 were excavated at two magnetic anomaly locations, and scrap metal was not found at either test pit. Test pit logs are provided in Appendix B.

6.4 ANALYTICAL RESULTS AND COPC SELECTION

This section provides the data, evaluation, and selection of human health COPCs for subsurface soil and groundwater contamination at Site 33. The selection of ecological COPCs is discussed in Section 6.6. The human health screening evaluation is based on the following samples:

- Six subsurface soil samples
- Three groundwater samples collected from temporary monitoring wells

The results were evaluated as described in Section 4.3. Complete chemical analytical results are presented in Appendix H.

6.4.1 Data and Risk-Based Evaluation of Subsurface Soil Contamination

Positive analytical results and summary statistics for subsurface soil samples are provided in Tables 6-2 and 6-3, respectively.

Based on the analytical results, seven metals (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) were detected at concentrations exceeding human health screening levels.

- All of the samples had at least one the seven metals detected at concentrations greater than the screening concentrations.

- Of the metals that exceeded the screening levels, only arsenic was detected at a maximum concentration greater than the clayey soil background threshold concentration. The remaining metals were detected at maximum concentrations less than the clayey soil background threshold concentrations.

- Maximum concentrations for aluminum, arsenic, chromium, iron, manganese, and vanadium were reported in sample S33SB0030201 or its duplicate, S33SBDUP0101.

The COPC concentrations greater than risk screening levels and background are shown on Figure 6-3.

None of the other detected metals exceeded any screening levels. No explosives were detected in the subsurface soil.

Based on the laboratory results, arsenic is to be retained as a soil COPC for further risk evaluation.

6.4.2 Data and Risk-Based Evaluation of Groundwater Contamination

Positive analytical results for unfiltered and filtered groundwater samples are provided in Table 6-4. The summary statistics for unfiltered and filtered groundwater samples are provided in Table 6-5.

Based on the analytical results, six metals (aluminum, arsenic, chromium, iron, manganese, and vanadium) were detected at concentrations exceeding human health screening concentrations.

- All samples had at least one of the six metals detected at a concentration greater than screening concentrations.

- Of the six metals, three (aluminum, iron, and manganese) were detected at maximum concentrations less than the background threshold concentrations.

- Arsenic, chromium, and vanadium were detected at maximum concentrations greater than the background threshold concentrations in a single sample (S33TW0030001, the most downgradient well).

- The maximum concentrations for aluminum, arsenic, chromium, iron, manganese, and vanadium were reported in sample S33TW0030001.

- With the exception of manganese, the metals concentrations in the filtered samples were less than screening levels and background threshold concentrations. Manganese concentrations in all of the filtered samples were greater than the background threshold concentration.

The COPC concentrations greater than risk screening levels and background for unfiltered groundwater samples are shown on Figure 6-4.

The sample with the maximum concentrations, S33TW0030001, also had a very high turbidity, more than 999 NTUs, as measured by a field turbidity meter during sample collection. This high turbidity is probably responsible for the very high metals concentrations in the sample. The metals concentrations in the filtered sample from the same location were very low and were comparable to the filtered metals concentrations from the other two wells..

None of the other detected metals exceeded any screening levels. Only one explosive, 2,6-dinitrotoluene, was detected in the groundwater, but it did not exceed the screening level.

Based on the laboratory results, arsenic, chromium, and vanadium are to be retained as groundwater COPCs for further risk evaluation.

6.5 HUMAN HEALTH RISK SCREENING EVALUATION

This section contains a summary of the human health risk estimates for Site 33. The methodology used to calculate the risks presented in this section is provided in Appendix I. Chemical-specific risk estimates and risks to affected target organs for COPCs in subsurface soil and groundwater are presented in Tables 6-6 and 6-7, respectively. A discussion of the estimated noncarcinogenic and carcinogenic risks is provided in the balance of this section.

6.5.1 Subsurface Soil

Estimated incremental lifetime cancer risks (ILCRs) for exposure to subsurface soil at Site 33 are presented in Table 6-6. The cumulative cancer risk is 5.8×10^{-5}, which is within EPA's target cancer risk range of 1.0×10^{-6} to 1.0×10^{-4}.

The cumulative HI (the sum of HQs for each COPC) is 1.1, which is approximately equal to the target level of 1 for noncarcinogenic health effects. Given the marginal exceedance of the benchmark, adverse health effects are not anticipated for receptors exposed to subsurface soil under the defined conditions.

6.5.2 Groundwater

ILCRs for exposure to groundwater at Site 33 are presented in Table 6-7. The cumulative cancer risk is 2.6×10^{-4}, which exceeds EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}. Arsenic (ILCR = 2.6×10^{-4}) was the only contributor to the cumulative ILCR. The arsenic concentration also exceeded the MCL.

The cumulative HI is 1.9. When the HI exceeds 1, target organ effects for individual COPCs contributing to the risk are considered. Arsenic, chromium, and vanadium were the contributors to the HI and they affect different target organs. The target organs for arsenic (HQ = 1.1) are the skin and cardiovascular system. The toxicity criterion for chromium (HQ = 0.5) is based on the No Observed Adverse Effect Level (NOAEL) and the toxicity criterion for vanadium (HQ = 0.3) is based on the No Observed Effect Level (NOEL). Since the HQs for the affected target organs are less than or approximately equal to the acceptable level of 1.0, adverse health effects are not anticipated for exposures to groundwater at Site 33.

Because of the high turbidity in the sample with the highest metals concentrations, the risk was also calculated for filtered water, as shown on Table 6-8. For this calculation, the cumulative cancer risk is below the EPA's target risk range, and the HQ is much less than 1.0.

Note that there is currently no risk to current users of the site because there is no exposure to the groundwater. Similarly, the risk from the subsurface soil to current site users under an industrial scenario is substantially lower than the residential exposure. Risk calculations for industrial exposure to subsurface soil are included in Appendix I.

6.6 ECOLOGICAL RISK SCREENING EVALUATION

Although subsurface samples were collected at Site 33, subsurface sample results were not included in the ecological COPC screening because invertebrates and plants are not exposed to subsurface soils. Therefore, only the groundwater data was used in the ecological COPC screening. Groundwater data was

evaluated due to the possibility of discharge to Mattawoman Creek and potential risk to aquatic receptors. Unfiltered and filtered samples were evaluated in the screening (see Table 6-9).

6.6.1 Data and Risk-Based Evaluation of Groundwater Contamination

Six metals in the unfiltered samples had maximum concentrations in sample S33TW0030001 exceeding the COPC screening values, including aluminum, chromium, copper, iron, lead, and zinc. However, all maximum metals concentrations were below the screening values in the filtered samples. Filtered sample results are believed to better represent any indications of toxicity when evaluating risks to aquatic receptors because dissolved metals are potentially more bioavailable (EPA, 1992). For these reasons, metals are not considered to pose potential risks to aquatic receptors.

One explosive, 2,6-dinitrotoluene was retained as a COPC because a screening value is unavailable for comparison. However, the maximum detected concentration (0.13 ug/L) is well below the BTAG screening level for 2,4-dinitrotoluene (230 ug/L). Even though the chemicals are slightly different it is unlikely that the low detection of 2,6-dinitrotoluene will cause a risk to aquatic receptors. Therefore, 2,6-dinitrotoluene is not considered to pose a potential risk to aquatic receptors.

6.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.7.1 Summary and Conclusions

Arsenic was detected in the subsurface soil and arsenic, chromium, and vanadium were detected in groundwater at concentrations greater than human health screening levels. The metals were considered to be COPCs and a preliminary risk evaluation was performed.

The preliminary human health risk evaluation showed that the subsurface soil concentrations were within risk range acceptable to the EPA, but that the arsenic concentration in groundwater exceeded the acceptable risk range. The arsenic concentration in groundwater also exceeded the MCL. However, the groundwater sample with the highest metals concentrations had a very high turbidity, and the unfiltered metals concentrations from this sample may not be representative of the groundwater. Using the filtered groundwater analytical results for the purposes of comparison, the risk is less than the EPA's target range, and the HQ is much less than 1.0.

The preliminary ecological risk evaluation showed that the groundwater concentrations did not pose unacceptable risks to ecological receptors. Because the site was a disposal pit, contamination, if present, was not anticipated to be at the surface. No surface soil samples were collected, so terrestrial ecological receptors could not be quantitatively evaluated.

6.7.2 Recommendations

Because the high turbidity in the groundwater sample, an additional supplemental investigation is recommended. This supplemental investigation would consist of installing a temporary monitoring well near S33TW003 so that a low turbidity sample can be obtained and analyzed. If the results show that metals are at concentrations acceptable to human health, then no action is recommended. If the results show that metals are at concentrations unacceptable to human health, then an RI and FS are recommended for this site.

TABLE 6-1

ENVIRONMENTAL SAMPLING AND ANALYSIS SUMMARY - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	Sample Designation	Sample Depth (feet below ground surface) (1)	Sample Analysis					
			TCL VOCs	TCL SVOCs	TAL Metals(2)	Beryllium and Copper(2)	TCL Pesticides/ PCBs	Explosives (with nitrocellulose, nitroguanidine, and nitroglycerine)
SUBSURFACE SOIL								
S33SB001 / S33TW001	S33SB0010101	6-8			●			● (3)
S33SB001 / S33TW001	S33SB0010201	14-16			●			● (3)
S33SB002 / S33TW002	S33SB0020101	6-8			●			● (3)
S33SB002 / S33TW002	S33SB0020201	14-16			●			● (3)
S33SB003	S33SB0030101	3 – 5			●			● (3)
S33SB003	S33SB0030201	8 – 10			●			● (3)
S33SB0030201	S33SBDUP0101	8 – 10			●			● (3)
TEMPORARY WELLS								
S33TW001	S33TW0010001	--			●			● (3)
S33TW002	S33TW0020001	--			●			● (3)
S33TW003	S33TW0030001	--			●			● (3)

Notes:

1 Sample depths are as collected in the field.
2 Groundwater samples were analyzed for total and filtered metals.
3 Excluding nitrocellulose.

TABLE 6-2

SUMMARY OF POSITIVE DETECTIONS - SUBSURFACE SOIL - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S33SB001/TW001	S33SB001/TW001	S33SB002/TW002	S33SB002/TW002	S33SB003/TW003	S33SB003/TW003	S33SB003/TW003
Sample Number	S33SB0010101	S33SB0010201	S33SB0020101	S33SB0020201	S33SB0030101	S33SB0030201	S33SBDUP0101
Duplicate of:							S33SB0030201
Collection Date	02/07/02	02/07/02	02/08/02	02/08/02	02/12/02	02/12/02	02/12/02
Interval, feet bgs	6 - 8	14 - 16	6 - 8	14 - 16	3 - 5	8 - 10	8 - 10
Inorganics (mg/kg)							
ALUMINUM	6520	5870	2760	4880	7660	12500	13000
ARSENIC	6.1	5.3 K	1.6 K	5.6 K	3.2 K	25 K	17.9 K
BARIUM	29.5	40.3	17.3	29.4	15.9	22.4	20.4
BERYLLIUM	0.34 K	1.3 K	0.16 K	1.5 K	0.22 K	1.9 K	1.5 K
CALCIUM	551	1170	165	640	8.9 U	14.1 U	30.6 U
CHROMIUM	15.1	18	11.6	21.2	16.6	44.1	47.5
COBALT	0.97 U	3 J	0.22 U	2 J	1.5 J	2.5 J	1.5 J
COPPER	3.6 K	7 K	3.3 K	13.2	7.6 K	4.7 J	3.9 J
IRON	12700	17700	7770	32300	15400	50200	40300
LEAD	8.4 J	9.3 J	4.4 J	7.9 J	8 J	10.1 J	7.2 J
MAGNESIUM	625	897	177	641	554	1930	1980
MANGANESE	2.4 J	16.8 J	1.4 J	21.8 J	20.9 J	228 J	107 J
MERCURY	0.047 U	0.055	0.055 U	0.046 U	0.055 U	0.057 U	0.059 U
NICKEL	2.9 K	9.6 K	0.94 U	13 K	3.1 K	9.5 K	7.3 K
POTASSIUM	546 J	981 J	292 J	853 J	543 J	3990 J	4100 J
SELENIUM	0.38 U	0.35 UL	0.32 U	0.43 UL	0.42 U	0.61 J	0.46 UL
THALLIUM	0.38 U	0.35 UL	0.33 K	0.63 J	0.42 U	1.1 K	0.93 J
VANADIUM	36.2	29.9	14.4 K	36.8	25.1	55.6	49.5
ZINC	12.1 U	37	5.9 K	36.3	14.6	49.3	38.8

Notes:
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.
= Sample concentration exceeds screening concentration. See Table 6-3.

TABLE 6-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 33

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Residential (5)	EPA SSLs Soil to Air(6)	U.S. EPA Region 3 SSLs Soil to Groundwater(7)	COPC Flag	Rationale for Contaminant Deletion or Selection(8)
Inorganics																	
7429-90-5	Aluminum	2760		13000		mg/kg	S33SB0030201-D	6/6	NA	6740	13000	35400	7800 N	NA	NA	No	BKG
7440-38-2	Arsenic	1.6	K	25	K	mg/kg	S33SB0030201	6/6	NA	7.21	25	18.9	0.43 C	750	0.026	Yes	ASL
7440-39-3	Barium	15.9		40.3		mg/kg	S33SB0010201	6/6	NA	25.6	40.3	134	550 N	690000	2100	No	BSL, BKG
7440-41-7	Beryllium	0.16	K	1.9	K	mg/kg	S33SB0030201	6/6	NA	0.870	1.9	3.3	16 N	1300	1200	No	BSL, BKG
7440-70-2	Calcium	165		1170		mg/kg	S33SB0010201	4/6	8.9 - 30.6	424	1170	2590	NA	NA	NA	No	NUT, BKG
7440-47-3	Chromium	11.6		47.5		mg/kg	S33SB0030201-D	6/6	NA	21.4	47.5	60.1	23 (9) N	270	42	No	BKG
7440-48-4	Cobalt	1.5	J	3	J	mg/kg	S33SB0010201	4/6	0.22 - 0.97	1.52	3	133	160 N	NA	NA	No	BSL, BKG
7440-50-8	Copper	3.3	K	13.2		mg/kg	S33SB0020201	6/6	NA	6.50	13.2	48.6	310 N	NA	11000	No	BSL, BKG
7439-89-6	Iron	7770		50200		mg/kg	S33SB0030201	6/6	NA	21853	50200	83100	2300 N	NA	NA	No	BKG
7439-92-1	Lead	4.4	J	10.1	J	mg/kg	S33SB0030201	6/6	NA	7.78	10.1	40.5	400 (10)	NA	NA	No	BSL, BKG
7439-95-4	Magnesium	177		1980		mg/kg	S33SB0030201-D	6/6	NA	808	1980	2640	NA	NA	NA	No	NUT, BKG
7439-96-5	Manganese	1.4	J	228	J	mg/kg	S33SB0030201	6/6	NA	38.5	228	4130	160 N	NA	950	No	BKG
7439-97-6	Mercury	0.055		0.055		mg/kg	S33SB0010201	1/6	0.046 - 0.059	0.031	0.055	0.18	2.3 (11) N	10	2	No	BSL, BKG
7440-02-0	Nickel	2.9	K	13	K	mg/kg	S33SB0020201	5/6	0.94	6.25	13	18.2	160 N	13000	130 (12)	No	BSL, BKG
7440-09-7	Potassium	292	J	4100	J	mg/kg	S33SB0030201-D	6/6	NA	1210	4100	2610	NA	NA	NA	No	NUT
7782-49-2	Selenium	0.61	J	0.61	J	mg/kg	S33SB0030201	1/6	0.32 - 0.46	0.228	0.61	13.3	39 N	NA	19	No	BSL, BKG
7440-28-0	Thallium	0.33	K	1.1	K	mg/kg	S33SB0030201	3/6	0.35 - 0.42	0.425	1.1	21.8	0.55 N	NA	3.6	No	BKG
7440-62-2	Vanadium	14.4	K	55.6		mg/kg	S33SB0030201	6/6	NA	32.5	55.6	194	55 N	NA	5100	No	BKG
7440-66-6	Zinc	5.9	K	49.3		mg/kg	S33SB0030201	5/6	12.1	24.0	49.3	70.4	2300 N	NA	14000	No	BSL, BKG

Notes:
1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL for clayey soils from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TINUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Soil Screening Levels for Inhalation EPA, May 1996. Soil Screening Guidance.
7 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. DAF (Dilution attenuation factor) of 20.
8 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)
9 - Value is for hexavalent chromium.
10 - OSWER screening level. EPA,1994:Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil.
11 - Value is for mercuric chloride.
12 - Soil Screening Levels for migration to groundwater. EPA, May 1996. Soil Screening Guidance.
Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
K = Estimated value, biased high.
C = Carcinogenic.
N = Noncarcinogenic.

Associated Samples:
S33SB0010101 S33SB0030101
S33SB0010201 S33SB0030201
S33SB0020101 S33SB0030201-D
S33SB0020201

TABLE 6-4

SUMMARY OF POSITIVE DETECTIONS - GROUNDWATER - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location Sample Number Unfiltered/filtered? Collection Date	S33SB001/TW001 S33TW0010001 Unfiltered 02/08/02	S33SB001/TW001 S33TW0010001-F Filtered 02/09/02	S33SB002/TW002 S33TW0020001 Unfiltered 02/12/02	S33SB002/TW002 S33TW0020001-F Filtered 02/13/02	S33SB003/TW003 S33TW0030001 Unfiltered 02/12/02	S33SB003/TW003 S33TW0030001-F Filtered 02/08/02
Explosives (ug/L)						
2,6-DINITROTOLUENE	0.2 U		0.11 J		0.13 J	
Inorganics (ug/L)						
ALUMINUM	**286**	**53.5 U**	**435**	17.2 U	**15400**	18.6 U
ARSENIC	**2 U**	**2 U**	**2 U**	**2 U**	**11.8 K**	2 U
BARIUM	25.8 J	25.3	21.8 J	21.8	117 J	22.9
BERYLLIUM	0.2 U	0.2 U	0.2 U	0.2 U	2.8 K	0.2 U
CALCIUM	3780	3800	2570	2790	5400	2760
CHROMIUM	1.7 K	0.75 K	1.8 K	0.4 U	**56**	0.64 K
COBALT	3.9 U	3.8 U	3.1 U	4 U	**42.8 K**	3.3 U
COPPER	1.4 U	1 U	1.7 U	1 U	26.8	2.6 U
IRON	**700**	223	**1060**	23 U	**30600**	23 U
LEAD	0.4 U	0.4 U	0.77 U	0.4 U	9.8	0.4 U
MAGNESIUM	**1130**	**1130**	**905**	**969**	**4210**	**897**
MANGANESE	**59.3**	**62.7**	**62.8**	**61.2**	**191**	**61.5**
NICKEL	4.6 U	4.4 U	2.8 U	2.6 U	31 K	3.4 U
POTASSIUM	1380	1380	1470	1280	7290	1200
SODIUM	3110 U	3090 U	6070	2350 U	6320	3070 U
VANADIUM	1.1 K	0.3 U	2 K	0.37 K	**76.4 K**	0.3 U
ZINC	16.9 U	15 U	18.3 U	10.5 U	**129**	14.2 U

Notes:
Blank means no analysis was performed.
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.
= Sample concentration exceeds screening concentration. See Table 6-5.

TABLE 6-5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH GROUNDWATER - SITE 33
SITE SCREENING STUDY
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 33

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Tap Water (5)	Potential ARAR/TBC Value(6)	Potential ARAR/TBC Source(6)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Inorganics, Total																	
7429-90-5	Aluminum	286		15400		ug/L	S33TW0030001	3/3	NA	5374	15400	286545198	3700 N	50 to 200	SMCL	No	BKG
7440-38-2	Arsenic	11.8	K	11.8	K	ug/L	S33TW0030001	1/3	2	4.60	11.8	NA	0.045 C	10	MCL	Yes	ASL
7440-39-3	Barium	21.8	J	117	J	ug/L	S33TW0030001	3/3	NA	54.9	117	254	260 N	2000	MCL	No	BSL, BKG
7440-41-7	Beryllium	2.8	K	2.8	K	ug/L	S33TW0030001	1/3	0.2	1.00	2.8	NA	7.3 N	4	MCL	No	BSL
7440-70-2	Calcium	2570		5400		ug/L	S33TW0030001	3/3	NA	3917	5400	599450	NA	NA	NA	No	NUT, BKG
7440-47-3	Chromium	1.7	K	56		ug/L	S33TW0030001	3/3	NA	19.8	56	20.9	11 (8) N	100	MCL	Yes	ASL
7440-48-4	Cobalt	42.8	K	42.8	K	ug/L	S33TW0030001	1/3	3.1 - 3.9	15.4	42.8	39.6	73 N	NA	NA	No	BSL
7440-50-8	Copper	26.8		26.8		ug/L	S33TW0030001	1/3	1.4 - 1.7	9.45	26.8	22.4	150 N	1300 (9)	MCL	No	BSL
7439-89-6	Iron	700		30600		ug/L	S33TW0030001	3/3	NA	10787	30600	57199	1100 N	300	SMCL	No	BKG
7439-92-1	Lead	9.8		9.8		ug/L	S33TW0030001	1/3	0.4 - 0.77	3.46	9.8	NA	NA	15 (9)	MCL	No	BSL
7439-95-4	Magnesium	905		4210		ug/L	S33TW0030001	3/3	NA	2082	4210	31254	NA	NA	NA	No	NUT, BKG
7439-96-5	Manganese	59.3		191		ug/L	S33TW0030001	3/3	NA	104	191	28160	73 N	50	SMCL	No	BKG
7440-02-0	Nickel	31	K	31	K	ug/L	S33TW0030001	1/3	2.8 - 4.6	11.6	31	39	73 N	NA	NA	No	BSL, BKG
7440-09-7	Potassium	1380		7290		ug/L	S33TW0030001	3/3	NA	3380	7290	83058	NA	NA	NA	No	NUT, BKG
7440-23-5	Sodium	6070		6320		ug/L	S33TW0030001	2/3	3110	4648	6320	79585	NA	NA	NA	No	NUT, BKG
7440-62-2	Vanadium	1.1	K	76.4	K	ug/L	S33TW0030001	3/3	NA	26.5	76.4	24.1	26 N	NA	NA	Yes	ASL
7440-66-6	Zinc	129		129		ug/L	S33TW0030001	1/3	16.9 - 18.3	48.9	129	45.2	1100 N	5000	SMCL	No	BSL
Explosives																	
606-20-2	2,6-Dinitrotoluene	0.11	J	0.13	J	ug/L	S33TW0030001	2/3	0.2	0.113	0.13	NA	3.7 N	NA	NA	No	BSL
Inorganics, Filtered																	
7440-39-3	Barium	21.8		25.3		ug/L	S33TW0010001-F	3/3	NA	23.3	25.3	254	260 N	2000	MCL	No	BSL, BKG
7440-70-2	Calcium	2760		3800		ug/L	S33TW0010001-F	3/3	NA	3117	3800	599450	NA	NA	NA	No	NUT, BKG
7440-47-3	Chromium	0.64	K	0.75	K	ug/L	S33TW0010001-F	2/3	0.4	0.530	0.75	20.9	11 N	100	MCL	No	BSL, BKG
7439-89-6	Iron	223		223		ug/L	S33TW0010001-F	1/3	23	82.0	223	57199	1100 N	300	SMCL	No	BSL, BKG
7439-95-4	Magnesium	897		1130		ug/L	S33TW0010001-F	3/3	NA	999	1130	31254	NA	NA	NA	No	NUT, BKG
7439-96-5	Manganese	61.2		62.7		ug/L	S33TW0010001-F	3/3	NA	61.8	62.7	28160	73 N	50	SMCL	No	BKG
7440-09-7	Potassium	1200		1380		ug/L	S33TW0010001-F	3/3	NA	1287	1380	83058	NA	NA	NA	No	NUT, BKG
7440-62-2	Vanadium	0.37	K	0.37	K	ug/L	S33TW0020001-F	1/3	0.3	0.223	0.37	24.1	26 N	NA	NA	No	BSL, BKG

Notes:
1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Drinking Water Standards and Health Advisories, EPA 2000.
7 - Rationale Codes: Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)
8 - Value is for hexavalent chromium.
9 - Action Level.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
J = Estimated Value.
K = Estimated value, biased high.
MCL - Maximum Contaminant Level.
SMCL - Secondary Maximum Contaminant Level.
C = Carcinogenic
N = Noncarcinogenic

Shading indicates that the maximum detected concentration exceeded the screening criteria; therefore, the chemical was retained as a COPC.

Associated Samples:

S33TW0010001	S33TW0010001-F
S33TW0020001	S33TW0020001-F
S33TW0030001	S33TW0030001-F

TABLE 6-6

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SUBSURFACE SOIL - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary	RBC[1] (mg/kg)	Estimated HQ
Arsenic	25	0.43	5.8E-05	Skin, Vascular	23	1.1
	Total Carcinogenic Risk		5.8E-05		Total HI	1.1

Target Organ HIs

Total Vascular HI =	1.1
Total Skin HI =	1.1

Notes:

1 Risk-Based Concentration (RBC) Table (EPA Region 3, 2002). Some noncarcinogenic RBCs not presented in the EPA Region 3 RBC Table were calculated per the methodology detailed in Appendix I.

TABLE 6-7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - GROUNDWATER - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration µg/L	RBC[1] µg/L	Estimated ILCR	Primary	RBC[1] µg/L	Estimated HQ
Arsenic	11.8	0.045	2.6E-04	Skin, Vascular	11	1.1
Chromium	56	NA	NA	NOAEL	110	0.5
Vanadium	76.4	NA	NA	NOEL	260	0.3
		Total Carcinogenic Risk	**2.6E-04**		**Total HI**	**1.9**

Target Organ HIs

Total Skin HI =	1.1
Total Vascular HI =	1.1

Notes:
1 Risk-Based Concentration (RBC) Table (EPA Region 3, 2002). Some noncarcinogenic RBCs not presented in the EPA Region 3 RBC Table were calculated per the methodology detailed in Appendix I.
2 NA - Not applicable. The EPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD).

Definition:
NOAEL = No Observed Adverse Effect Level
NOEL = No Observed Effect Level

TABLE 6-8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - FILTERED GROUNDWATER - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration µg/L	RBC[1] µg/L	Estimated ILCR	Primary	RBC[1] µg/L	Estimated HQ
Arsenic	ND	NA	NA	Skin, Vascular	11	NA
Chromium	0.75	NA	NA	NOAEL	110	0.007
Vanadium	0.37	NA	NA	NOEL	260	0.001
		Total Carcinogenic Risk	NA		Total HI	0.008

1 Risk-Based Concentration (RBC) Table (EPA Region III, 2002). Some noncarcinogenic RBCs not presented in the EPA Region III Risk Based Concentration Table were calculated as per the methodology detail in Appendix I.
2 NA - Not applicable. The EPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (R

Definition:
NOAEL = No Observed Adverse Effect Level
NOEL = No Observed Effect Level

TABLE 6-9

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER - SITE 33
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration[1]	Location of Maximum Concentration	Average of Positive Results	Average of All Results	Grounwater COPC Screening Level[2]	Ecological Effects Quotient[3]	Retain as a COPC?	Rationale for Contaminant Deletion or Selection [4]
Inorganics, Total (ug/L)										
Aluminum	3/3	286	15400	S33TW0030001	5374	5374	25	616	YES	ASL
Arsenic	1/3	11.8 K	11.8 K	S33TW0030001	11.8	4.6	48	0.2	NO	BSL
Barium	3/3	21.8 J	117 J	S33TW0030001	54.9	54.9	10000	0.01	NO	BSL
Beryllium	1/3	2.8 K	2.8 K	S33TW0030001	2.8	1	5.3	0.5	NO	BSL
Calcium	3/3	2570	5400	S33TW0030001	3917	3917	NA	NA	NO	NT
Chromium	3/3	1.7 K	56	S33TW0030001	19.8	19.8	2	28	YES	ASL
Cobalt	1/3	42.8 K	42.8 K	S33TW0030001	42.8	15.4	35000	0.001	NO	BSL
Copper	1/3	26.8	26.8	S33TW0030001	26.8	9.5	6.5	4.1	YES	ASL
Iron	3/3	700	30600	S33TW0030001	10787	10787	320	96	YES	ASL
Lead	1/3	9.8	9.8	S33TW0030001	9.8	3.5	3.2	3.1	YES	ASL
Magnesium	3/3	905	4210	S33TW0030001	2082	2082	NA	NA	NO	NT
Manganese	3/3	59.3	191	S33TW0030001	104	104	14500	0.01	NO	BSL
Nickel	1/3	31 K	31 K	S33TW0030001	31	11.6	160	0.2	NO	BSL
Potassium	3/3	1380	7290	S33TW0030001	3380	3380	NA	NA	NO	NT
Sodium	2/3	6070	6320	S33TW0030001	6195	4648	NA	NA	NO	NT
Vanadium	3/3	1.1 K	76.4 K	S33TW0030001	26.5	26.5	10000	0.01	NO	BSL
Zinc	1/3	129	129	S33TW0030001	129	48.9	30	4.3	YES	ASL
Inorganics, Filtered (ug/L)										
Barium	3/3	21.8	25.3	S33TW0010001-F	23.3	23.3	10000	0.003	NO	BSL
Calcium	3/3	2760	3800	S33TW0010001-F	3117	3117	NA	NA	NO	NT
Chromium	2/3	0.64 K	0.75 K	S33TW0010001-F	0.7	0.53	2	3.8E-01	NO	BSL
Iron	1/3	223	223	S33TW0010001-F	223	82	320	0.7	NO	BSL
Magnesium	3/3	897	1130	S33TW0010001-F	999	999	NA	NA	NO	NT
Manganese	3/3	61.2	62.7	S33TW0010001-F	61.8	61.8	14500	0.004	NO	BSL
Potassium	3/3	1200	1380	S33TW0010001-F	1287	1287	NA	NA	NO	NT
Vanadium	1/3	0.37 K	0.37 K	S33TW0020001-F	0.37	0.22	10000	0.00004	NO	BSL
Explosives (ug/L)										
2,6-Dinitrotoluene	2/3	0.11 J	0.13 J	S33TW0030001	0.12	0.11	NA	NA	YES	NTX

Shaded cells indicate that the chemical was selected as a COPC.
COPC = Chemical of Potential Concern
NA = Not Available
J = Estimated value
K = Estimated value, biased high
The sample and duplicate were counted as two separate samples when determining the minimum and maximum detected concentrtions and location of maximum concentration, but were only counted as one sample when determining the frequency of detection. One-half of the detection limit was used when averaging non-detected data.

Footnotes:
1 The maximum detected concentration was used to calculate the ecological effects quotient.
2 Refer to Table 4-5 for sources of groundwater screening criteria
3 Refer to Section 4.4.4 for ecological effects quotient calculation.
4 Rationale Codes:
For Selection as a COPC:
ASL = Above COPC Screening Level
BIO = Bioaccumulative Chemical
NTX = No Toxicity Information Available

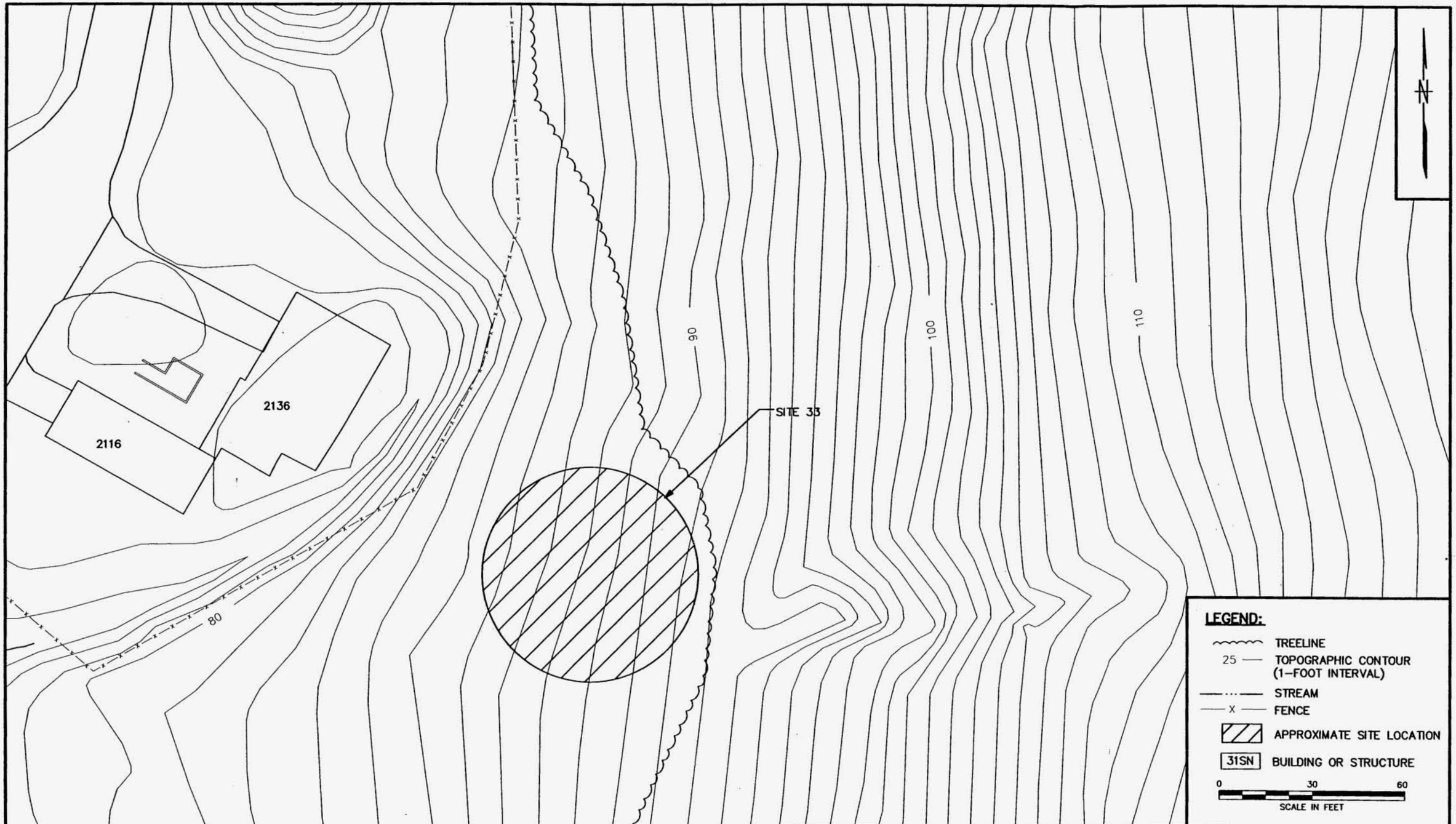
For Elimination as a COPC:
BSL = Below COPC Screening Level
NT = Nontoxic

Associated Samples:

S33TW0010001
S33TW0020001
S33TW0030001

S33TW0010001-F
S33TW0020001-F
S33TW0030001-F

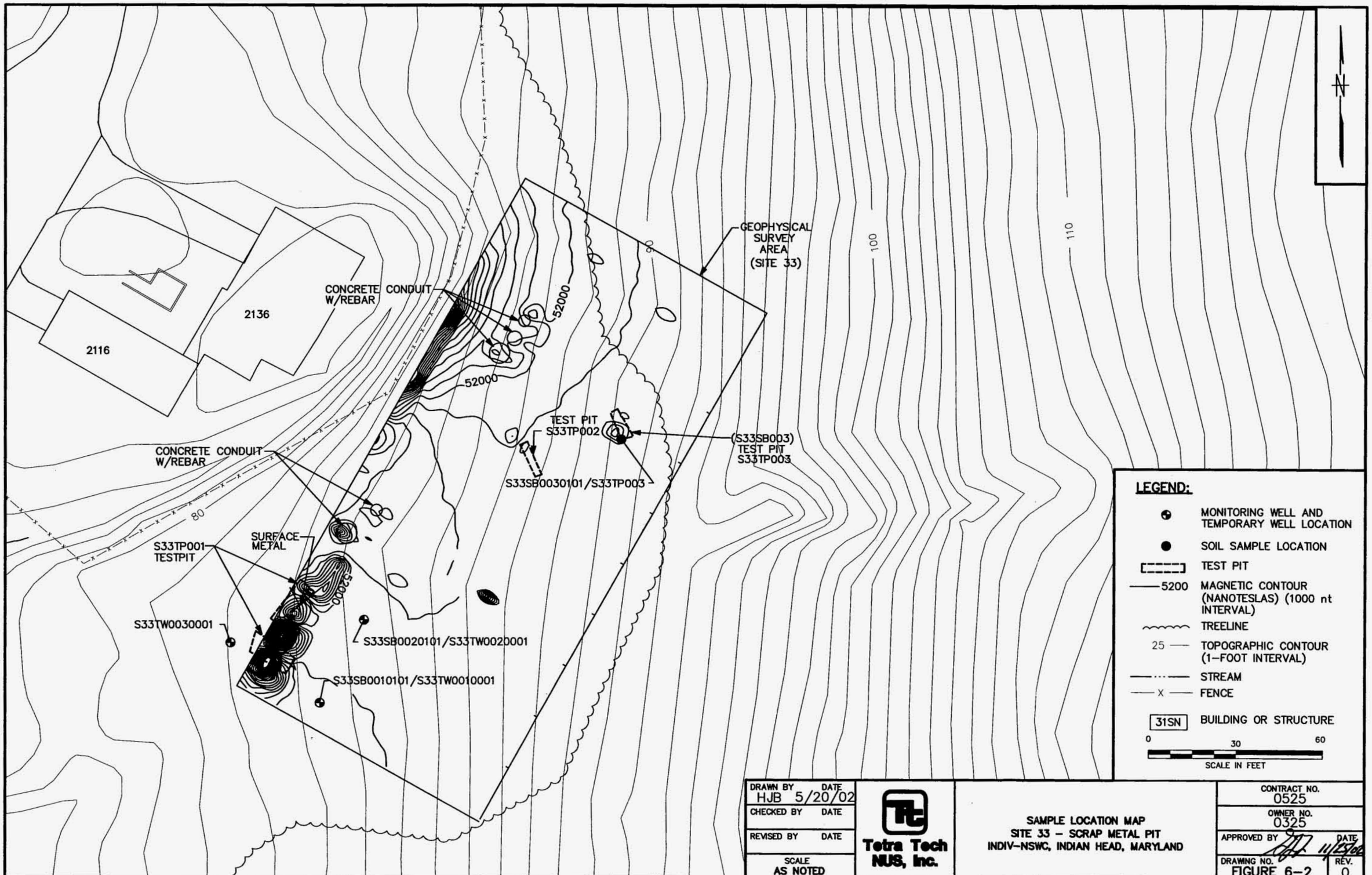
ACAD: 0525CM62.dwg 05/20/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SITE LAYOUT SITE 33 – SCRAP METAL PIT INDIV-NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 6-1 REV. 0

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

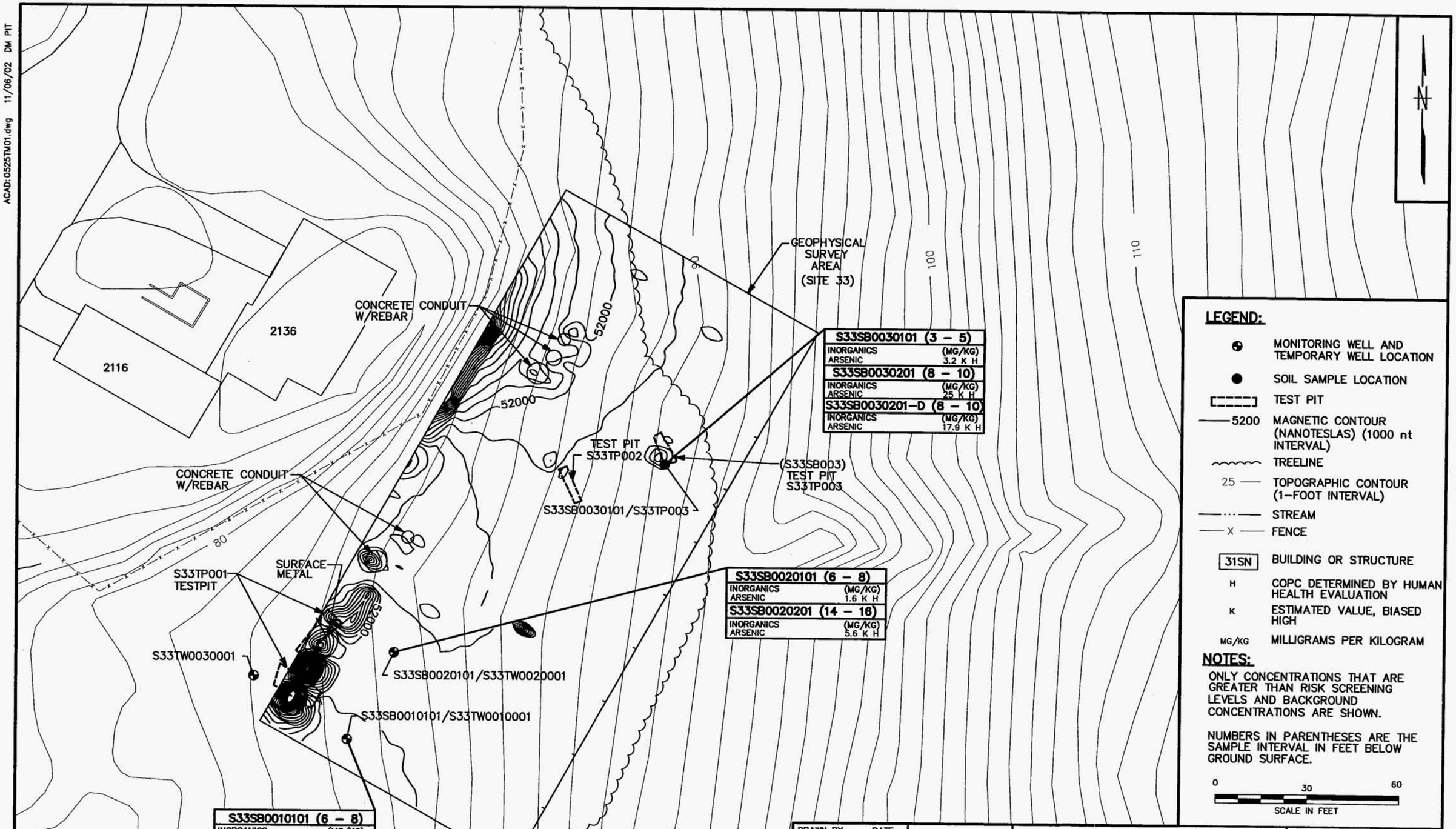
ACAD:0525GM12.dwg 11/06/02 DM PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SAMPLE LOCATION MAP SITE 33 – SCRAP METAL PIT INDIV-NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 6-2 REV. 0

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

ACAD:0525TM01.dwg 11/06/02 DM PIT



DRAWN BY	DATE
HJB	5/20/02
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

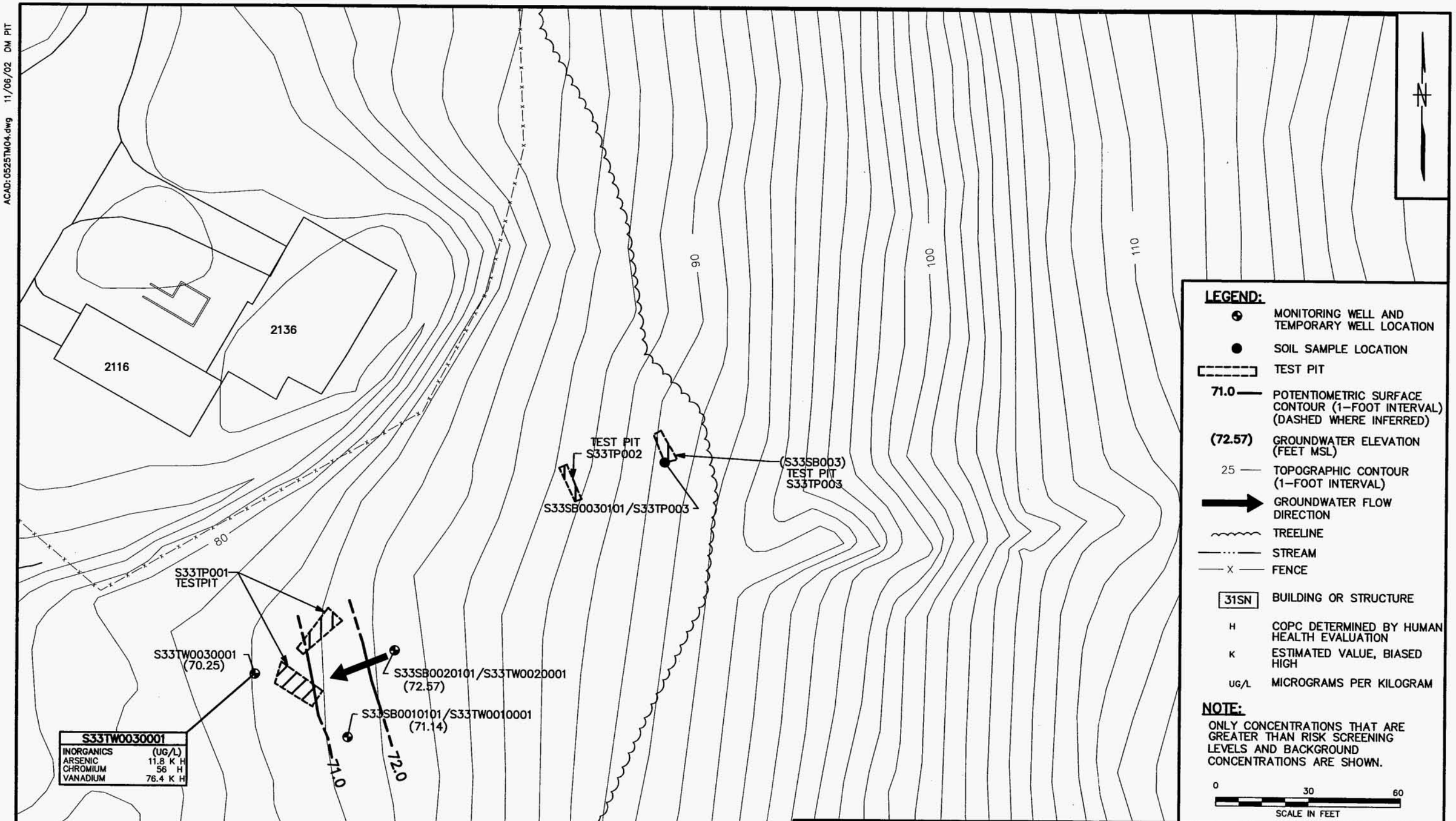
Tetra Tech NUS, Inc.

SUBSURFACE SOIL COPC CONCENTRATIONS
SITE 33 – SCRAP METAL PIT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NO. 0525
OWNER NO. 0325
APPROVED BY: DATE 11/25/02
DRAWING NO. FIGURE 6-3
REV. 0

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

ACAD:0525TM04.dwg 11/06/02 DM PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	GROUNDWATER COPC CONCENTRATIONS SITE 33 – SCRAP METAL PIT INDIV–NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 6–4 REV. 0

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

7.0 SITE 34 – TOOL BURIAL

7.1 BACKGROUND

Site 34 is located within the Stump Neck Annex. Beryllium-copper alloy hand tools reportedly buried near Building D-21CSN, in the area shown on Figure 7-1. Two burial holes, each about 5 feet by 15 feet by 12 feet deep were reported. The volume of tools in each pit was said to be about 5 feet by 8 feet by 2 feet. The tools were hand tools such as hammers, wrenches, screwdrivers, pliers, scrapers, and knives that were used in explosive ordnance disposal (EOD) work because they are nonmagnetic and nonsparking. According to interviewees, the tools in the pits had failed a magnetometer test and were considered unserviceable. The burial was said to have taken place in 1972 or 1973. It was noted that the magnetometer test took place in Building D-21CSN, which was added in 1973. A memorandum dated May 28, 1975 (Ser 113-45-75) contains a sketch showing the two test pits 60 feet and 70 feet southeast of the building. On-site investigations confirmed subsidence of soil at these locations (Hart, 1983).

7.2 SITE CHARACTERISTICS

7.2.1 Topography

As illustrated on Figure 7-1, the land surface at Site 34 gently slopes toward Chicamuxen Creek to the south. The land surface elevation across the site ranges from approximately 1 to 6 feet above msl.

7.2.2 Surface Water

Precipitation either infiltrates the soil or runs off the ground surface. Surface water runoff from Site 34 is likely to go to Chicamuxen Creek to the south directly or via a drainage swale to the west.

7.2.3 Geology/Soils

Logs from soil borings and test pits installed at the site indicate that shallow geologic conditions consist primarily of sand and gravelly sand overlying clay and silt. However, the clay and silt layer is absent at S34TW003. The gravels are composed of quartz and are well rounded to subrounded. Soil boring and test pit logs are provided in Appendix B.

7.2.4 Hydrogeology

The shallow aquifer beneath the site displays the characteristics of an unconfined system. After the wells were installed, the water level in the wells stabilized to the depth at which it was encountered during well

installation. Groundwater at the site was encountered at approximately 2 to 6 feet bgs. Based on the groundwater level elevations, the groundwater flow direction is to the northwest away from Chicamuxen Creek and toward the Mattawoman Creek to the northwest (Figure 7-2). The groundwater levels used to generate potentiometric contours were measured on February 12, 2002. The groundwater-level data are provided in Appendix E.

7.3 FIELD INVESTIGATION

A geophysical survey and test pit excavations were completed at the site to locate the tool burial pit and to evaluate the potential presence of contaminants. In addition, groundwater and subsurface soil samples were collected and submitted to a fixed-base laboratory for chemical analysis. The sample depths and analyses are summarized on Table 7-1.

7.3.1 Geophysical Investigation

An EM-31 electromagnetometer was used to perform a geophysical survey at Site 34 in order to locate the tool burial pit(s). The electromagnetometer measures the changes in the ground conductivity using a patented electromagnetic inductive technique that makes the measurements without electrodes or ground contact. This is a very useful instrument to locate buried non-ferrous metallic debris. The unit of conductivity that is used is millisiemens per meter (mS/m). The effective exploration depth of the instrument is approximately 20 feet.

As shown on Figure 7-2, the survey was conducted on a reference grid that was 80 feet by 190 feet. The resulting conductivity contour map is presented on Figure 7-2. The anomalies are indicated by the high-density contour lines. The major anomalies on Figure 7-2 are labeled as A, B, and C. Anomaly A actually results from Building D-21 immediately to the north of the anomalous area. Anomaly B is a reflection of a pile of scrap metal on the ground surface. However, anomaly C indicates the potential presence of buried metal and was considered the likely location of the tool burial area. A detailed report of the geophysical survey results is provided in Appendix D.

7.3.2 Test Pit Activities

One test pit was installed in the suspected area, as described in Section 7.3.1. The test pit location is shown on Figure 7-2. The excavation at S34TP001 uncovered abundant quantities of the beryllium-copper alloy tools. Other materials were also found such as canvas material, hardware, plastics, and paper. The S34TP001 test pit was approximately 2 feet wide, 10 feet in length and a depth of 10 feet bgs. Test pit log is provided in Appendix B.

7.3.3 Temporary Well Installation and Groundwater Sampling

Three temporary monitoring wells were installed at the site to determine if wastes from the tool burial pit had contaminated shallow groundwater. Based on field observation, the downgradient flow direction was believed to be toward Chicamuxen Creek. One well (S34TW002) was installed downgradient of the suspected burial area. Two wells (S34TW001 and S34TW003) were installed upgradient. Subsequent water-level data suggest that the groundwater flow is to the northwest, as described in Section 7.2.4, therefore, well S34TW003 is a downgradient well. Well locations are shown on Figure 7-2. The wells were constructed with 1-inch-ID PVC riser and screen material; they were installed and abandoned as described in Section 3.0. State of Maryland abandonment reports and TtNUS temporary well construction diagrams are presented in Appendix A.

Groundwater samples were collected from the temporary wells, as described in Section 3.2.3, and analyzed for beryllium and copper (total and dissolved). Groundwater sample log sheets are provided in Appendix C.

7.3.4 Subsurface Soil Sampling

One subsurface soil sample was collected from within the area of beryllium-copper alloy tools encountered at S34TP001 (the sample location designation is S34SB001) at a depth of 4 to 4.5 feet bgs. The soil sample was collected using a backhoe. The sample depth and analyses are summarized on Table 7-1. Sample locations are shown on Figure 7-2.

No elevated PID readings were recorded during the subsurface investigation. Ordnance hardware was found in the test pit; therefore, the soil sample was submitted to a fixed-base laboratory to be analyzed for explosives including nitrocellulose, nitroguanidine, and nitroglycerine, in addition to beryllium and copper. Soil sample log sheets are provided in Appendix C.

One field duplicate S34SBDUP0101 was collected at the same location as S34SB0010101 and analyzed for the same parameters.

7.4 ANALYTICAL RESULTS AND COPC SELECTION

This section provides the data, evaluation, and selection of human health COPCs for subsurface soil and groundwater contamination at Site 34. The selection of ecological COPCs is discussed in Section 7.6. This screening evaluation is based on the following samples:

- One subsurface soil sample
- Three groundwater samples collected from temporary monitoring wells

The results were evaluated as described in Section 4.3. Complete chemical analytical results are presented in Appendix H.

7.4.1 Data and Risk-Based Evaluation of Subsurface Soil Contamination

Positive analytical results and summary statistics for subsurface soil samples are provided in Tables 7-2 and 7-3, respectively.

Based on the analytical results, although copper concentrations exceeded background concentrations, neither beryllium nor copper concentrations exceeded the screening levels in the subsurface soil samples. Both metals were detected in sample S34SB0010101. No explosives were detected in the subsurface soil. Therefore, there are no soil COPCs.

7.4.2 Data and Risk-Based Evaluation of Groundwater Contamination

Positive analytical results for unfiltered and filtered groundwater samples are provided in Table 7-4. The summary statistics for unfiltered and filtered groundwater samples are provided in Table 7-5.

Based on the analytical results, neither beryllium nor copper concentrations exceeded the screening levels in the groundwater samples. Therefore, there are no groundwater COPCs. Beryllium was detected only in sample S34TW0010001.

7.5 HUMAN HEALTH RISK SCREENING EVALUATION

COPCs were not selected from the environmental media sampled at Site 34. No further human health risk screening is necessary.

7.6 ECOLOGICAL RISK SCREENING EVALUATION

Surface water, surface soil, and sediment samples were not collected at Site 34 were not collected, so the ecological COPC screening was performed with groundwater results only. Groundwater data was evaluated due to the possibility of discharge to Mattawoman Creek and potential risks to aquatic receptors. Unfiltered and filtered samples were evaluated in the screening (see Table 7-6).

7.6.1 Data and Risk-Based Evaluation of Groundwater Contamination

Beryllium and copper were detected in unfiltered samples and beryllium was detected in filtered samples. Maximum concentrations were below the screening values, so beryllium and copper were not retained as COPCs.

7.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

7.7.1 Summary and Conclusions

Tools that were buried at the sites were found during the test pit investigation. Concentrations of beryllium and copper in the subsurface soil and groundwater samples were less than human health and ecological screening levels. In addition, no explosives were detected in the subsurface soil. Thus, there are no COPCs, and no unacceptable risks to human health or ecological receptors were identified.

The preliminary ecological risk evaluation showed that the groundwater concentrations did not pose unacceptable risks to ecological receptors. Because the site was a burial pit, contamination, if present, was not anticipated to be at the surface. No surface soil samples were collected, so terrestrial ecological receptors could not be quantitatively evaluated.

7.7.2 Recommendations

No action is required for Site 34, so the site should be removed from additional study under the FFA, and a No Action Decision Document should be prepared for this site in accordance with the FFA.

TABLE 7-1

ENVIRONMENTAL SAMPLING AND ANALYSIS SUMMARY – SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	Sample Designation	Sample Depth (feet below ground surface) (1)	Sample Analysis					
			TCL VOCs	TCL SVOCs	TAL Metals(2)	Beryllium and Copper(2)	TCL Pesticides/ PCBs	Explosives (with nitrocellulose, nitroguanidine, and nitroglycerine)
SUBSURFACE SOIL								
S34SB001 48 hr TAT	S34SB0010101	From bottom of excavation 4-4.5'				●		●
Duplicate at S34SB0010101	S34SBDUP0101	From bottom of excavation				●		●
TEMPORARY WELLS								
S34TW001	S34TW0010001	--				●		
S34TW002	S34TW0020001	--				●		
S34TW003	S34TW0030001	--				●		

Notes:

1 Sample depths are as collected in the field.
2 Groundwater samples were analyzed for total and filtered metals.

TABLE 7-2

SUMMARY OF POSITIVE DETECTIONS - SUBSURFACE SOIL - SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S34SB001	S34SB001
Sample Number	S34SB0010101	S34SBDUP0101
Duplicate of:		S34SB0010101
Collection Date	1/30/2002	1/30/2002
Interval, feet bgs	4 - 4.5	4 - 4.5
Inorganics (mg/kg)		
BERYLLIUM	0.65	0.565
COPPER	110	85.55

TABLE 7-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL - SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 34

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Residential (5)	EPA SSLs Soil to Air(6)	U.S. EPA Region 3 SSLs Soil to Groundwater(7)	COPC Flag	Rationale for Contaminant Deletion or Selection(8)
Inorganics																	
7440-41-7	Beryllium	0.48		0.65		mg/kg	S34SB0010101	1/1	NA	0.565	0.65	1.5	16 N	1300	1200	No	BSL, BKG
7440-50-8	Copper	61.1		110		mg/kg	S34SB0010101	1/1	NA	85.6	110	47.6	310 N	NA	11000	No	BSL

Notes:
1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL for non-clayey soils from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Soil Screening Levels for Inhalation EPA, May 1996, Soil Screening Guidance.
7 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. DAF (Dilution attenuation factor) of 20.
8 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)

Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
C = Carcinogenic.
N = Noncarcinogenic.

Associated Samples:
S34SB0010101
S34SB0010101-D

TABLE 7-4

SUMMARY OF POSITIVE DETECTIONS - GROUNDWATER - SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S34TW001	S34TW001	S34TW002	S34TW002	S34TW003	S34TW003
Sample Number	S34TW0010001	S34TW0010001-F	S34TW0020001	S34TW0020001-F	S34TW0030001	S34TW0030001-F
Unfiltered/filtered?	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Collection Date	02/08/02	02/08/02	02/04/02	02/04/02	02/04/02	02/04/02
Inorganics (ug/L)						
BERYLLIUM	1.6 K	1.7 K	0.2 U	0.2 U	1.2 K	1.1 K
COPPER	1 U	1 U	1 U	1 U	3 K	1 U

Notes:
U - Not detected at detection limit value shown.
K - Estimated value, biased high.

TABLE 7-5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH GROUNDWATER - SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 34

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Tap Water (5)	Potential ARAR/TBC Value(6)	Potential ARAR/TBC Source(6)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Inorganics, Total																	
7440-41-7	Beryllium	1.2	K	1.6	K	ug/L	S34TW0010001	2/3	0.2	0.967	1.6	NA	7.3 N	4	MCL	No	BSL
7440-50-8	Copper	3	K	3	K	ug/L	S34TW0030001	1/3	1	1.33	3	22.4	150 N	1300 (8)	MCL	No	BSL, BKG
Inorganics, Filtered																	
7440-41-7	Beryllium	1.1	K	1.7	K	ug/L	S34TW0010001-F	2/3	0.2	0.967	1.7	NA	73 N	4	MCL	No	BSL

Notes:
1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Drinking Water Standards and Health Advisories, EPA 2000.
7 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)
8 - Action Level.

Definitions:
NA = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J = Estimated value
K = Estimated value, biased high
N - Noncarcinogenic
MCL - Maximum Contaminant Level.
SMCL - Secondary Maximum Contaminant Level.

Shading indicates that the maximum detected concentration exceeded the screening criteria therefore the chemical was retained as a COPC.

Associated Samples:

S34TW0010001	S34TW0010001-F
S34TW0020001	S34TW0020001-F
S34TW0030001	S34TW0030001-F

TABLE 7-6

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER - SITE 34
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIANHEAD, MARYLAND

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration[1]	Location of Maximum Concentration	Average of Positive Results	Average of All Results	Groundwater COPC Screening Level[2]	Ecological Effects Quotient[3]	Retain as a COPC?	Rationale for Contaminant Deletion or Selection[4]
Inorganics, Total (ug/L)										
Beryllium	2/3	1.2 K	1.6 K	S34TW0010001	1.4	0.97	5.3	0.30	NO	BSL
Copper	1/3	3 K	3 K	S34TW0030001	3	1.33	6.5	0.46	NO	BSL
Inorganics, Filtered (ug/L)										
Beryllium	2/3	1.1 K	1.7 K	S34TW0010001-F	1.4	0.97	5.3	0.32	NO	BSL

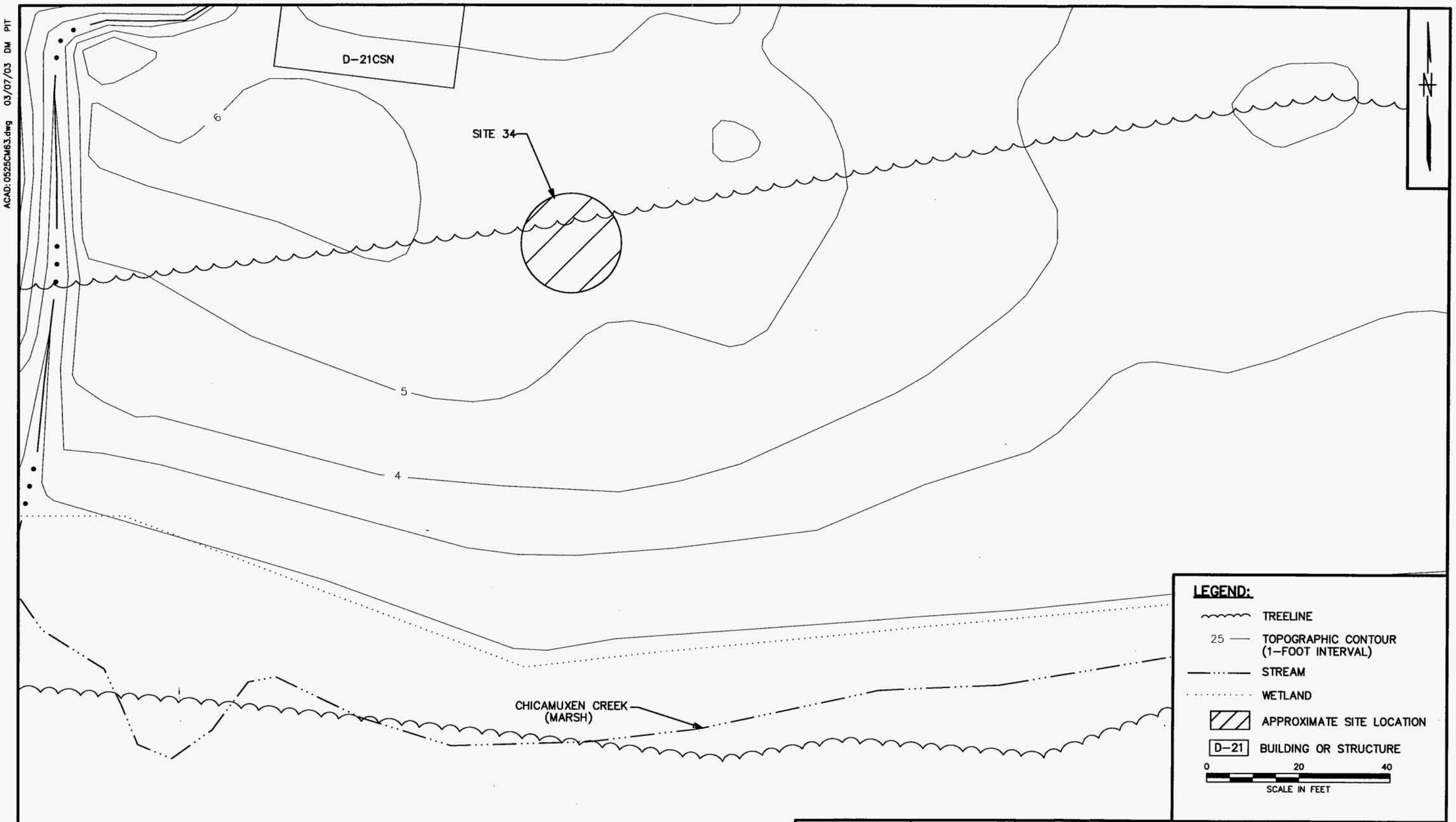
Shaded cells indicate that the chemical was selected as a COPC.
COPC = Chemical of Potential Concern
K = Estimated value, biased high
The sample and duplicate were counted as two separate samples when determining the minimum and maximum detected concentrations and location of maximum concentration, but were only counted as one sample when determining the frequency of detection. One-half of the detection limit was used when averaging non-detected data.

Footnotes:
1 The maximum detected concentration was used to calculate the ecological effects quotient.
2 Refer to Table 4-5 for sources of groundwater screening criteria
3 Refer to Section 4.4.4 for ecological effects quotient calculation.
4 Rationale Code:
For Elimination as a COPC:
BSL = Below COPC Screening Level

Associated Samples:

S34TW0010001
S34TW0020001
S34TW0030001
S34TW0010001-F
S34TW0020001-F
S34TW0030001-F

ACAD: 0525CM63.dwg 03/07/03 DM PIT



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CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 3/7/03
SCALE AS NOTED			DRAWING NO. FIGURE 7-1 REV. 0

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

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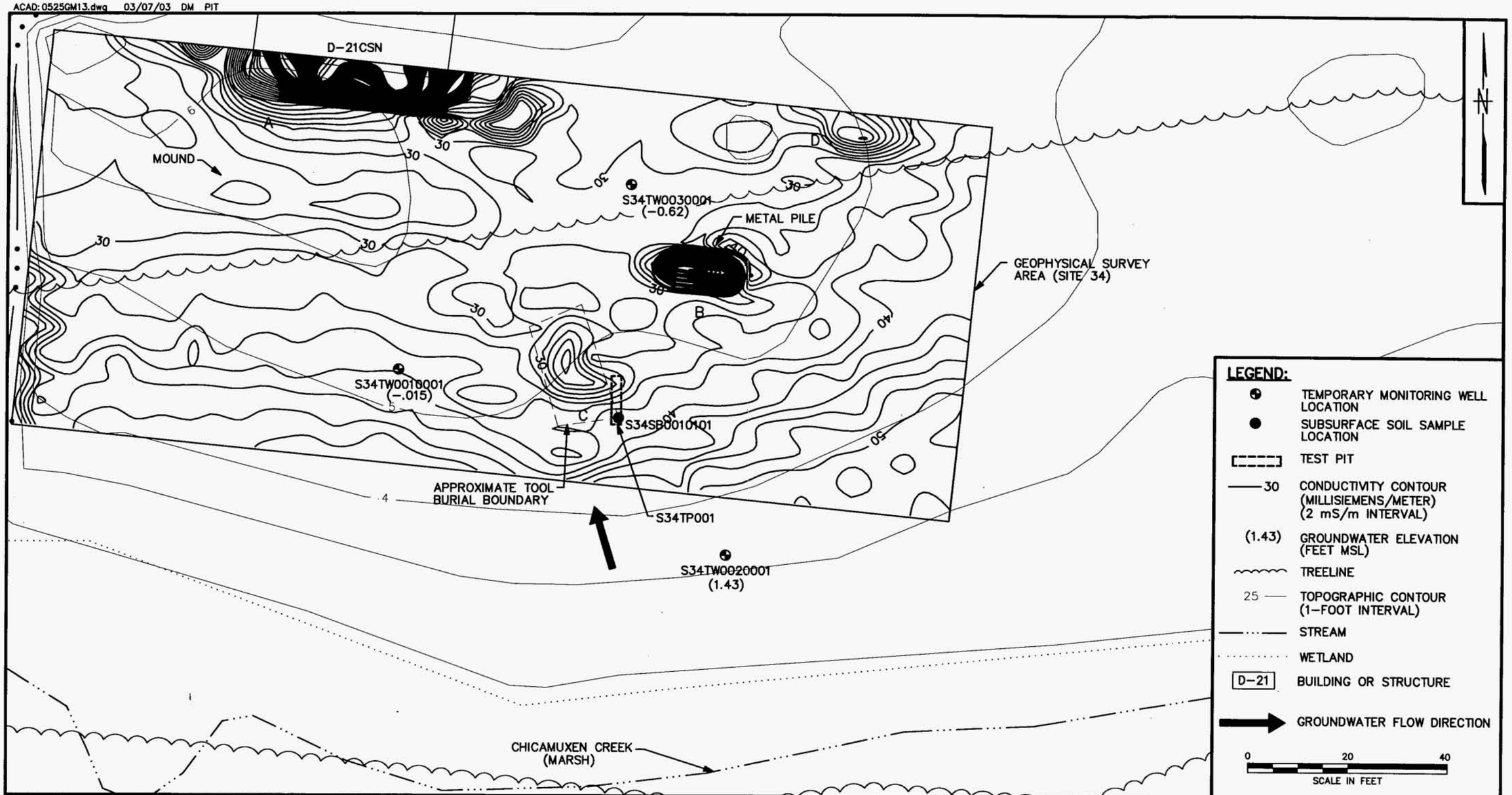

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJB DATE 5/15/02
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

SAMPLE LOCATION MAP
SITE 34 – TOOL BURIAL
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NO. 0525
OWNER NO. 0325
APPROVED BY
DATE 3/7/03
APPROVED BY
DATE
DRAWING NO. FIGURE 7-2
REV. 0

FORM CADD NO. T+NUS_BH.DGN - REV 0 - 1/20/98

8.0 SITE 36 – CLOSED LANDFILL

8.1 BACKGROUND

The IAS (Hart, 1983) reported that there was a landfill in the area shown on Figure 8-1. The filled area was a wetland or marsh. The filled, leveled ground occupied an area of approximately 1 to 2 acres. Grass and other low vegetation covered most of the site. The fill was believed to contain metal casings such as mines, bombs, and torpedoes. The contents were reportedly certified inert and did not contain any explosives or chemicals when buried. The landfill was used from 1972 to 1974. A site inspection revealed evidence of small metal parts in the surface soil, which was a gravelly-clay fill material.

8.2 SITE CHARACTERISTICS

8.2.1 Topography

As illustrated on Figure 8-1, the land surface at Site 36 gently slopes toward Chicamuxen Creek to the west. The land surface elevation across the site ranges from approximately 1 to 10 feet above msl.

8.2.2 Surface Water

Precipitation most likely infiltrates the soil and possibly runs off the ground surface into the surrounding Chicamuxen Creek. The site is bounded by Chicamuxen Creek to the north, west, and south.

8.3 FIELD INVESTIGATION

A geophysical survey was completed at the site to better define the size and location of the landfill. Environmental samples were not collected during this investigation.

8.3.1 Geophysical Investigation

An EM-31 electromagnetometer was used to perform a geophysical survey at Site 36. The electromagnetometer measures the changes in the ground conductivity using a patented electromagnetic inductive technique that makes the measurements without electrodes or ground contact. This is a very useful instrument to locate buried non-ferrous metallic debris. The unit of conductivity used is mS/m. The results are showed on Figure 8-2.

As shown on the figure, the survey was conducted along 15 transects that were spaced 30 feet apart; measurements were taken at intervals of 10 feet along each transect. The effective exploration depth of the instrument is approximately 20 feet. The high densities (anomalies) of the contour lines on Figure 8-2

indicate where metal debris may be found in the subsurface. Anomalies are seen throughout the suspected landfill area. Based on field observations, surface debris is scattered along much of the shoreline, which is marked by the approximated boundary (Figure 8-2) except along Roach Road. The very dense contours located adjacent to and along Roach Road are attributed to the underground utilities. A detailed report of the geophysical survey results is provided in Appendix D.

8.4 ANALYTICAL RESULTS

In accordance with the work plan, no environmental samples were collected at Site 36.

8.5 HUMAN HEALTH RISK SCREENING EVALUATION

Because no samples were collected at Site 36, a human health screening evaluation cannot be performed.

8.6 ECOLOGICAL RISK SCREENING EVALUATION

Because no samples were collected at Site 36, an ecological risk screening evaluation cannot be performed.

8.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

8.7.1 Summary and Conclusions

Based on the results of the geophysical investigation and site history, there is evidence that a relatively large quantity of waste has been disposed at the site. However, since no samples were collected, the nature and potential extent of contamination cannot be evaluated. The extent of waste burial has been estimated by the geophysical investigation.

Because of the extent of the site and the potential for contamination, additional investigation of this site is required to determine the nature and extent of contamination.

8.7.2 Recommendations

An RI and FS are recommended for this site. The results of the geophysical survey support the view that the site is a former landfill. The RI will establish the type of contaminants, if any, that are present, and the FS will determine the remedial measures appropriate to address contamination identified during the RI, as well as addressing State of Maryland regulations for closing landfills.

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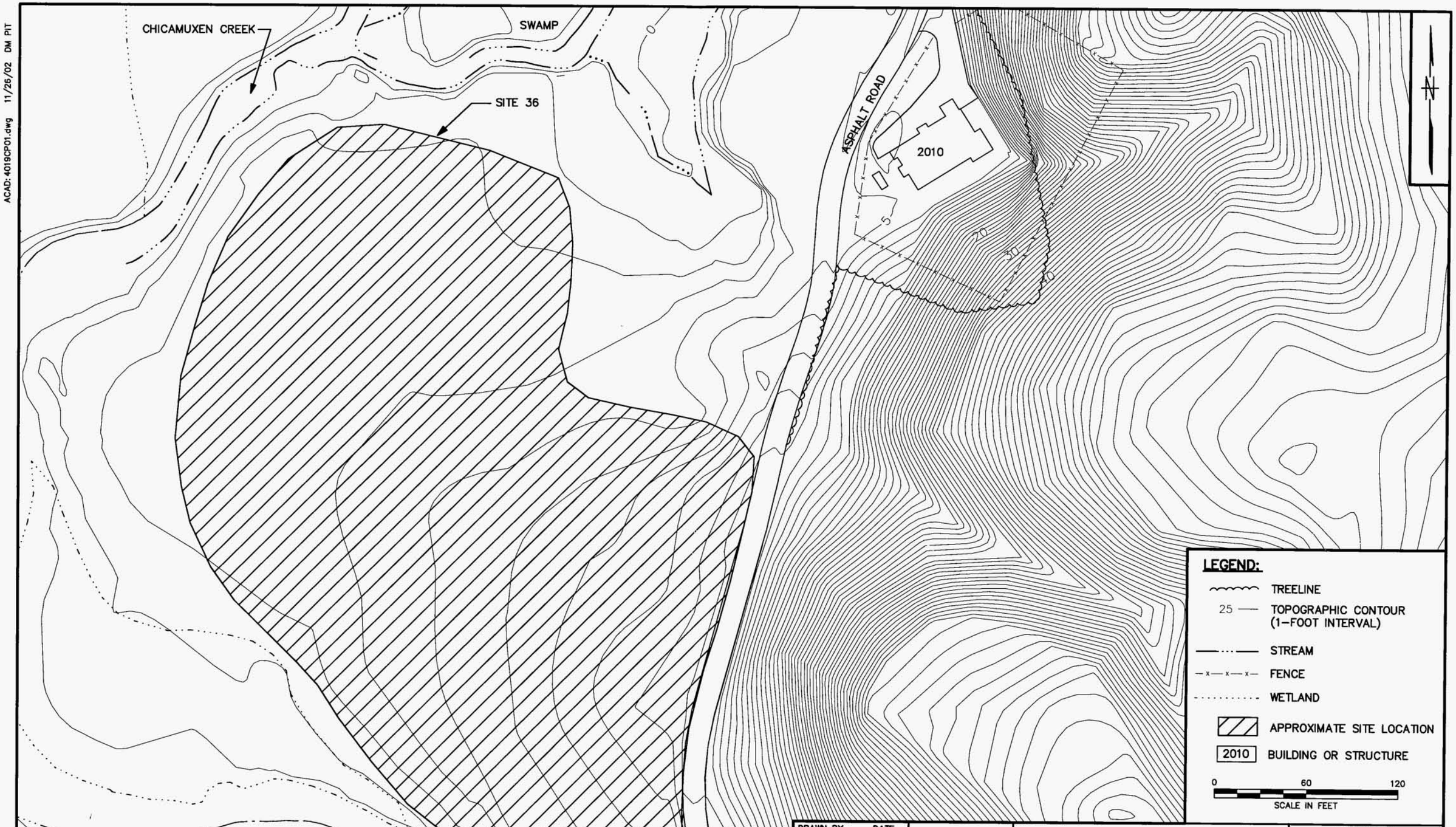

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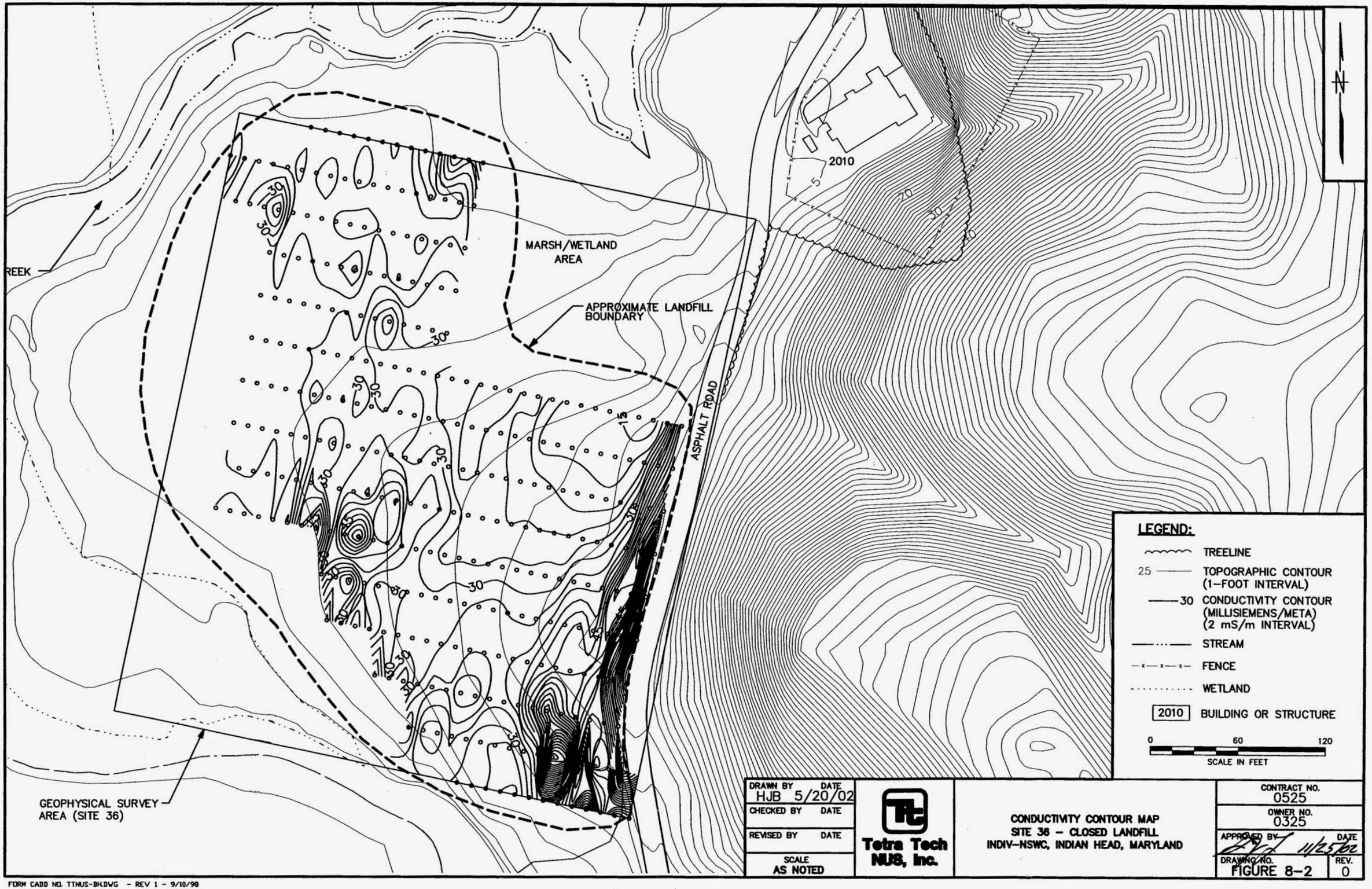
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 8–1 REV. 0

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

ACAD: 0525GM14.dwg 05/29/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	CONDUCTIVITY CONTOUR MAP SITE 36 - CLOSED LANDFILL INDIV-NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 8-2 REV. 0

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

9.0 SITE 37 – CAUSEWAY

9.1 BACKGROUND

Site 37 is a causeway on the northern side of Stump Neck Annex, adjacent to Mattawoman Creek and about 150 feet northeast of Building 2075. Archer Avenue runs along the top of the causeway. The road crosses a narrow neck of land that has been built up with fill materials. The location is shown on Figure 9-1. Reportedly, the causeway fill may contain hazardous materials in addition to rubble. An on-site inspection showed generous use of large concrete slabs to protect the Mattawoman Creek side of the roadway from erosion for a distance of 300 to 400 feet along the roadway. There was no visual evidence of hazardous material on site (Hart, 1983).

9.2 SITE CHARACTERISTICS

9.2.1 Topography

As illustrated on Figure 9-1, the top of the causeway is relatively flat. Steep banks mark the southern boundary, giving way to the marshy headwaters of Chicamuxen Creek. The site is bounded to the north by riprap baskets that separate the graded road area from the sandy beach shoreline of Mattawoman Creek. The land surface elevation across the site ranges from approximately 1 foot above msl along the southern and northern edges to approximately 5 to 7 feet above msl on the Archer Avenue road surface.

9.2.2 Surface Water

Precipitation and surface water runoff from the paved road are likely to flow to the adjacent grassy areas and either infiltrate the soil or run off to Chicamuxen Creek or Mattawoman Creek.

9.2.3 Geology/Soils

Logs from soil borings installed at the site indicate that shallow geologic conditions consist primarily of sand overlying silt and clay north of Archer Avenue and of sand and gravel at the well boring south of Archer Avenue. No waste material was encountered in the soil borings. Soil boring logs are provided in Appendix B.

9.2.4 Hydrogeology

The shallow aquifer present beneath the site displays the characteristics of an unconfined system. After the wells were installed, the water level in the wells stabilized to the depth at which it was encountered

during well installation. Groundwater at the site was encountered at approximately 5.5 feet bgs. The potentiometric surface (see Figure 9-3) shows that the groundwater flow direction is to the northwest toward Mattawoman Creek. The groundwater-levels used to generate potentiometric contours were measured on February 12, 2002. The groundwater level data are provided in Appendix E.

9.3 FIELD INVESTIGATION

Groundwater, subsurface soil, surface water, and sediment samples were collected and submitted to a fixed-base laboratory for chemical analysis to evaluate the potential presence or absence of contaminants. The samples and analyses are summarized on Table 9-1.

9.3.1 Temporary Well Installation and Groundwater Sampling

Three temporary monitoring wells were installed at the site to determine if material from the causeway had contaminated shallow groundwater. One well (S37TW002) was installed upgradient of the causeway south of Archer Avenue. Two wells (S37TW001 and S37TW003) were installed downgradient of the causeway north of Archer Avenue. Well locations are shown on Figure 9-2. The wells were constructed with 1-inch-ID PVC riser and screen material and installed and abandoned as described in Section 3.0. State of Maryland abandonment reports and TtNUS temporary well construction diagrams are presented in Appendix A.

Groundwater samples were collected from the temporary wells, as described in Section 3.2.3, and analyzed for TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), TCL pesticides/PCBs, and explosives including nitroguanidine, nitroglycerine, and nitrocellulose. Groundwater sample log sheets are provided in Appendix C.

One field duplicate, S37TWDUP001, was collected at the same location as S37TW0010001 and analyzed for TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), TCL pesticides/PCBs, and explosives including nitroguanidine, nitroglycerine, and nitrocellulose.

9.3.2 Subsurface Soil Sampling

Five subsurface soil samples were collected; two from each downgradient well boring (S37TW001/SB001 and S37TW003/SB003) and one from S37TW003/SB002. The second subsurface soil sample proposed at S37TW003/SB002 was not collected because of the abundant gravel encountered in the subsurface material. The soil samples were collected using HSA drilling and split-spoon sampling techniques. Sample locations are shown on Figure 9-2.

Two subsurface soil samples were selected from each boring location based upon field observations and the depths proposed in the work plan. Except at S37TW003/SB002, only one sample was collected, for the reasons discussed above. No elevated PID readings or waste were encountered during the subsurface investigation. The samples were submitted to a fixed-base laboratory to be analyzed for TCL VOCs, TCL SVOCs, TAL metals, TCL pesticides/PCBs, and explosives including nitroguanidine, nitroglycerine, and nitrocellulose. The samples and analyses are summarized on Table 9-1. Soil sample log sheets are provided in Appendix C.

9.3.3 Surface Water and Sediment Sampling

Three surface water and three sediment samples were collected in pairs, two from Mattawoman Creek and one from Chicamuxen Creek south of the causeway. Sample locations are shown on Figure 9-2. Surface water samples were collected as described in Section 3.2.4. Sediment samples were collected as described in Section 3.2.5. The surface water and sediment samples were submitted to a fixed-based laboratory and analyzed for TCL VOCs, TCL SVOCs, TAL metals, TCL pesticides/PCBs, and explosives. Sample log sheets are provided in Appendix C.

One field duplicate, FD1310202, was collected at the same location as S37SW0010001 and another field duplicate, FD1310201, was collected at the same location as S37SD0010001. Both duplicate samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals, TCL pesticides/PCBs, and explosives.

9.4 ANALYTICAL RESULTS AND COPC SELECTION

This section provides the data, evaluation, and selection of human health COPCs for subsurface soil, groundwater, surface water, and sediment contamination at Site 37. The selection of ecological COPCs is discussed in Section 9.6. This screening evaluation is based on the following samples:

- Five subsurface soil samples
- Three groundwater samples collected from temporary monitoring wells
- Three surface water and sediment samples collected in pairs

The results were evaluated as described in Section 4.3. Complete chemical analytical results are presented in Appendix H.

9.4.1 Data and Risk-Based Evaluation of Subsurface Soil Contamination

Positive analytical results and summary statistics for subsurface soil samples are provided in Tables 9-2 and 9-3, respectively.

Based on the analytical results, arsenic and iron were detected at concentrations exceeding screening levels. Neither was detected at a maximum concentration greater than the respective non-clayey soil background threshold concentration. Metal concentrations were detected at concentrations greater than screening levels in all samples. Maximum concentrations for arsenic and iron were reported in sample S37SB0030101.

None of the detected VOCs, SVOCs, or pesticides exceeded any screening levels. No PCBs or explosives were detected in the subsurface soil.

9.4.2 Data and Risk-Based Evaluation of Groundwater Contamination

Positive analytical results for unfiltered and filtered groundwater samples are provided in Table 9-4. The summary statistics for unfiltered and filtered groundwater samples are provided in Table 9-5.

As shown on Table 9-4, the concentrations of several metals in the filtered samples from S37TW002 and S37TW003 are greater than the concentrations in the respective unfiltered samples. These samples were not filtered in the field, and this may have led to the unusual results. Therefore, when these groundwater samples were evaluated for COPCs, the filtered sample results were also considered, as the maximum detected concentrations were often reported for the filtered samples.

Based on the analytical results, one SVOC, one explosive, and four metals exceeded the screening levels in the groundwater samples.

- Four metals (arsenic, barium, iron, and manganese) were detected at concentrations exceeding screening level concentrations.

- Of the four metals, only arsenic and barium were detected at maximum concentrations greater than the background threshold concentrations.

- Iron and manganese were detected at maximum concentrations that wee less than the background threshold concentrations.

- All of the samples contained at least one of the four metals at a concentration greater than the corresponding screening level concentration.

- The maximum concentrations of barium, iron, and manganese were reported in sample S37TW0020001.

- The maximum concentration for arsenic was reported in sample S37W0010001.

Arsenic and barium were retained as COPCs for evaluation because they exceeded the screening values for unfiltered groundwater samples. The results for unfiltered groundwater are shown on Figure 9-3.

One SVOC (naphthalene) was detected at a concentration greater than screening level in one sample, S37TW0020001. Naphthalene is retained as a COPC. The COPC concentrations that are greater than the screening levels for groundwater are shown on Figure 9-3.

One explosive (RDX) was detected at a concentration greater than the screening level in one sample, S37TW0020001. RDX is retained as a COPC. The COPC concentrations greater than the screening levels for groundwater are shown on Figure 9-3.

None of the detected VOCs exceeded any screening levels. No pesticides/PCBs were detected in the groundwater.

9.4.3 Data and Risk-Based Evaluation of Surface Water Contamination

Positive analytical results and summary statistics for surface water samples are provided in Tables 9-6 and 9-7, respectively.

Based on the analytical results, three metals (iron, manganese, and thallium) were detected at concentrations exceeding screening levels in the surface water samples and are retained as COPCs. Each of the samples contained at least one of the three metals at a concentration exceeding the corresponding screening level concentration. Maximum concentrations for all three metals were reported in sample S37SW0030001. The COPC concentrations that are greater than screening levels are shown on Figure 9-4.

Naphthalene was the only SVOC and 4,4'-DDD was the only pesticide detected at concentrations greater than the screening levels and are retained as COPCs. No explosives, VOCs, or PCBs were detected in the surface water.

Sample S37SW0030001 had a relatively high turbidity, 14 NTUs, as measured by a field turbidity meter during sample collection. The high turbidity is probably responsible for the high metals concentrations in the sample.

The thallium concentrations may be false positives. The trace ICP method, which is part of CLP SOW ILM04.1 and used in the analysis, can lead to false positives for lead, arsenic, and thallium. These false positives can be eliminated by using other methods.

9.4.4 Data and Risk-Based Evaluation of Sediment Contamination

Positive analytical results and summary statistics for sediment samples are provided in Tables 9-8 and 9-9, respectively. The sediment data are presented in Appendix H.

Five metals were detected at concentrations exceeding screening levels (aluminum, arsenic, iron, lead, and manganese). The metals were detected at concentrations greater than screening levels in only one sample. Therefore, aluminum, arsenic, iron, lead, and manganese are retained as COPCs in sediment at Site 37. Maximum concentrations for all the metals were reported in sample S37SD0030001. The COPC concentrations that are greater than screening levels are shown on Figure 9-5.

Benzo(a)pyrene was the only SVOC detected at a concentration greater than the screening levels and is retained as a COPC. None of the detected VOCs or pesticides exceeded any screening levels. No PCBs or explosives were detected in the sediment.

9.5 HUMAN HEALTH RISK SCREENING EVALUATION

This section contains a summary of the human health risk estimates for Site 37. The methodology used to calculate the risks presented in this section is provided in Appendix I. Chemical-specific risk estimates and risks to affected target organs for COPCs in groundwater, surface water, and sediment are presented in Tables 9-10, 9-11, and 9-12, respectively. No risks were estimated for exposures to subsurface soil because no COPCs were identified in this medium. A discussion of the estimated noncarcinogenic and carcinogenic risks is provided in the remainder of this section.

9.5.1 Groundwater

ILCRs for exposure to groundwater at Site 37 are presented in Table 9-10. The cumulative cancer risk is 1.4×10^{-4}, which exceeds the EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}. Arsenic (1.4×10^{-4}) is the major contributor to the cancer risk.

The cumulative HI is 2.2, which exceeds the target level of 1.0. Naphthalene (HQ = 1.5) was the major contributor to the noncarcinogenic risks.

Note that there is currently no risk to present users of the site because there is no exposure to the groundwater.

9.5.2 Surface Water

ILCRs for exposure to surface water at Site 37 are presented in Table 9-11. The cumulative cancer risk is 1.1×10^{-7}, which is below EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}.

The cumulative HI is 7.9, which exceeds the target level of 1.0. Manganese (HQ = 3.3) and thallium (HQ = 3.0) were the major contributors to the noncarcinogenic risks.

Note that sample S37SW0030001 was somewhat turbid. The relatively high concentrations of metals in the sample may be attributable to the suspended solids. If the turbidity is contributing a large portion of the metals concentration, then the HQs may be lower.

9.5.3 Sediment

Estimated cancer risks (ILCRs) for exposure to sediment at Site 37 are presented in Table 9-12. The cumulative cancer risk is 3.4×10^{-5}, which is within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}.

The cumulative HI is 2.0. When the HI exceeds 1, target organ effects for individual COPCs contributing to the risk are considered. Arsenic, iron, and manganese were the major contributors to the HI and they affect different target organs. The target organs for arsenic (HQ = 0.5) are the skin and cardiovascular system. The target organs for iron (HQ = 1.1) are blood and the gastrointestinal system. The target organ for manganese (HQ = 0.3) is the central nervous system. Because the HQs for the affected target organs are less than or approximately equal to the acceptable level of 1.0, no adverse health effects are anticipated for exposures to sediment at Site 37.

The risk from the sediment to current site users under an industrial scenario is substantially lower than the residential exposure. Risk calculations for industrial exposure to sediment are included in Appendix I.

9.5.4 Exposure to Lead

Lead was identified as a COPC for sediment at Site 37. The maximum detected concentration of lead in sediment (456 mg/kg) exceeded the Office of Solid Waste and Emergency Response (OSWER) soil screening level of 400 mg/kg for residential land use but was less than the EPA screening level of 750 mg/kg for industrial land use.

Hypothetical future residential exposures to lead in sediment were evaluated using EPA's integrated exposure uptake biokinetic (IEUBK) lead model (EPA, 2001). It should be noted that the IEUBK model is designed to evaluate residential exposures to soil and therefore the results of the evaluation are conservative since the exposure frequency used in the IEUBK model for exposure to soil is greater than the exposure frequency anticipated for exposure to sediment.

As recommended by the IEUBK model, the average concentration of lead in sediment (157 mg/kg) was used as the exposure point concentration. Default parameters were used for the rest of the model input parameters. IEUBK model outputs are included in Appendix I. The estimated geometric mean blood-lead level for children exposed to lead in sediment was 3.0 µg/dL, which is less than the level of concern of 10 µg/dL. The IEUBK model estimates that 0.5 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which is less than the EPA acceptable level of 5 percent. Based on the results from the IEUBK model, blood-lead levels for children and the percent of children expected to have blood levels greater than 10 µg/dL are within acceptable levels as determined by EPA.

9.5.5 Uncertainty Analysis

A summary of the uncertainties specific to the human health risk screening for Site 37 is included in this section. The impact of a particular uncertainty on the results of the risk screening is also identified. General uncertainties associated with the risk estimates were provided in Appendix I.

9.5.5.1 Uncertainty Associated with Screening Criteria for Surface Water and Sediment

No EPA Region 3 RBCs are available for surface water and sediment; therefore, tap water RBCs were used to evaluate surface water and residential soil RBCs were used to evaluate sediment. The tap water RBCs are based on an individual drinking 2 liters of water a day for 350 days a year. The residential soil RBCs are based on an individual being exposed to soil 350 days a year. It is very unlikely that an individual would consume 2 liters of surface water a day or be exposed to surface water and sediment 350 days a year. Consequently, the use of RBCs for soil/groundwater to evaluate sediment/surface water will result in conservative estimates of risk. The use of the RBCs for soil/groundwater to estimate risks from exposures to sediment/surface water could overestimate risks by as much as an order of magnitude.

9.5.5.2 Uncertainty Associated with Background Data

No background data are available for surface water. In addition, background threshold concentrations for sediment were not used. Therefore, surface water and sediment were not screened against background for the selection of COPCs. Consequently, it is not known if inorganics retained as COPCs in surface water and sediment at Site 37 are site related or naturally occurring.

9.5.5.3 Uncertainty Associated with Nitrocellulose

Toxicity values are not currently available for nitrocellulose. Consequently, risk-based screening levels used for the selection of chemicals of potential concern are not currently published. However, a review of the conclusions and recommendations of the EPA Health Advisory for Nitrocellulose indicates that the chemical has a very low toxicity: "Based on available toxicity data and chemical and physical properties of the compound, nitrocellulose is apparently non-toxic to dogs, rats, and mice and is not digested or absorbed in these species. These data, along with the relative insolubility of nitrocellulose in water, suggest that Health Advisory values for nitrocellulose in drinking water are unnecessary. The physical characteristics of the drinking water as they relate to turbidity, clarity, taste and similar indicators of palatability appear to be the only guidelines necessary." Toxicity information suggests that the LD_{50} (lethal dose for 50 percent of the test animals) is greater than 5 grams per kilogram. It should be noted that published risk-based concentrations for other chemicals that are considered relatively non-toxic (e.g., aluminum) typically exceed 10,000 µg/L (tap-water) and 10,000 mg/kg (residential soil). Nitrocellulose concentrations detected in the environmental media at Mattawoman Creek do not exceed these concentrations.

9.6 ECOLOGICAL RISK SCREENING EVALUATION

This section contains a summary of the ecological COPC screening evaluation for Site 37. Surface water, groundwater, and sediment results were used in the evaluation. Subsurface sample results were not considered in the evaluation because invertebrates and plants are not exposed to subsurface soils. Groundwater data was evaluated due to the possibility of discharge to Mattawoman Creek and potential risks to aquatic receptors. The ecological COPC screening tables for groundwater, surface water, and sediment are presented in Tables 9-13, 9-14, and 9-15, respectively.

As noted in Section 9.5, there are COPCs that pose unacceptable human health risk, so additional investigation and evaluation of the site will be required. Further evaluation of ecological COPCs can be performed at that time.

9.6.1 Groundwater

VOCs, SVOCs, unfiltered and filtered metals, and one explosive were detected in groundwater samples at Site 37 (see Table 9-13). Of the VOCs and SVOCs detected, no maximum detected concentrations exceeded the screening values.

Three metals, including aluminum, iron, and silver, were detected at maximum concentrations exceeding the screening values and were retained as ecological COPCs in unfiltered samples. No other metals exceeded screening values in unfiltered samples. Only two metals, cadmium and iron, were detected at maximum concentrations exceeding the screening values and are retained as ecological COPCs in filtered samples. No other metals exceeded the screening values in filtered samples.

Only one explosive, RDX, was detected in groundwater at Site 37 at a maximum concentration of 1.2 µg/L, but it did not have a screening value. Therefore, RDX is retained as a COPC.

9.6.2 Surface water

SVOCs, one pesticide, and unfiltered metals were detected in surface water samples at Site 37 (see Table 9-14). Of the four SVOCs detected, 4-methylphenol is retained as a COPC because a screening value was not available for comparison.

Four metals, including aluminum, iron, lead, and zinc, had maximum concentrations exceeding the screening values and are retained as COPCs for further evaluation.

Thallium concentrations reported in the surface water samples may be false positives from the analytical method.

9.6.3 Sediment

One VOC, fifteen SVOCs, two pesticides, one explosive, and nineteen metals were detected in sediment samples at Site 37 (see Table 9-15). One VOC, acetone, is retained as a COPC because a screening value was unavailable for comparison.

Eight SVOCs, including 2-methylnaphthalene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene, and pyrene are retained as COPCs because maximum detected concentrations exceeded the screening values. Benzaldehyde is retained as a COPC because no screening value was available for comparison.

Two pesticides, 4,4'-DDD and 4,4'-DDE, are retained as COPCs because maximum detected concentrations exceeded screening values. Nitrocellulose is retained as a COPC because no screening value was available for comparison.

Seven metals, including arsenic, barium, cadmium, copper, iron, lead, and nickel, are retained as COPCs because maximum concentrations exceeded screening values. Beryllium is retained as a COPC because no screening value was available for comparison.

9.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

9.7.1 Summary and Conclusions

No human health COPCs were detected in subsurface soil samples. Arsenic, barium, naphthalene, and RDX were selected as human health COPCs in groundwater. Iron, manganese, thallium, naphthalene, and 4,4'-DDD were selected as COPCs in surface water. Aluminum, arsenic, iron, lead, nickel, and benzo(a)pyrene were selected as COPCs in sediment. A human health risk evaluation was performed based on these COPCs.

The human health risk evaluation showed that, in groundwater, the ILCR and HQ both exceeded the acceptable ranges. In surface water, the ILCR was in the acceptable range, but the HQ exceeded the acceptable benchmark. In sediments, the ILCR and HQ were both in the acceptable ranges.

The ecological risk evaluation showed that there are several ecological COPCs in groundwater, surface water, and sediment. Additional investigation is needed to further evaluate the ecological COPCs. Because the various materials were buried at the site, contamination, if present, was not anticipated to be at the surface. No surface soil samples were collected, so terrestrial ecological receptors could not be quantitatively evaluated.

Freshwater sediment background was not used, and the limited number of environmental samples restricted the use of statistical background analysis. Thus, the COPC selection is conservative, and some of the COPCs may be naturally occurring.

9.7.2 Recommendations

An RI and FS are recommended for this site. Both human health and ecological aspects should be considered. Thallium analyses should be performed by EPA Method SW-846 6020 ICP/MS to eliminate false positives. The investigation should include a statistical comparison of the sediment sample analytical results to the background data set.

TABLE 9-1

ENVIRONMENTAL SAMPLING AND ANALYSIS SUMMARY – SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	Sample Designation	Sample Depth (feet below ground surface) (1)	Sample Analysis					
			TCL VOCs	TCL SVOCs	TAL Metals(2)	Beryllium and Copper(2)	TCL Pesticides/ PCBs	Explosives (with nitrocellulose, nitroguanidine, and nitroglycerine)
SUBSURFACE SOIL								
S37SB001 / S37TW001	S37SB0010101	2 – 4	●	●	●		●	●
S37SB001 / S37TW001	S37SB0010201	4 – 6	●	●	●		●	●
S37SB002 / S37TW002	S37SB0020101	2 – 4	●	●	●		●	●
S37SB003/S37TTW003	S37SB0030101	2 – 4	●	●	●		●	●
S37SB003/S37TTW003	S37SB0030201	4 – 6	●	●	●		●	●
TEMPORARY WELLS								
S37TW001	S37TW0010001	--	●	●	●		●	●
Duplicate of S37TW0010001	S37TWDUP001	--	●	●	●		●	●
S37TW002	S37TW0020001	--	●	●	●		●	●
S37TW003	S37TW0030001	--	●	●	●		●	●
SURFACE WATER								
S37SW001	S37SW0010001	--	●	●	●		●	●
Duplicate of S37SW0010001	FD01310202	--	●	●	●		●	●
S37SW002	S37SW0020001	--	●	●	●		●	●
S37SW003	S37SW0030001	--	●	●	●		●	●

TABLE 9-1

ENVIRONMENTAL SAMPLING AND ANALYSIS SUMMARY – SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	Sample Designation	Sample Depth (feet below ground surface) (1)	Sample Analysis					
			TCL VOCs	TCL SVOCs	TAL Metals(2)	Beryllium and Copper(2)	TCL Pesticides/ PCBs	Explosives (with nitrocellulose, nitroguanidine, and nitroglycerine)
SEDIMENT								
S37SD001	S37SD0010001	--	●	●	●		●	●
Duplicate of S37SD0010001	FD01310201	--	●	●	●		●	●
S37SD002	S37SD0020001	--	●	●	●		●	●
S37SD003	S37SD0030001	--	●	●	●		●	●

Notes:

1 Sample depths are as collected in the field.
2 Groundwater samples were analyzed for total and filtered metals.

TABLE 9-2

SUMMARY OF POSITIVE DETECTIONS - SUBSURFACE SOIL - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location Sample Number Collection Date Interval, feet bgs	S37SB001/TW001 S37SB0010101 02/05/02 2 - 4	S37SB001/TW001 S37SB0010201 02/05/02 4 - 6	S37SB002/TW002 S37SB0020101 02/05/02 2 - 4	S37SB003/TW003 S37SB0030101 02/05/02 2 - 4	S37SB003/TW003 S37SB0030201 02/05/02 4 - 6
Volatile Organics (ug/kg)					
ACETONE	4 J	18	10 U	2 J	10 U
Semivolatile Organics (ug/kg)					
2-METHYLNAPHTHALENE	78 J	380 U	350 UJ	350 U	97 J
BENZO(A)ANTHRACENE	340 U	380 U	41 J	350 U	370 U
BENZO(B)FLUORANTHENE	340 U	380 U	110 J	350 U	370 U
BENZO(K)FLUORANTHENE	340 U	380 U	44 J	350 U	370 U
CHRYSENE	340 U	380 U	70 J	350 U	370 U
FLUORANTHENE	340 U	380 U	87 J	350 U	86 J
PHENANTHRENE	340 U	380 U	41 J	350 U	370 U
PYRENE	340 U	380 U	99 J	350 U	86 J
Pesticides/PCBs (ug/kg)					
4,4'-DDT	3.4 U	3.9	4.7	3.6 U	3.7 U
Inorganics (mg/kg)					
ALUMINUM	382 J	554 J	3410 J	3900 J	1010 J
ARSENIC	0.8 K	0.87 K	2.6 K	4.3 K	1.1 K
BARIUM	5.5	5.9	8.6	13.4	6.1
BERYLLIUM	0.095 K	0.093 K	0.12 K	0.13 K	0.084 K
CADMIUM	0.1 K	0.031 U	0.038 U	0.039 U	0.031 U
CALCIUM	78.5	571	2040	25.7	148
CHROMIUM	2.8 K	4.1	15	9.2	3.4 K
COBALT	0.79 U	0.7 U	3.7 K	4.7 K	1.1 K
COPPER	1.8 K	2.4 K	14.7	5.6 K	3.6 K
IRON	2600 J	3030 J	8970 J	11200 J	3550 J
LEAD	15.5	8.2	22.9	13.5	7.2
MAGNESIUM	56.5 U	112	2530	133	95.3
MANGANESE	60.4	28.8	76.6	108	53.2
NICKEL	3.8 K	3.8 K	16.1	3.1 K	4 K
POTASSIUM	61.6 U	82.5 U	186	182	70.9 U
SODIUM	52.3 U	58.3 U	821	47.9 U	34.5 U
VANADIUM	4 K	4.1 K	17.5 K	15 K	4.9 K
ZINC	9.1	8.2	14.7	9.6	8.6

Notes:
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.

TABLE 9-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 37

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Residential (5)	EPA SSLs Soil to Air(6)	U.S. EPA Region 3 SSLs Soil to Groundwater(7)	COPC Flag	Rationale for Contaminant Deletion or Selection(8)
Volatile Organic Compounds																	
67-64-1	Acetone	2	J	18		ug/kg	S37SB0010201	3/5	10	6.80	18	NA	780000 N	100000000	2500	No	BSL
Semivolatile Organic Compounds																	
91-57-6	2-Methylnaphthalene	78	J	97	J	ug/kg	S37SB0030201	2/5	350 - 380	143	97	NA	160000 N	NA	22000	No	BSL
56-55-3	Benzo(a)anthracene	41	J	41	J	ug/kg	S37SB0020101	1/5	340 - 380	152	41	NA	870 C	NA	1500	No	BSL
205-99-2	Benzo(b)fluoranthene	110	J	110	J	ug/kg	S37SB0020101	1/5	340 - 380	166	110	NA	870 C	NA	4500	No	BSL
207-08-9	Benzo(k)fluoranthene	44	J	44	J	ug/kg	S37SB0020101	1/5	340 - 380	153	44	NA	8700 C	NA	45000	No	BSL
218-01-9	Chrysene	70	J	70	J	ug/kg	S37SB0020101	1/5	340 - 380	158	70	NA	87000 C	NA	150000	No	BSL
206-44-0	Fluoranthene	86	J	87	J	ug/kg	S37SB0020101	2/5	340 - 380	142	87	NA	310000 N	NA	6300000	No	BSL
85-01-8	Phenanthrene	41	J	41	J	ug/kg	S37SB0020101	1/5	340 - 380	152	41	NA	230000 (9) N	NA	NA	No	BSL
129-00-0	Pyrene	86	J	99	J	ug/kg	S37SB0020101	2/5	340 - 380	144	99	NA	230000 N	NA	680000	No	BSL
Pesticides/PCBs																	
50-29-3	4,4'-DDT	3.9		4.7		ug/kg	S37SB0020101	2/5	3.4 - 3.7	2.79	4.7	NA	1900 C	NA	1200	No	BSL
Inorganics																	
7429-90-5	Aluminum	382	J	3900	J	mg/kg	S37SB0030101	5/5	NA	1851	3900	21400	7800 N	NA	NA	No	BSL, BKG
7440-38-2	Arsenic	0.8	K	4.3	K	mg/kg	S37SB0030101	5/5	NA	1.93	4.3	28.7	0.43 C	750	0.026	No	BKG
7440-39-3	Barium	5.5		13.4		mg/kg	S37SB0030101	5/5	NA	7.90	13.4	66.5	550 N	690000	2100	No	BSL, BKG
7440-41-7	Beryllium	0.084	K	0.13	K	mg/kg	S37SB0030101	5/5	NA	0.104	0.13	1.5	16 N	1300	1200	No	BSL, BKG
7440-43-9	Cadmium	0.1	K	0.1	K	mg/kg	S37SB0010101	1/5	0.031 - 0.039	0.034	0.1	0.61	3.9 N	1800	27	No	BSL, BKG
7440-70-2	Calcium	25.7		2040		mg/kg	S37SB0020101	5/5	NA	573	2040	1270	NA	NA	NA	No	NUT
7440-47-3	Chromium	2.8	K	15		mg/kg	S37SB0020101	5/5	NA	6.90	15	59.1	23 (10) N	270	42	No	BSL, BKG
7440-48-4	Cobalt	1.1	K	4.7	K	mg/kg	S37SB0030101	3/5	0.7 - 0.79	2.05	4.7	14.7	160 N	NA	NA	No	BSL, BKG
7440-50-8	Copper	1.8	K	14.7		mg/kg	S37SB0020101	5/5	NA	5.62	14.7	47.6	310 N	NA	11000	No	BSL, BKG
7439-89-6	Iron	2600	J	11200	J	mg/kg	S37SB0030101	5/5	NA	5870	11200	35200	2300 N	NA	NA	No	BKG
7439-92-1	Lead	7.2		22.9		mg/kg	S37SB0020101	5/5	NA	13.5	22.9	38.6	400 (11)	NA	NA	No	BSL, BKG
7439-95-4	Magnesium	95.3		2530		mg/kg	S37SB0020101	4/5	56.5	580	2530	2940	NA	NA	NA	No	NUT, BKG
7439-96-5	Manganese	28.8		108		mg/kg	S37SB0030101	5/5	NA	65.4	108	155	160 N	NA	950	No	BSL, BKG
7440-02-0	Nickel	3.1	K	16.1		mg/kg	S37SB0020101	5/5	NA	6.16	16.1	15.9	160 N	13000	130 (12)	No	BSL
7440-09-7	Potassium	182		186		mg/kg	S37SB0020101	2/5	61.6 - 82.5	95.1	186	3440	NA	NA	NA	No	NUT, BKG
7440-23-5	Sodium	821		821		mg/kg	S37SB0020101	1/5	34.5 - 58.3	184	821	461	NA	NA	NA	No	NUT
7440-62-2	Vanadium	4	K	17.5	K	mg/kg	S37SB0020101	5/5	NA	9.10	17.5	102	55 N	NA	5100	No	BSL, BKG
7440-66-6	Zinc	8.2		14.7		mg/kg	S37SB0020101	5/5	NA	10.0	14.7	49.7	2300 N	NA	14000	No	BSL, BKG

Notes:
1 - Minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL for sany soils from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Soil Screening Levels for Inhalation EPA, May 1996. Soil Screening Guidance.
7 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. DAF (Dilution attenuation factor) of 20.
8 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)
9 - Value is for pyrene.
10 - Value is for hexavalent chromium.
11 - OSWER screening level. EPA, 1994: Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and Lead Contaminated Soil.
12 - Soil screening levels for migration to groundwater. EPA, May 1996. Soil Screening Guidance.
Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
K = Estimated value, biased high.
C = Carcinogenic.
N = Noncarcinogenic.

Associated Samples:
S37SB0010101
S37SB0010201
S37SB0020101
S37SB0030101
S37SB0030201

TABLE 9-4

SUMMARY OF POSITIVE DETECTIONS - GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001
Sample Number	S37TW0010001	S37TW0010001-F	S37TWDUP001	S37TWDUP001-F
Unfiltered/filtered?	Unfiltered	Filtered	Unfiltered	Filtered
Duplicate of:			S37TW0010001	S37TW0010001-F
Collection Date	02/05/02	02/05/02	02/05/02	02/05/02
Volatile Organics (ug/L)				
TOTAL XYLENES	1 U		1 U	
Semivolatile Organics (ug/L)				
2-METHYLNAPHTHALENE	5 U		5 U	
ACENAPHTHENE	5 U		5 U	
BIS(2-ETHYLHEXYL)PHTHALATE	5 U		2 J	
FLUORENE	5 U		5 U	
NAPHTHALENE	5 U		5 U	
NITROBENZENE				
PHENANTHRENE	5 U		5 U	
Explosives (ug/L)				
NITROBENZENE	0.2 U		0.2 U	
RDX	0.5 U		0.5 U	
Inorganics (ug/L)				
ALUMINUM	214	18.9	92.5	23.4
ARSENIC	6.1 K	2 U	5.8 K	2 U
BARIUM	149 J	127 J	157 J	131 J
CADMIUM	0.41 K	0.2 U	0.46 K	0.2 U
CALCIUM	94600	91700	99900	92600
CHROMIUM	1 U	0.86 U	0.77 U	0.77 U
COBALT	4.7 K	4.3 U	4.7 K	4.1 U
IRON	10500	3260	11000	2290
MAGNESIUM	24900 J	23800 J	26100 J	24300 J
MANGANESE	2840 J	2660 J	2980 J	2740 J
NICKEL	4.7 U	4.5 U	4.5 U	4 U
POTASSIUM	6660 J	6470 J	6780 J	6630 J
SELENIUM	2.5 K	2 U	3.4 K	2 U
SILVER	0.5 U	0.71 U	0.5 U	0.91 U
SODIUM	155000	153000	158000	153000
VANADIUM	0.3 U	0.3 U	0.3 U	0.3 U

Notes:
Blank means no analysis was performed.
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.
L - Est[illegible]d value biased low.

TABLE 9-4

SUMMARY OF POSITIVE DETECTIONS - GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
Sample Number	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
Unfiltered/filtered?	Unfiltered	Filtered	Unfiltered	Filtered
Duplicate of:				
Collection Date	02/06/02	02/08/02	02/06/02	02/08/02
Volatile Organics (ug/L)				
TOTAL XYLENES	2		1 U	
Semivolatile Organics (ug/L)				
2-METHYLNAPHTHALENE	6		5 U	
ACENAPHTHENE	2 J		5 U	
BIS(2-ETHYLHEXYL)PHTHALATE	5 U		5 U	
FLUORENE	3 J		5 U	
NAPHTHALENE	10		5 U	
NITROBENZENE	5 U		5 U	
PHENANTHRENE	4 J		5 U	
Explosives (ug/L)				
NITROBENZENE	0.2 U		0.087 J	
RDX	1.2		0.5 U	
Inorganics (ug/L)				
ALUMINUM	14.9 U	55.5 U	11.5 U	31.8 U
ARSENIC	2 U	2 U	2 U	3.2 K
BARIUM	299	134	92.1 J	229
CADMIUM	0.2 UL	0.98 J	0.2 UL	0.76 J
CALCIUM	231000	171000	131000	149000
CHROMIUM	0.4 U	0.66 K	0.4 U	0.4 U
COBALT	0.43 U	11.4 K	1.2 U	2.5 U
IRON	444	15100	194	12700
MAGNESIUM	13900	34900	47400	26500
MANGANESE	183	3310	56.7	2050
NICKEL	2.1 U	14.9 K	10.8 U	5.6 U
POTASSIUM	4400	4570	7640	6470
SELENIUM	3.1 J	2 UL	2 UL	2 UL
SILVER	0.5 UL	0.5 UL	0.86 J	0.5 UL
SODIUM	72900	321000	216000	717000
VANADIUM	0.3 U	0.3 U	0.3 K	0.3 U

Notes:
Blank means no analysis was performed.
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.
L - Esti[illegible]d value biased low.

TABLE 9-5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Site 37

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Tap Water (5)	Potential ARAR/TBC Value(6)	Potential ARAR/TBC Source(6)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Volatile Organic Compounds																	
1330-20-7	Total Xylenes	2		2		ug/L	S37TW0020001	1/3	1	1.00	2	NA	1200 N	10000	MCL	No	BSL
Semivolatile Organic Compounds																	
91-57-6	2-Methylnaphthalene	6		6		ug/L	S37TW0020001	1/3	5	3.67	6	NA	12 N	NA	NA	No	BSL
83-32-9	Acenaphthene	2	J	2	J	ug/L	S37TW0020001	1/3	5	2.33	2	NA	37 N	NA	NA	No	BSL
117-81-7	Bis(2-Ethylhexyl)phthalate	2	J	2	J	ug/L	S37TW0010001-D	1/3	5	2.33	2	NA	4.8 C	6	MCL	No	BSL
86-73-7	Fluorene	3	J	3	J	ug/L	S37TW0020001	1/3	5	2.67	3	NA	24 N	NA	NA	No	BSL
91-20-3	Naphthalene	10		10		ug/L	S37TW0020001	1/3	5	5.00	10	NA	0.65 N	NA	NA	Yes	ASL
98-95-3	Nitrobenzene	0.087	J	0.087	J	ug/L	S37TW0030001	1/5	0.2 - 5	1.06	0.087	NA	0.35 N	NA	NA	No	BSL
85-01-8	Phenanthrene	4	J	4	J	ug/L	S37TW0020001	1/3	5	3.00	4	NA	18 (8) N	NA	NA	No	BSL
Inorganics, Total																	
7429-90-5	Aluminum	92.5		214		ug/L	S37TW0010001	1/3	11.5 - 14.9	55.5	214	286545198	3700 N	50 to 200	SMCL	No	BKG
7440-38-2	Arsenic	5.8	K	6.1	K	ug/L	S37TW0010001	1/3	2	2.65	6.1	NA	0.045 C	10	MCL	Yes	ASL
7440-39-3	Barium	92.1	J	299	J	ug/L	S37TW0020001	3/3	NA	181	299	254	260 N	2000	MCL	Yes	ASL
7440-43-9	Cadmium	0.41	K	0.46	K	ug/L	S37TW0010001-D	1/3	0.2	0.212	0.46	2.8	1.8 N	5	MCL	No	BSL, BKG
7440-70-2	Calcium	94600		231000		ug/L	S37TW0020001	3/3	NA	153083	231000	599450	NA	NA	NA	No	NUT, BKG
7440-48-4	Cobalt	4.7	K	4.7	K	ug/L	S37TW0010001, S37TW0010001-D	1/3	0.43 - 1.2	1.84	4.7	39.6	73 N	NA	NA	No	BSL, BKG
7439-89-6	Iron	194		11000		ug/L	S37TW0010001-D	3/3	NA	3796	11000	57199	1100 N	300	SMCL	No	BKG
7439-95-4	Magnesium	13900		47400		ug/L	S37TW0030001	3/3	NA	28933	47400	31254	NA	NA	NA	No	NUT
7439-96-5	Manganese	56.7		2980		ug/L	S37TW0010001-D	3/3	NA	1050	2980	28160	73 N	50	SMCL	No	BKG
7440-09-7	Potassium	4400		7640		ug/L	S37TW0030001	3/3	NA	6253	7640	83058	NA	NA	NA	No	NUT, BKG
7782-49-2	Selenium	2.5	K	3.4	K	ug/L	S37TW0010001-D	2/3	2	2.35	3.4	NA	18 N	50	MCL	No	BSL
7440-22-4	Silver	0.86	J	0.86	J	ug/L	S37TW0030001	1/3	0.5	0.453	0.86	NA	18 N	100	SMCL	No	BSL
7440-23-5	Sodium	72900		216000		ug/L	S37TW0030001	3/3	NA	148467	216000	79585	NA	NA	NA	No	NUT
7440-62-2	Vanadium	0.3	K	0.3	K	ug/L	S37TW0030001	1/3	0.3	0.200	0.3	24.1	26 N	NA	NA	No	BSL, BKG
Explosives																	
121-82-4	RDX	1.2		1.2		ug/L	S37TW0020001	1/3	0.5	0.567	1.2	NA	0.61 C	NA	NA	Yes	ASL
Inorganics, Filtered																	
7429-90-5	Aluminum	18.9		23.4		ug/L	S37TW0010001-F-D	1/3	31.8 - 55.5	21.6	23.4	286545198	3700 N	50 to 200	SMCL	No	BSL, BKG
7440-38-2	Arsenic	3.2	K	3.2	K	ug/L	S37TW0030001-F	1/3	2	1.73	3.2	NA	0.045 C	10	MCL	Yes	ASL
7440-39-3	Barium	127	J	229		ug/L	S37TW0030001-F	3/3	NA	164	229	254	260 N	2000	MCL	No	BSL, BKG
7440-43-9	Cadmium	0.76	J	0.98	J	ug/L	S37TW0020001-F	2/3	0.2	0.613	0.98	2.8	1.8 N	5	MCL	No	BSL, BKG
7440-70-2	Calcium	91700		171000		ug/L	S37TW0020001-F	3/3	NA	137383	171000	599450	NA	NA	NA	No	NUT, BKG
7440-47-3	Chromium	0.66	K	0.66	K	ug/L	S37TW0020001-F	1/3	0.4 - 0.86	0.423	0.66	20.9	11 N	100	MCL	No	BSL, BKG
7440-48-4	Cobalt	11.4	K	11.4	K	ug/L	S37TW0020001-F	1/3	2.5 - 4.3	4.92	11.4	39.6	73 N	NA	NA	No	BSL, BKG
7439-89-6	Iron	2290		15100		ug/L	S37TW0020001-F	3/3	NA	10192	15100	57199	1100 N	300	SMCL	No	BKG
7439-95-4	Magnesium	23800	J	34900		ug/L	S37TW0020001-F	3/3	NA	28483	34900	31254	NA	NA	NA	No	NUT
7439-96-5	Manganese	2050		3310		ug/L	S37TW0020001-F	3/3	NA	2687	3310	28160	73 N	50	SMCL	No	BKG
7440-02-0	Nickel	14.9	K	14.9	K	ug/L	S37TW0020001-F	1/3	4 - 5.6	6.61	14.9	39	73 N	NA	NA	No	BSL, BKG
7440-09-7	Potassium	4570		6630	J	ug/L	S37TW0010001-F-D	3/3	NA	5863	6630	83058	NA	NA	NA	No	NUT, BKG
7440-23-5	Sodium	153000		717000		ug/L	S37TW0030001-F	3/3	NA	397000	717000	79585	NA	NA	NA	No	NUT, BKG

Notes:
1 - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - 95% UTL from Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Drinking Water Standards and Health Advisories, EPA 2000.
7 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
No Toxicity Information (NTX)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)

8 - Value is for pyrene.
Shading Indicates that the maximum detected concentration exceeded the screening criteria therefore the chemical was retained as a COPC.

Associated Samples:
S37TW0010001 S37TW0010001-F
S37TW0010001-D S37TW0010001-F-D
S37TW0020001 S37TW0020001-F
S37TW0030001 S37TW0030001-F

Definitions:
NA = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J = Estimated Value
K = Estimated value, biased high
MCL - Maximum Contaminant Level.
SMCL - Secondary Maximum Contaminant Level.
C = Carcinogenic
N - Noncarcinogenic

TABLE 9-6

SUMMARY OF POSITIVE DETECTIONS - SURFACE WATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
Sample Number	S37SW0010001	FD01310202	S37SW0020001	S37SW0030001
Duplicate of:		S37SW0010001		
Collection Date	01/31/02	01/31/02	01/31/02	02/05/02
Semivolatile Organics (ug/L)				
2-METHYLNAPHTHALENE	2 J	5 U	5 U	5 U
4-METHYLPHENOL	5 U	5 U	5 U	3 J
NAPHTHALENE	5	5 U	5 U	5 U
PHENOL	5 U	2 J	5 U	5 U
Pesticides/PCBs (ug/L)				
4,4'-DDD	0.02 U	0.02 U	0.02 U	0.032
Inorganics (ug/L)				
ALUMINUM	91.9 U	99.5 U	134 U	1350
BARIUM	74.4 J	74.2 J	73.7 J	124 J
CADMIUM	0.21 K	0.24 K	0.27 K	0.41 K
CALCIUM	72200	71600	70600	17300
COBALT	1.1 U	1.1 U	0.99 U	29.6 K
IRON	124 U	155 U	140 U	9080
LEAD	0.4 U	0.4 U	0.4 U	9.1
MAGNESIUM	127000 J	126000 J	124000 J	12900 J
MANGANESE	61 J	63.9 J	61.5 J	2430 J
NICKEL	2.4 U	2.1 U	2.3 U	10.3 K
POTASSIUM	54400 J	54600 J	50400 J	3340 J
SELENIUM	2.1 K	2 U	2 U	2 U
SODIUM	980000	988000	978000	112000
THALLIUM	5 K	7.7 K	6.2 K	2 U
VANADIUM	8.4 K	8.1 K	8.2 K	1.9 K
ZINC	2 U	2 U	2 U	42.7

Notes:
U - Not detected at detection limit value shown.
J - Estimated value.
K - Estimated value, biased high.

TABLE 9-7

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE WATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water
Exposure Point: Site 37

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (1)	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Tap Water (5)	Potential ARAR/TBC Value	Potential ARAR/TBC Source(8)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Semivolatile Organic Compounds																	
91-57-6	2-Methylnaphthalene	2	J	2	J	ug/L	S37SW0010001	1/3	5	2.33	2	NA	12 N	NA	NA	No	BSL
106-44-5	4-Methylphenol	3	J	3	J	ug/L	S37SW0030001	1/3	5	2.67	3	NA	18 N	NA	NA	No	BSL
91-20-3	Naphthalene	5		5		ug/L	S37SW0010001	1/3	5	3.33	5	NA	0.65 N	NA	NA	Yes	ASL
108-95-2	Phenol	2	J	2	J	ug/L	S37SW0010001-D	1/3	5	2.33	2	NA	2200 N	21000	NRWQC	No	BSL
Pesticides/PCBs																	
72-54-8	4,4'-DDD	0.032		0.032		ug/L	S37SW0030001	1/3	0.02	0.017	0.032	NA	0.28 C	0.00083	NRWQC	Yes	ASL
Inorganics																	
7429-90-5	Aluminum	1350		1350		ug/L	S37SW0030001	1/3	91.9 - 134	488	1350	NA	3700 N	NA	NA	No	BSL
7440-39-3	Barium	73.7	J	124	J	ug/L	S37SW0030001	3/3	NA	90.7	124	NA	260 N	1000	NRWQC	No	BSL
7440-43-9	Cadmium	0.21	K	0.41	K	ug/L	S37SW0030001	3/3	NA	0.302	0.41	NA	1.8 N	NA	NA	No	BSL
7440-70-2	Calcium	17300		72200		ug/L	S37SW0010001	3/3	NA	53267	72200	NA	NA	NA	NA	No	NUT
7440-48-4	Cobalt	29.6	K	29.6	K	ug/L	S37SW0030001	1/3	0.99 - 1.1	10.2	29.6	NA	73 N	NA	NA	No	BSL
7439-89-6	Iron	9080		9080		ug/L	S37SW0030001	1/3	124 - 155	3073	9080	NA	1100 N	300	NRWQC	Yes	ASL
7439-92-1	Lead	9.1		9.1		ug/L	S37SW0030001	1/3	0.4	3.17	9.1	NA	15 (8)	NA	NA	No	BSL
7439-95-4	Magnesium	12900	J	127000	J	ug/L	S37SW0010001	3/3	NA	87800	127000	NA	NA	NA	NA	No	NUT
7439-96-5	Manganese	61	J	2430	J	ug/L	S37SW0030001	3/3	NA	851	2430	NA	73 N	50	NRWQC	Yes	ASL
7440-02-0	Nickel	10.3	K	10.3	K	ug/L	S37SW0030001	1/3	2.1 - 2.4	4.19	10.3	NA	73 N	610	NRWQC	No	BSL
7440-09-7	Potassium	3340	J	54600	J	ug/L	S37SW0010001-D	3/3	NA	36080	54600	NA	NA	NA	NA	No	NUT
7782-49-2	Selenium	2.1	K	2.1	K	ug/L	S37SW0010001	1/3	2	1.18	2.1	NA	18 N	170	NRWQC	No	BSL
7440-23-5	Sodium	112000		988000		ug/L	S37SW0010001-D	3/3	NA	691333	988000	NA	NA	NA	NA	No	NUT
7440-28-0	Thallium	5	K	7.7	K	ug/L	S37SW0010001-D	2/3	2	4.52	7.7	NA	0.26 N	1.7	NRWQC	Yes	ASL
7440-62-2	Vanadium	1.9	K	8.4	K	ug/L	S37SW0010001	3/3	NA	6.12	8.4	NA	26 N	NA	NA	No	BSL
7440-66-6	Zinc	42.7		42.7		ug/L	S37SW0030001	1/3	2	14.9	42.7	NA	1100 N	9100	NRWQC	No	BSL

Notes:
(1) - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
(2) - Values presented are sample-specific quantitation limits.
(3) - The maximum detected concentration is used for screening purposes.
(4) - No Background data available.
(5) - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
(6) - EPA National Recommend Water Quality Criteria (NRWQC), April 1999.
(7) - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
(8) - Action Level, Drinking Water Standards and Health Advisories, U.S. EPA 2000.
Shading indicates that the maximum detected concentration exceeded the screening criteria therefore the chemical was retained as a COPC.

Associated Samples:
S37SW0010001
S37SW0010001-D
S37SW0020001
S37SW0030001

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered.
J = Estimated Value.
K = Estimated value, biased high.
NRWQC = National Recommended Water Quality Criteria.
C = Carcinogenic.
N = Noncarcinogenic.

TABLE 9-8

SUMMARY OF POSITIVE DETECTIONS - SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
Sample Number	S37SD0010001	FD01310201	S37SD0020001	S37SD0030001
Duplicate of:		S37SD0010001		
Collection Date	01/31/02	01/31/02	01/31/02	02/05/02
Interval, feet bgs	0 - 1	0 - 1	0 - 1	0 - 1
Volatile Organics (ug/kg)				
ACETONE	12 U	11 U	12 U	85 J
Semivolatile Organics (ug/kg)				
2-METHYLNAPHTHALENE	390	370 U	400 U	2000 J
ACENAPHTHYLENE	61 J	370 U	400 U	2300 UJ
BENZALDEHYDE	360 U	370 U	400 U	700 J
BENZO(A)ANTHRACENE	360 U	710	400 U	2300 UJ
BENZO(A)PYRENE	360 U	630	400 U	2300 UJ
BENZO(B)FLUORANTHENE	360 U	320 J	400 U	2300 UJ
BENZO(G,H,I)PERYLENE	360 U	150 J	400 U	2300 UJ
BENZO(K)FLUORANTHENE	360 U	83 J	400 U	2300 UJ
CHRYSENE	360 U	1100	400 U	2300 UJ
DIBENZO(A,H)ANTHRACENE	360 U	57 J	400 U	2300 UJ
FLUORANTHENE	360 U	170 J	400 U	2300 UJ
INDENO(1,2,3-CD)PYRENE	360 U	79 J	400 U	2300 UJ
NAPHTHALENE	360 U	370 U	400 U	640 J
PHENANTHRENE	360 U	260 J	400 U	2300 UJ
PYRENE	360 U	1100	400 U	520 J
Pesticides/PCBs (ug/kg)				
4,4'-DDD	3.6 U	3.7 U	4 U	180 J
4,4'-DDE	3.6 U	3.7 U	4 U	73 J
Explosives (mg/kg)				
NITROCELLULOSE	0.49 U	0.69 U	0.69 U	4.5 J
Inorganics (mg/kg)				
ALUMINUM	356 J	356 J	208 J	10200 J
ARSENIC	0.69 K	2.6 K	0.64 K	11.5 J
BARIUM	4.2 J	4.1 J	3 J	140 J
BERYLLIUM	0.17 K	0.14 K	0.071 K	2 J
CADMIUM	0.076 K	0.058 K	0.16 K	1.5 J
CALCIUM	129	72.7	82.7	4550 J
CHROMIUM	4 K	3.3 K	2.3 K	18 J
COBALT	0.95 K	0.95 K	0.56 U	34.2 J
COPPER	0.55 U	2.3 U	1.2 U	100 J
IRON	5970 J	5030 J	1620 J	25800 J
LEAD	6.8	5.7	8.5	456 J
MAGNESIUM	101	104	70.1	2550 J
MANGANESE	73.6 J	61.9 J	34.2 J	435 J
NICKEL	1.5 K	1.7 K	0.78 K	51.9 J
POTASSIUM	101 U	77.6 U	75.2 U	1590 J
SILVER	0.7 K	0.58 K	0.22 K	0.69 UJ
SODIUM	101	70.8	112	1530 U
VANADIUM	5.3 K	8.4 K	3.1 K	43.5 J
ZINC	11.6	13.5	10.5 U	141 J

Notes:
U - Not detected at detection limit value shown.
J - Estimated value
K - Estimated value, biased high.

TABLE 9-9

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Site 37

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Residential (5)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Volatile Organic Compounds															
67-64-1	Acetone	85	J	85	J	ug/kg	S37SD0030001	1/3	11 - 12	32.3	85	NA	780000 N	No	BSL
Semivolatile Organic Compounds															
91-57-6	2-Methylnaphthalene	390		2000	J	ug/kg	S37SD0030001	2/3	370 - 400	829	2000	NA	160000 N	No	BSL
208-96-8	Acenaphthylene	61	J	61	J	ug/kg	S37SD0010001	1/3	370 - 2300	470	61	NA	470000 (8) N	No	BSL
100-52-7	Benzaldehyde	700	J	700	J	ug/kg	S37SD0030001	1/3	360 - 400	361	700	NA	780000 N	No	BSL
56-55-3	Benzo(a)anthracene	710		710		ug/kg	S37SD0010001-D	1/3	360 - 2300	598	710	NA	870 C	No	BSL
50-32-8	**Benzo(a)pyrene**	630		630		ug/kg	S37SD0010001-D	1/3	360 - 2300	585	630	NA	**87 C**	**Yes**	ASL
205-99-2	Benzo(b)fluoranthene	320	J	320	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	557	320	NA	870 C	No	BSL
191-24-2	Benzo(g,h,i)perylene	150	J	150	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	500	150	NA	230000 (9) N	No	BSL
207-08-9	Benzo(k)fluoranthene	83	J	83	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	478	83	NA	8700 C	No	BSL
218-01-9	Chrysene	1100		1100		ug/kg	S37SD0010001-D	1/3	360 - 2300	663	1100	NA	87000 C	No	BSL
53-70-3	Dibenzo(a,h)anthracene	57	J	57	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	469	57	NA	87 C	No	BSL
206-44-0	Fluoranthene	170	J	170	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	507	170	NA	310000 N	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	79	J	79	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	476	79	NA	870 C	No	BSL
91-20-3	Naphthalene	640	J	640	J	ug/kg	S37SD0030001	1/3	360 - 400	341	640	NA	160000 N	No	BSL
85-01-8	Phenanthrene	260	J	260	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	537	260	NA	230000 (9) N	No	BSL
129-00-0	Pyrene	520	J	1100		ug/kg	S37SD0010001-D	2/3	360 - 400	453	1100	NA	230000 N	No	BSL
Pesticides/PCBs															
72-54-8	4,4'-DDD	180	J	180	J	ug/kg	S37SD0030001	1/3	3.6 - 4	61.3	180	NA	2700 C	No	BSL
72-55-9	4,4'-DDE	73	J	73	J	ug/kg	S37SD0030001	1/3	3.6 - 4	25.6	73	NA	1900 C	No	BSL
Explosives															
9004-70-0	Nitrocellulose	4.5	J	4.5	J	mg/kg	S37SD0030001	1/3	0.49 - 0.69	1.71	4.5	NA	NA	No	NTX
Inorganics															
7429-90-5	**Aluminum**	208	J	10200	J	mg/kg	S37SD0030001	3/3	NA	3588	10200	52362	**7800 N**	**Yes**	ASL
7440-38-2	**Arsenic**	0.64	K	11.5	J	mg/kg	S37SD0030001	3/3	NA	4.60	11.5	63	**0.43 C**	**Yes**	ASL
7440-39-3	Barium	3	J	140	J	mg/kg	S37SD0030001	3/3	NA	49.1	140	577	550 N	No	BSL
7440-41-7	Beryllium	0.071	K	2	J	mg/kg	S37SD0030001	3/3	NA	0.742	2	10.9	16 N	No	BSL
7440-43-9	Cadmium	0.058	K	1.5	J	mg/kg	S37SD0030001	3/3	NA	0.576	1.5	1.85	3.9 N	No	BSL
7440-70-2	Calcium	72.7		4550	J	mg/kg	S37SD0030001	3/3	NA	1578	4550	88137	NA	No	NUT
7440-47-3	Chromium	2.3	K	18	J	mg/kg	S37SD0030001	3/3	NA	7.98	18	79.2	23 (10) N	No	BSL
7440-48-4	Cobalt	0.95	K	34.2	J	mg/kg	S37SD0030001	2/3	0.56	11.8	34.2	118	160 N	No	BSL
7440-50-8	Copper	100	J	100	J	mg/kg	S37SD0030001	1/3	0.55 - 2.3	33.8	100	297	310 N	No	BSL
7439-89-6	**Iron**	1620	J	25800	J	mg/kg	S37SD0030001	3/3	NA	10973	25800	193218	**2300 N**	**Yes**	ASL
7439-92-1	**Lead**	5.7		456	J	mg/kg	S37SD0030001	3/3	NA	157	456	476	**400 (11)**	**Yes**	ASL
7439-95-4	Magnesium	70.1		2550	J	mg/kg	S37SD0030001	3/3	NA	908	2550	19043	NA	No	NUT
7439-96-5	**Manganese**	34.2	J	435	J	mg/kg	S37SD0030001	3/3	NA	179	435	2561	**160 N**	**Yes**	ASL
7440-02-0	Nickel	0.78	K	51.9	J	mg/kg	S37SD0030001	3/3	NA	18.1	51.9	382	160 N	No	BSL
7440-09-7	Potassium	1590	J	1590	J	mg/kg	S37SD0030001	1/3	75.2 - 101	557	1590	5061	NA	No	NUT
7440-22-4	Silver	0.22	K	0.7	K	mg/kg	S37SD0010001	2/3	0.69	0.402	0.7	0.92	39 N	No	BSL
7440-23-5	Sodium	70.8		112		mg/kg	S37SD0020001	2/3	1530	321	112	472	NA	No	NUT
7440-62-2	Vanadium	3.1	K	43.5	J	mg/kg	S37SD0030001	3/3	NA	17.8	43.5	196	55 N	No	BSL
7440-66-6	Zinc	11.6		141	J	mg/kg	S37SD0030001	2/3	10.5	52.9	141	1660	2300 N	No	BSL

TABLE 9-9

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Notes:
1 - Minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
The 95% UTL is shown for informational purposes only. Sediment is not screened against background, see text.
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Soil Screening Levels for Inhalation EPA, May 1996. Soil Screening Guidance.
7 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
8 - Value is for acenaphthene. Below Screening Level (BSL)
9 - Value is for pyrene. Below Background Value (BKG)
10 - Value is for hexavalent chromium. No Toxicity Information (NTX)
11 - OSWER screening level. EPA, 1994: Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and Lead Contaminated Soil.
Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Associated Samples:
S37SD0010001
S37SD0010001-D
S37SD0020001
S37SD0030001

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
K = Estimated value, biased high.
C = Carcinogenic.
N = Noncarcinogenic.
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

TABLE 9-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration µg/L	RBC[1] µg/L	Estimated ILCR	Primary	RBC[1] µg/L	Estimated HQ
Naphthalene	10	NA	NA	Body Weight	6.5	1.5
RDX	1.2	0.61	2.0E-06	Prostate	110	0.01
Arsenic	6.1	0.045	1.4E-04	Skin, Vascular	11	0.6
Barium	299	NA	NA	Kidney	2,600	0.1
		Total Carcinogenic Risk	**1.4E-04**		**Total HI**	**2.2**

Target Organ HIs

Total Skin HI =	0.6
Total Vascular HI =	0.6
Total Body Weight HI =	1.5
Total Prostate HI =	0.01
Total Kidney HI =	0.1

Notes:
1 Risk-Based Concentration (RBC) Table (EPA Region 3, 2002). Some noncarcinogenic RBCs not presented in the EPA Region 3 RBC Table were calculated per the methodology detailed in Appendix I.
2 NA - Not applicable. The EPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD).

TABLE 9-11

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SURFACE WATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration µg/L	RBC[1] µg/L	Estimated ILCR	Primary	RBC[1] µg/L	Estimated HQ
Naphthalene	5	NA	NA	Body Weight	6.5	0.8
4,4'-DDD	0.032	0.28	1.1E-07	NA	NA	NA
Iron	9080	NA	NA	Blood, GS	11000	0.8
Manganese	2430	NA	NA	CNS	730	3.3
Thallium	7.7	NA	NA	Liver	2.6	3.0
		Total Carcinogenic Risk	**1.1E-07**		**Total HI**	**7.9**

Target Organ HIs

Total Body Weight HI =	0.8
Total Blood HI =	0.8
Total GS HI =	0.8
Total CNS HI =	3.3
Total Liver HI =	3.0

Notes:
1 Risk-Based Concentration (RBC) Table (EPA Region 3, 2002). Some noncarcinogenic RBCs not presented in the EPA Region 3 RBC Table were calculated per the methodology detailed in Appendix I.
2 NA - Not applicable. The EPA has not established a cancer slope factor (CSF) or noncarcinogenic reference dose (RfD).

Definition:
GS - Gastrointestinal.
CNS - Central nervous system.

TABLE 9-12

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Concentration (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary	RBC[1] (mg/kg)	Estimated HQ
Benzo(a)pyrene	0.63	0.087	7.2E-06	NA	NA	NA
Aluminum	10200	NA	NA	Immune, Nails	78000	0.1
Arsenic	11.5	0.43	2.7E-05	Skin, Vascular	23	0.5
Iron	25800	NA	NA	Blood, GS	23000	1.1
Lead	456	NA	NA	NA	NA	NA
Manganese	435	NA	NA	CNS	1600	0.3
	Total Carcinogenic Risk		3.4E-05		Total HI	2.0

Target Organ HIs

Total Skin HI =	0.5
Total Vascular HI =	0.5
Total Immune HI =	0.1
Total Nails HI =	0.1
Total Blood HI =	1.1
Total GS HI =	1.1

Notes:
1 Risk-Based Concentration (RBC) Table (EPA Region 3, 2002). Some noncarcinogenic RBCs not presented in the EPA Region 3 RBC Table were calculated per the methodology detailed in Appendix I.

Definition:
GS - Gastrointestinal.
CNS - Central nervous system.

TABLE 9-13

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration[1]	Location of Maximum Concentration	Average of Positive Results	Average of All Results	Groundwater COPC Screening Level[2]	Ecological Effects Quotient[3]	Retain as a COPC?	Rationale for Contaminant Deletion or Selection[4]
Volatile Organics (ug/L)										
Total Xylenes	1/3	2	2	S37TW0020001	2	1	6000	0.0003	NO	BSL
Semivolatile Organics (ug/L)										
2-Methylnaphthalene	1/3	6	6	S37TW0020001	6	3.7	12	0.5	NO	BSL
Acenaphthene	1/3	2 J	2 J	S37TW0020001	2	2.3	520	0.00	NO	BSL
Bis(2-Ethylhexyl)phthalate	1/3	2 J	2 J	S37TW0010001-D	2	2.3	30	0.07	NO	BSL
Fluorene	1/3	3 J	3 J	S37TW0020001	3	2.7	430	0.0	NO	BSL
Naphthalene	1/3	10	10	S37TW0020001	10	5	100	0.1	NO	BSL
Nitrobenzene	1/5	0.1 J	0.1 J	S37TW0030001	0.1	1.1	27000	3.2E-06	NO	BSL
Phenanthrene	1/3	4 J	4 J	S37TW0020001	4	3	6.3	0.63	NO	BSL
Inorganics, Total (ug/L)										
Aluminum	1/3	93	214	S37TW0010001	153	55	25	8.6	YES	ASL
Arsenic	1/3	5.8 K	6.1 K	S37TW0010001	6.0	2.7	48	0.1	NO	BSL
Barium	3/3	92 J	299	S37TW0020001	181	181	10000	0.03	NO	BSL
Cadmium	1/3	0.4 K	0.5 K	S37TW0010001-D	0.4	0.2	0.53	0.9	NO	BSL
Calcium	3/3	94600	231000	S37TW0020001	153083	153083	NA	NA	NO	NT
Cobalt	1/3	4.7 K	4.7 K	S37TW0010001	4.7	1.8	35000	0.0001	NO	BSL
Iron	3/3	194	11000	S37TW0010001-D	3796	3796	320	34	YES	ASL
Magnesium	3/3	13900	47400	S37TW0030001	28933	28933	NA	NA	NO	NT
Manganese	3/3	57	2980 J	S37TW0010001-D	1050	1050	14500	0.2	NO	BSL
Potassium	3/3	4400	7640	S37TW0030001	6253	6253	NA	NA	NO	NT
Selenium	2/3	2.5 K	3.4 K	S37TW0010001-D	3	2.4	5	0.7	NO	BSL
Silver	1/3	0.9 J	0.9 J	S37TW0030001	0.9	0.5	0.0001	8600	YES	ASL
Sodium	3/3	72900	216000	S37TW0030001	148467	148467	NA	NA	NO	NT
Vanadium	1/3	0.3 K	0.3 K	S37TW0030001	0.3	0.2	10000	0.00003	NO	BSL
Inorganics, Filtered (ug/L)										
Aluminum	1/3	18.9	23.4	S37TW0010001-F-D	21.2	21.6	25	0.9	NO	BSL
Arsenic	1/3	3.2 K	3.2 K	S37TW0030001-F	3.2	1.7	48	0.07	NO	BSL
Barium	3/3	127 J	229	S37TW0030001-F	164	164	10000	0.02	NO	BSL
Cadmium	2/3	0.76 J	0.98 J	S37TW0020001-F	0.9	0.6	0.53	1.8	YES	ASL
Calcium	3/3	91700	171000	S37TW0020001-F	137383	137383	NA	NA	NO	NT
Chromium	1/3	0.66 K	0.66 K	S37TW0020001-F	0.7	0.4	2	0.3	NO	BSL
Cobalt	1/3	11.4 K	11.4 K	S37TW0020001-F	11.4	4.9	35000	0.0003	NO	BSL
Iron	3/3	2290	15100	S37TW0020001-F	10192	10192	320	47	YES	ASL
Magnesium	3/3	23800 J	34900	S37TW0020001-F	28483	28483	NA	NA	NO	NT
Manganese	3/3	2050	3310	S37TW0020001-F	2687	2687	14500	0.2	NO	BSL
Nickel	1/3	14.9 K	14.9 K	S37TW0020001-F	14.9	6.6	160	0.1	NO	BSL
Potassium	3/3	4570	6630 J	S37TW0010001-F-D	5863	5863	NA	NA	NO	NT
Sodium	3/3	153000	717000	S37TW0030001-F	397000	397000	NA	NA	NO	NT
Explosives (ug/L)										
RDX	1/3	1.2	1.2	S37TW0020001	1.2	0.6	NA	NA	YES	NTX

TABLE 9-13

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Notes:
Shaded cells indicate that the chemical was selected as a COPC.
COPC = Chemical of Potential Concern
NA = Not Available
J = Estimated value
K - Estimated value, biased high
The sample and duplicate were counted as two separate samples when determining the minimum and maximum detected concentrations and location of maximum concentration, but were only counted as one sample when determining the frequency of detection. One-half of the detection limit was used when averaging non-detected data.
1 The maximum detected concentration was used to calculate the ecological effects quotient.
2 Refer to Table 4-5 for sources of groundwater screening criteria
3 Refer to Section 4.4.4 for ecological effects quotient calculation.
4 Rationale Codes:
For Selection as a COPC:
ASL = Above COPC Screening Level
BIO = Bioaccumulative Chemical
NTX = No Toxicity Information Available
For Elimination as a COPC:
BSL = Below COPC Screening Level
NT = Nontoxic
NZ = Not applicable because these parameters are used to characterize the sediments and/or cannot be used to evaluate ecological risks

Associated Samples:

S37TW0010001
S37TW0010001-AVG
S37TW0010001-D
S37TW0020001
S37TW0030001
S37TW0010001-F
S37TW0010001-F-AVG
S37TW0010001-F-D
S37TW0020001-F
S37TW0030001-F

TABLE 9-14

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SURFACE WATER - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration[1]	Location of Maximum Concentration	Average of Positive Results	Average of All Results	SW COPC Screening Level[2]	Ecological Effects Quotient[3]	Retain as a COPC?	Rationale for Contaminant Deletion or Selection[4]
Semivolatile Organics (ug/L)										
2-METHYLNAPHTHALENE	1/3	2 J	2 J	S37SW0010001	2	2.3	12	0.17	NO	BSL
4-METHYLPHENOL	1/3	3 J	3 J	S37SW0030001	3	2.7	NA	NA	YES	NTX
NAPHTHALENE	1/3	5	5	S37SW0010001	5	3.3	100	0.1	NO	BSL
PHENOL	1/3	2 J	2 J	S37SW0010001-D	2	2.3	79	0.03	NO	BSL
Pesticides/PCBs (ug/L)										
4,4'-DDD	1/3	0.032	0.032	S37SW0030001	0.03	0.02	0.6	0.1	YES	ASL
Inorganics (ug/L)										
ALUMINUM	1/3	1350	1350	S37SW0030001	1350	488	25	54	YES	ASL
BARIUM	3/3	73.7 J	124 J	S37SW0030001	90.7	90.7	10000	0.01	NO	BSL
CADMIUM	3/3	0.21 K	0.41 K	S37SW0030001	0.3	0.3	0.53	0.8	NO	BSL
CALCIUM	3/3	17300	72200	S37SW0010001	53267	53267	NA	NA	NO	NT
COBALT	1/3	29.6 K	29.6 K	S37SW0030001	29.6	10.2	35000	0.001	NO	BSL
IRON	1/3	9080	9080	S37SW0030001	9080	3073	320	28.4	YES	ASL
LEAD	1/3	9.1	9.1	S37SW0030001	9.1	3.2	3.2	2.8	YES	ASL
MAGNESIUM	3/3	12900 J	127000 J	S37SW0010001	87800	87800	NA	NA	NO	NT
MANGANESE	3/3	61 J	2430 J	S37SW0030001	851	851.3	14500	0.2	NO	BSL
NICKEL	1/3	10.3 K	10.3 K	S37SW0030001	10.3	4.2	160	0.1	NO	BSL
POTASSIUM	3/3	3340 J	54600 J	S37SW0010001-D	36080	36080	NA	NA	NO	NT
SELENIUM	1/3	2.1 K	2.1 K	S37SW0010001	1.6	1.2	5	0.4	NO	BSL
SODIUM	3/3	112000	988000	S37SW0010001-D	691333	691333	NA	NA	NO	NT
THALLIUM	2/3	5 K	7.7 K	S37SW0010001-D	6.3	4.5	40	0.19	NO	BSL
VANADIUM	3/3	1.9 K	8.4 K	S37SW0010001	6.1	6.1	10000	0.001	NO	BSL
ZINC	1/3	42.7	42.7	S37SW0030001	42.7	14.9	30	1.4	YES	ASL

Notes:
Shaded cells indicate that the chemical was selected as a COPC.
COPC = Chemical of Potential Concern
NA = Not Available
J = Estimated value
K = Estimated value, biased high
The sample and duplicate were counted as two separate samples when determining the minimum and maximum detected concentrations and location of maximum concentration, but were only counted as one sample when determining the frequency of detection. One-half of the detection limit was used when averaging non-detected data.
1 The maximum detected concentration was used to calculate the ecological effects quotient.
2 Refer to Table 4-5 for sources of surface water screening criteria
3 Refer to Section 4.4.4 for ecological effects quotient calculation.
4 Rationale Codes:
For Selection as a COPC:
ASL = Above COPC Screening Level
BIO = Bioaccumulative Chemical
NTX = No Toxicity Information Available
For Elimination as a COPC:
BSL = Below COPC Screening Level
NT = Nontoxic

Associated Samples:

S37SW0010001,DUP
S37SW0010001-AVG,AVG
S37SW0010001-D,DUP
S37SW0020001,NORMAL
S37SW0030001,NORMAL

TABLE 9-15

SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Concentration	Maximum Concentration[1]	Location of Maximum Concentration	Average of Positive Results	Average of All Results	Sediment COPC Screening Level[2]	Ecological Effects Quotient[3]	Retain as a COPC?	Rationale for Contaminant Deletion or Selection[4]
Volatile Organics (ug/kg)										
ACETONE	1/3	85 J	85 J	S37SD0030001	85	32.3	NA	NA	YES	NTX
Semivolatile Organics (ug/kg)										
2-METHYLNAPHTHALENE	2/3	390	2000 J	S37SD0030001	1144	829	70	28.6	YES	ASL
ACENAPHTHYLENE	1/3	61 J	61 J	S37SD0010001	61	470	44	1.4	YES	ASL
BENZALDEHYDE	1/3	700 J	700 J	S37SD0030001	700	361	NA	NA	YES	NTX
BENZO(A)ANTHRACENE	1/3	710	710	S37SD0010001-D	445	598	261	2.7	YES	ASL
BENZO(A)PYRENE	1/3	630	630	S37SD0010001-D	405	585	430	1.5	YES	ASL
BENZO(B)FLUORANTHENE	1/3	320 J	320 J	S37SD0010001-D	320	557	3200	0.1	NO	BSL
BENZO(G,H,I)PERYLENE	1/3	150 J	150 J	S37SD0010001-D	150	500	670	0.2	NO	BSL
BENZO(K)FLUORANTHENE	1/3	83 J	83 J	S37SD0010001-D	83	478	240	0.35	NO	BSL
CHRYSENE	1/3	1100	1100	S37SD0010001-D	640	663	384	2.9	YES	ASL
DIBENZO(A,H)ANTHRACENE	1/3	57 J	57 J	S37SD0010001-D	57	469	63.4	0.9	NO	BSL
FLUORANTHENE	1/3	170 J	170 J	S37SD0010001-D	170	507	600	0.3	NO	BSL
INDENO(1,2,3-CD)PYRENE	1/3	79 J	79 J	S37SD0010001-D	79	476	600	0.1	NO	BSL
NAPHTHALENE	1/3	640 J	640 J	S37SD0030001	640	341	160	4	YES	ASL
PHENANTHRENE	1/3	260 J	260 J	S37SD0010001-D	260	537	240	1.1	YES	ASL
PYRENE	2/3	520 J	1100	S37SD0010001-D	580	453	665	1.7	YES	ASL
Pesticides/PCBs (ug/kg)										
4,4'-DDD	1/3	180 J	180 J	S37SD0030001	180	61.3	16	11.3	YES	ASL
4,4'-DDE	1/3	73 J	73 J	S37SD0030001	73	25.6	2.2	33	YES	ASL
Explosives (mg/kg)										
NITROCELLULOSE	1/3	4.5 J	4.5 J	S37SD0030001	4.5	1.71	NA	NA	YES	NTX
Inorganics (mg/kg)										
ALUMINUM	3/3	208 J	10200 J	S37SD0030001	3588	3588	58030	0.2	NO	BSL
ARSENIC	3/3	0.6 K	11.5 J	S37SD0030001	4.6	4.6	8.2	1.4	YES	ASL
BARIUM	3/3	3 J	140 J	S37SD0030001	49.1	49.1	48	2.9	YES	ASL
BERYLLIUM	3/3	0.1 K	2 J	S37SD0030001	0.7	0.7	NA	NA	YES	NTX
CADMIUM	3/3	0.1 K	1.5 J	S37SD0030001	0.6	0.6	1.2	1.3	YES	ASL
CALCIUM	3/3	72.7	4550 J	S37SD0030001	1578	1578	NA	NA	NO	NT
CHROMIUM	3/3	2.3 K	18 J	S37SD0030001	8.0	8.0	81	0.2	NO	BSL
COBALT	2/3	1.0 K	34.2 J	S37SD0030001	17.6	11.8	50	0.684	NO	BSL
COPPER	1/3	100 J	100 J	S37SD0030001	100	33.8	34	2.9	YES	ASL
IRON	3/3	1620 J	25800 J	S37SD0030001	10973	10973	2	12900	YES	ASL
LEAD	3/3	5.7	456 J	S37SD0030001	157	157	46.7	9.8	YES	ASL
MAGNESIUM	3/3	70.1	2550 J	S37SD0030001	908	908	NA	NA	NO	NT
MANGANESE	3/3	34.2 J	435 J	S37SD0030001	179	179	460	0.9	NO	BSL
NICKEL	3/3	0.8 K	51.9 J	S37SD0030001	18.1	18.1	20.9	2.5	YES	ASL
POTASSIUM	1/3	1590 J	1590 J	S37SD0030001	1590	557	NA	NA	NO	NT
SILVER	2/3	0.2 K	0.7 K	S37SD0010001	0.4	0.4	1	0.7	NO	BSL
SODIUM	2/3	70.8	112	S37SD0020001	99	321	NA	NA	NO	NT
VANADIUM	3/3	3.1 K	43.5 J	S37SD0030001	17.8	17.8	57	0.8	NO	BSL
ZINC	2/3	11.6	141 J	S37SD0030001	76.8	52.9	150	0.94	NO	BSL

TABLE 9-15

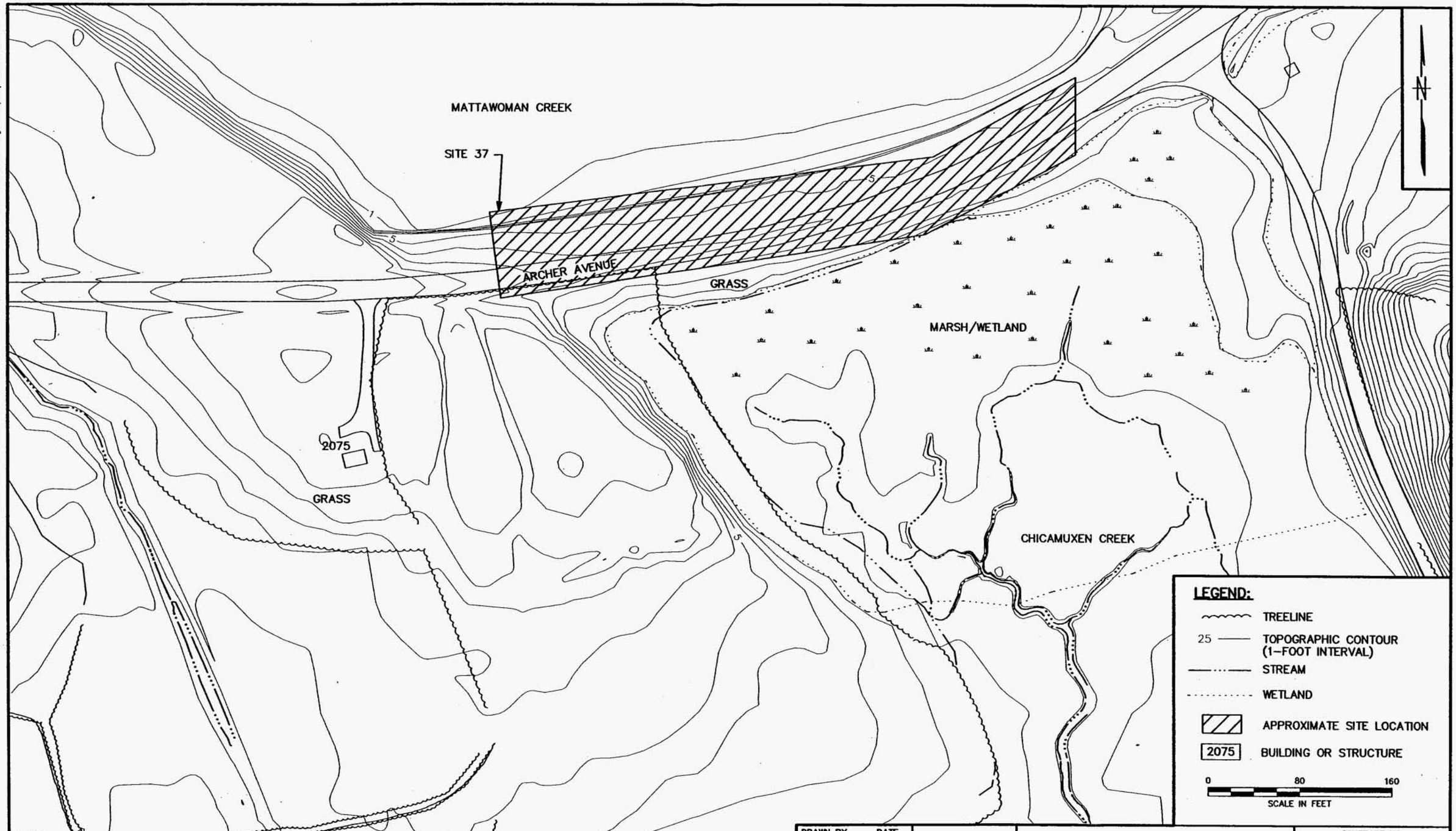
SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN - SEDIMENT - SITE 37
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Notes:
Shaded cells indicate that the chemical was selected as a COPC.
COPC = Chemical of Potential Concern
NA = Not Available
J = Estimaed value
K = Estimated value, biased high
The sample and duplicate were counted as two separate samples when determining the minimum and maximum detected concentrtions and location of maximum concentration, but were only counted as one sample when determining the frequency of detection. One-half of the detection limit was used when averaging non-detected data.
1 The maximum detected concentration was used to calculate the ecological effects quotient.
2 Refer to Table 4-4 for sources of sediment screening criteria
3 Refer to Section 4.4.4 for ecological effects quotient calculation.
4 Rationale Codes:
For Selection as a COPC:
ASL = Above COPC Screening Level
BIO = Bioaccumulative Chemical
NTX = No Toxicity Information Available
For Elimination as a COPC:
BSL = Below COPC Screening Level
NT = Nontoxic

Associated Samples:

S37SD0010001,DUP
S37SD0010001-AVG,AVG
S37SD0010001-D,DUP
S37SD0020001,NORMAL
S37SD0030001,NORMAL

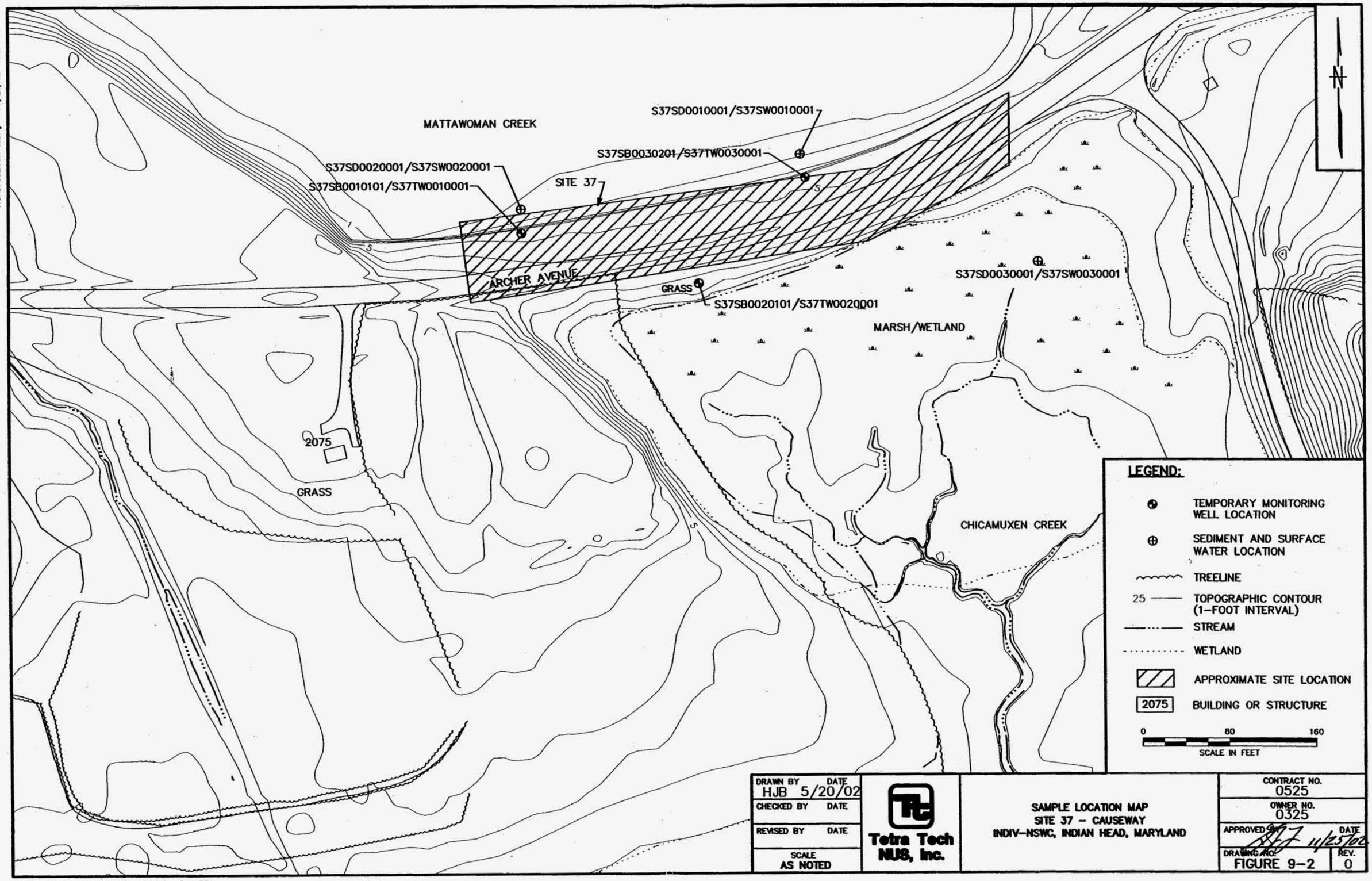
ACAD: 0525CM65.dwg 05/20/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SITE LAYOUT SITE 37 – CAUSEWAY INDIV–NSWC, INDIAN HAED, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 9–1 REV. 0

FORM CADD NO. TTNUS-BHLDWG – REV 1 – 9/10/98

ACAD: 0525GM15.dwg 05/21/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SAMPLE LOCATION MAP SITE 37 – CAUSEWAY INDIV–NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 9–2 REV. 0

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

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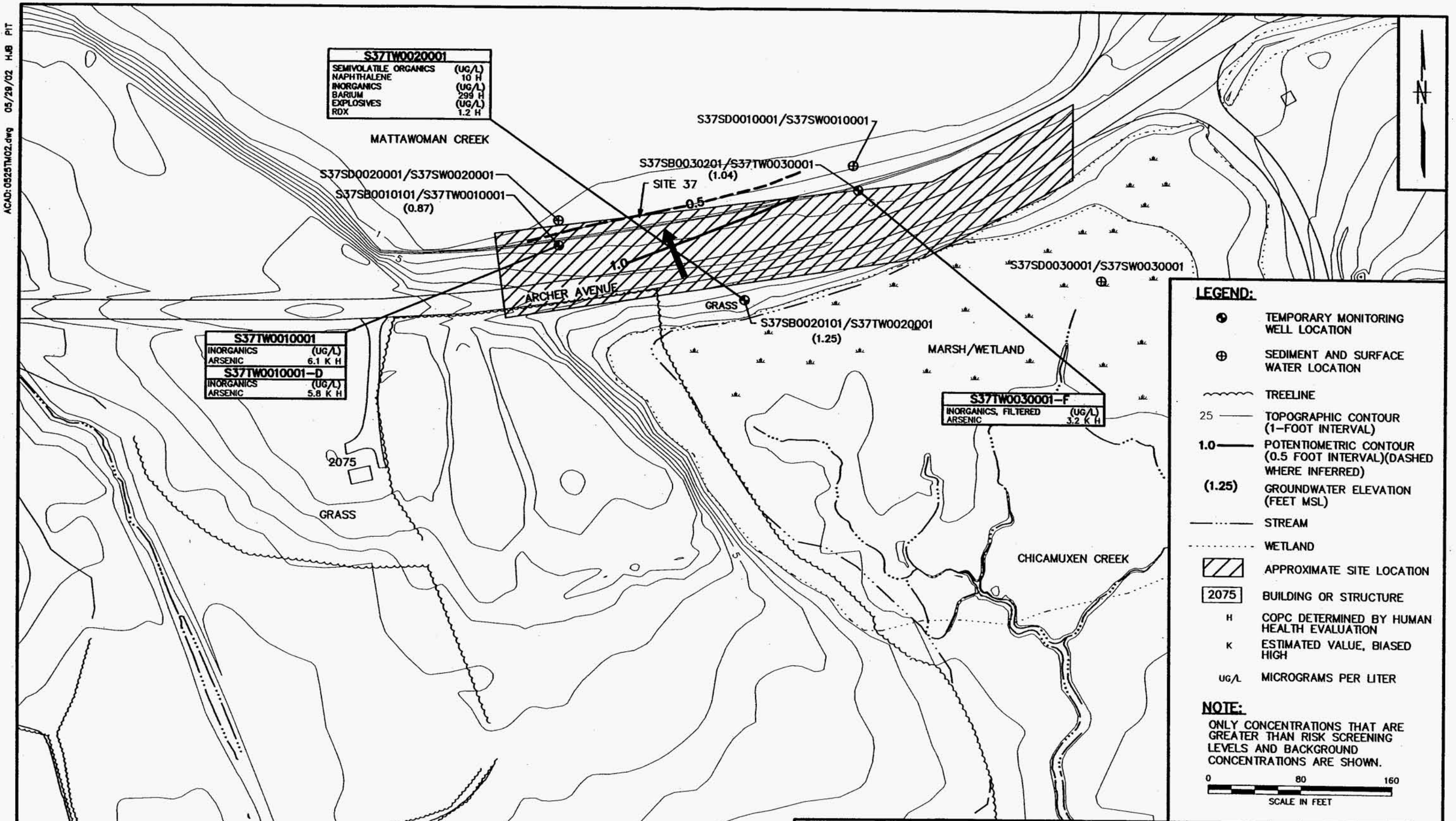

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CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

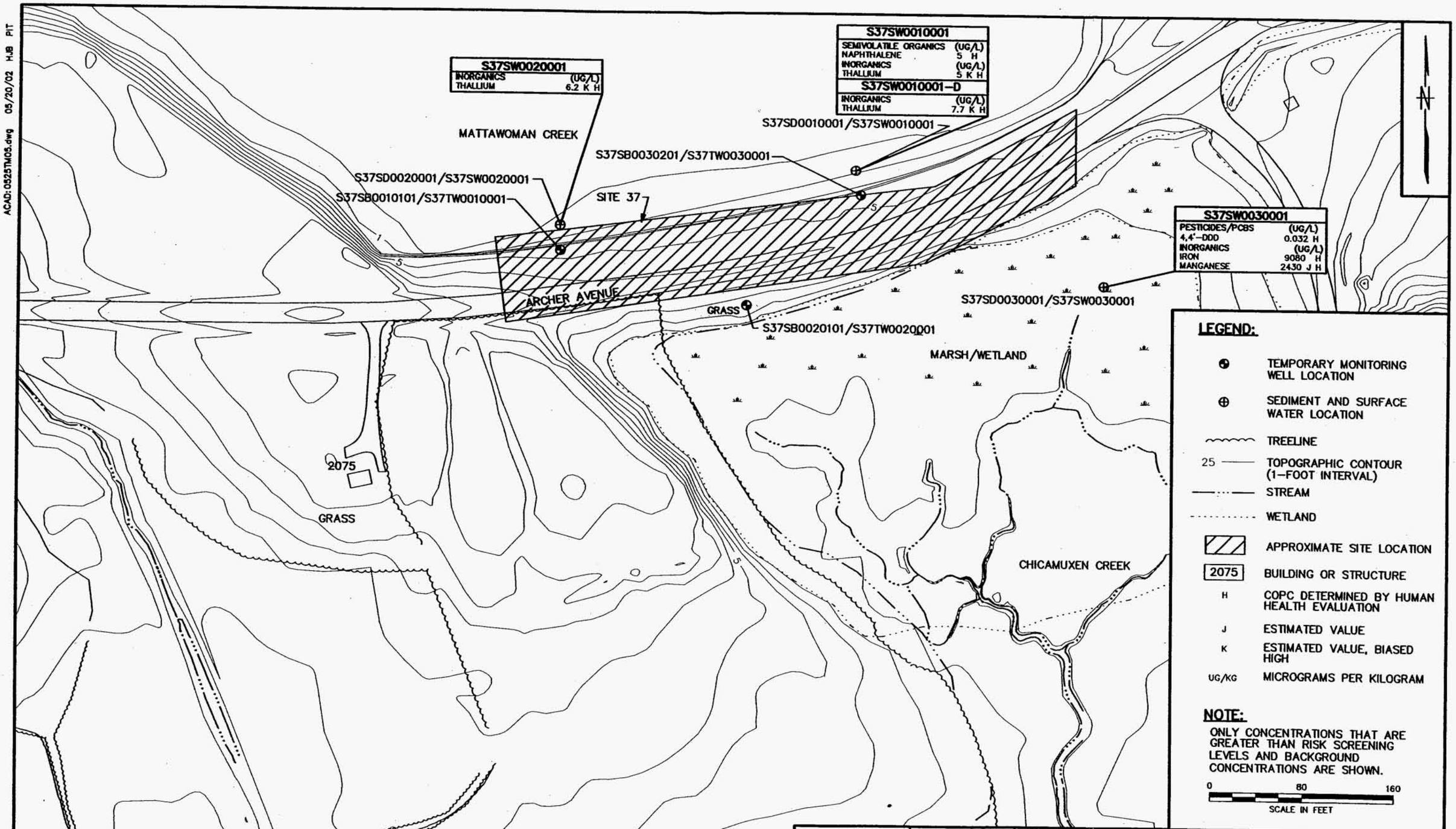
Tetra Tech NUS, Inc.

GROUNDWATER COPC CONCENTRATIONS
SITE 37 – CAUSEWAY
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NO. 0525	
OWNER NO. 0325	
APPROVED BY	DATE 11/25/02
DRAWING NO. FIGURE 9-3	REV. 0

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

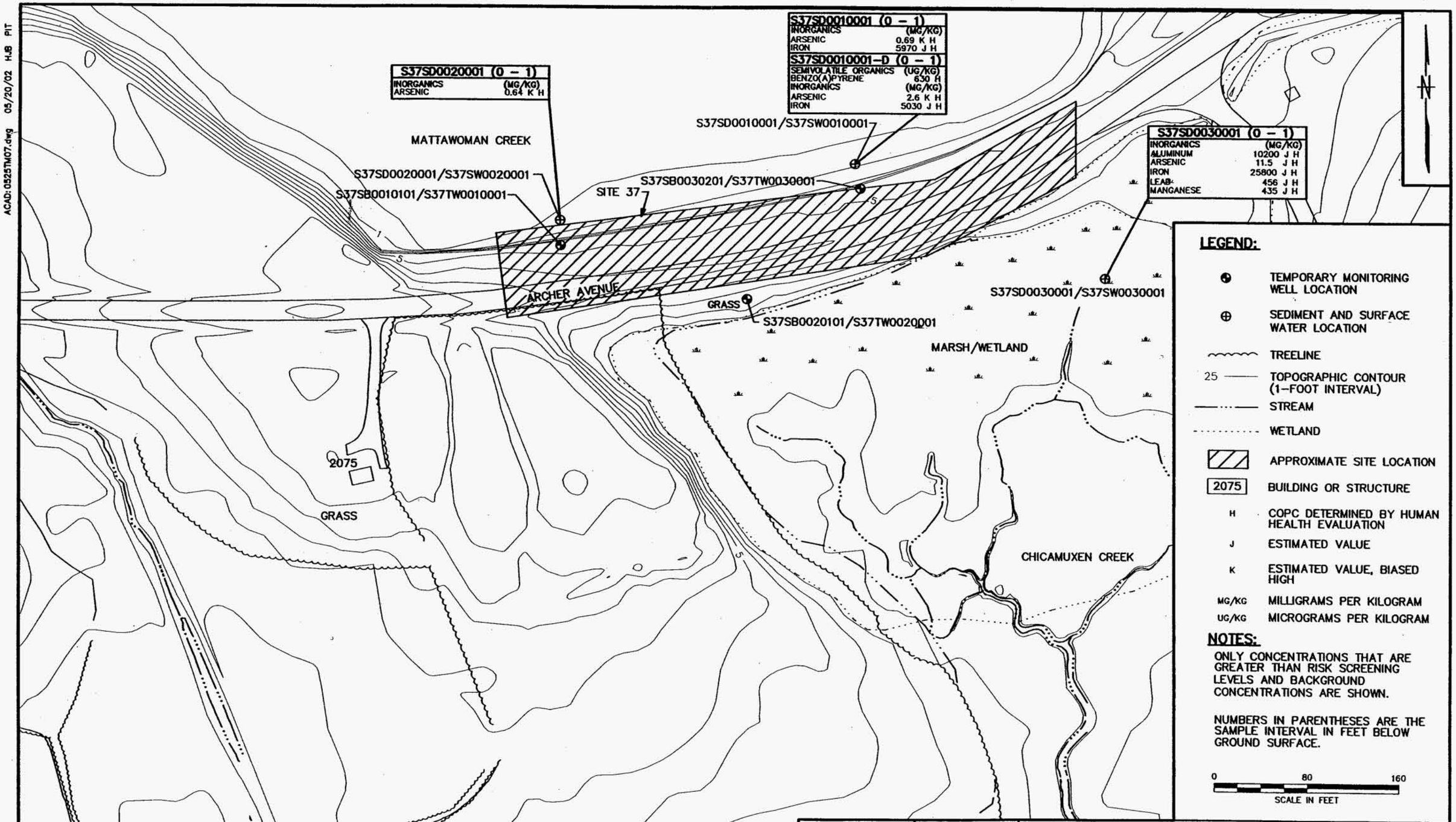
ACAD:0525TM05.dwg 05/20/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SURFACE WATER COPC CONCENTRATIONS SITE 37 – CAUSEWAY INDIV-NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 9-4 REV. 0

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

ACAD: 0525TM07.dwg 05/20/02 HJB PIT



DRAWN BY HJB DATE 5/20/02	Tetra Tech NUS, Inc.	SEDIMENT COPC CONCENTRATIONS SITE 37 – CAUSEWAY INDIV–NSWC, INDIAN HEAD, MARYLAND	CONTRACT NO. 0525
CHECKED BY DATE			OWNER NO. 0325
REVISED BY DATE			APPROVED BY DATE 11/25/02
SCALE AS NOTED			DRAWING NO. FIGURE 9–5 REV. 0

FORM CADD NO. TTNUS-BHLDWG – REV 1 – 9/10/98

10.0 SITE 51 - BUILDING 101 DRY WELL

10.1 BACKGROUND

Building 101 is located in the restricted area of the base near Thames and Evans Roads, next to Building 102, as shown on Figure 10-1. Site 51 is reportedly located between Buildings 101 and 102.

Department of the Navy, Bureau of Yards and Docks drawings 1028836, 1028837, and 1028839 (from the 1994 PA) show a dry well at Building 101. The flash tank detail, dry well detail, and the utilities site plan show a 1-inch steam condensate line leading to the dry well. No wastewater lines on the drawings lead to the dry well. Furthermore, the crushed stone of the dry well was 2 feet below grade, making it difficult to locate and access. It was therefore determined unlikely that any surface disposal took place at the well location (NEESA, 1991). The flash tank/steam condensate system no longer exists (NEESA, 1991).

Based on the drawings, the 1994 PA concluded that there is a lack of evidence to indicate the dry well was used for laboratory waste and that no hazardous waste disposal was suspected in the dry well. Therefore, the PA recommended no further work under the Navy Installation Restoration program (NEESA, 1991). However, this Site Screening investigation is being performed at Site 51 to field-verify the results of the PA. This site is not listed as an SSA in the FFA.

10.2 SITE CHARACTERISTICS

10.2.1 Topography

As illustrated on Figure 10-1, the land surface at Site 51 is relatively flat, with a very slight slope to the south. The land surface elevation across the site is approximately 102 feet above msl.

10.2.2 Surface Water

Precipitation most likely infiltrates the soil and possibly runs off across the ground surface into a drainage swale approximately 75 feet to the south.

10.2.3 Geology/Soils

The soil boring installed at the site indicated that the shallow geologic conditions consist primarily of silt and clay overlying gravel nearby the dry well. Soil boring logs are provided in Appendix B.

10.3 FIELD INVESTIGATION

A geophysical survey was completed at the site to locate the steam lines feeding into dry well(s). Subsurface soil samples were collected and submitted to a fixed-base laboratory for chemical analysis to evaluate the potential presence or absence of contaminants.

Observations made during the field investigation showed that there was only one dry well serving both Building 101 and Building 102. This dry well has been arbitrarily designated as Site 51.

Three pipes feed into the one identified dry well. One of the three pipes was still being used to discharge steam condensate from Building 101. This line was set approximately 0.5 foot below the ground surface and was indicated at the ground surface by distressed vegetation. The other two lines were approximately 1.5 to 2 feet bgs and appeared to be inactive. These two lines are suspected to be the lines from both Buildings 101 and 102 abandoned flash tanks. The dry well was constructed with a 2-foot by 2-foot by 2-foot pit covered with a steel grate at the ground surface. Gravel was encountered below the well at approximately 2 to 2.5 feet bgs and extended to at least 3 feet from the edges of the sidewalls.

10.3.1 Geophysical Investigation

A GPR system was used to perform a geophysical survey at Sites 51 and 52. The GPR transmits a 450 MHz electromagnetic signal into the ground and receives and measures the speed and amplitude of the reflected signal from the subsurface. The survey was conducted along eight north-south lines and ten east-west lines. The effective exploration depth of the instrument is approximately 10 feet. The results of the survey are shown on Figure 10-2, which shows the locations of buried pipes and other items identified by the GPR. A detailed report of the geophysical survey results is provided in Appendix D.

10.3.2 Subsurface Soil Sampling

Two subsurface soil samples were collected from a soil boring (S51SB001) installed adjacent to the dry well. The sample location is shown on Figure 10-2. The soil samples were collected using hand auger drilling techniques.

The sample depths were selected based upon field conditions in combination with the proposed depths from the work plan. No elevated PID readings or waste were encountered during the subsurface investigation. The soil consisted primarily of silt and clay overlying gravel that was encountered at 2 to 2.5 feet bgs. The samples were submitted to a fixed-base laboratory to be analyzed for TCL VOCs. The samples and analyses are summarized on Table 10-1. Soil sample log sheets are provided in Appendix C.

One field duplicate S51SBDUP0101 was collected at the same location as S51SB0010201 and analyzed for TCL VOCs.

10.4 ANALYTICAL RESULTS AND COPC SELECTION

This section provides the data, evaluation, and human health COPC selection of subsurface soil at Site 51. This screening evaluation is based on the following samples:

- Two subsurface soil samples

The results were evaluated as described below. Complete chemical analytical results are presented in Appendix H.

10.4.1 Data And Risk-Based Evaluation of Subsurface Soil Contamination

Positive analytical results and summary statistics for subsurface soil samples are provided in Tables 10-2 and 10-3, respectively.

Based on the laboratory results, concentrations of VOCs were less than the direct contact screening criteria (EPA Region 3 RBCs or EPA SSLs for soil to air). The maximum detected concentration of benzene exceeded the EPA Region 3 SSL for migration from soil to groundwater. Because the reported concentrations of these chemicals were less than the direct contact screening criteria, potential risks from direct exposure to these COPCs in soil are expected to be minimal. However, exceedances of EPA Region 3 migration to groundwater SSLs may indicate the potential for chemicals to leach to groundwater and impact water quality.

Toluene was also detected but at a concentration less than the screening levels. No other VOCs were detected in the subsurface soil. The COPC concentrations are shown on Figure 10-3.

10.5 HUMAN HEALTH RISK SCREENING EVALUATION

No COPCs were identified for direct exposure at Site 51. Therefore, no further human health risk screening is necessary.

There was only one sample with a benzene concentration greater than the EPA Region 3 SSL for migration to groundwater. However, the depth to groundwater is over 30 feet and the silty, clayey soil limits migration. Further, there is a layer of very low permeability above the water table that will further

limit contaminant migration (E/A&H, 1994). Therefore, the depth to the water table, the presence of the lower permeability unit, and the low benzene concentration lead to the conclusion that there is no significant risk to human health.

10.6 ECOLOGICAL RISK SCREENING EVALUATION

No surface soil, groundwater, surface water, or sediment samples were collected, so a quantitative ecological risk evaluation cannot be performed. The results of the subsurface samples further suggest that there are no chemicals of concern. Therefore, there is no risk to ecological receptors.

10.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

10.7.1 Summary and Conclusions

There is only one dry well in the vicinity of Buildings 101 and 102. This dry well has been designated as Site 51. There were no COPCs, so no unacceptable risks to human health and ecological receptors were identified.

Note that activities may occur near this site incidental to the activities being performed as part of the larger Lab Area Investigation (Sites 14, 15, 16, 49, 50, 53, 54, and 55).

10.7.2 Recommendations

No action is required for Site 51, and a no action decision document should be prepared, following the same procedures as for an SSA.

TABLE 10-1

ENVIRONMENTAL SAMPLING AND ANALYSIS SUMMARY – SITE 51
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	Sample Designation	Sample Depth (feet below ground surface) [1]	Sample Analysis					
			TCL VOCs	TCL SVOCs	TAL Metals[2]	Beryllium and Copper[2]	TCL Pesticides/ PCBs	Explosives (with nitrocellulose, nitroguanidine, and nitroglycerine)
SUBSURFACE SOIL								
S51SB001	S51SB0010101	1.5-2	●					
S51SB001	S51SB0010201	2-3	●					
Duplicate of S51SB0010101	SS51SBDUP0101	1.5-2	●					

Notes:

1 Sample depths are as collected in the field.

TABLE 10-2

SUMMARY OF POSITIVE DETECTIONS - SUBSURFACE SOIL - SITE 51
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Sample Location	S51SB001	S51SB001	S51SB001
Sample Number	S51SB0010101	S51SBDUP0101	S51SB0010201
Duplicate of:		S51SB0010101	
Collection Date	02/11/02	02/11/02	02/11/02
Interval, feet bgs	1.5 - 2	1.5 - 2	2 - 3
Volatile Organics (ug/kg)			
BENZENE	11 U	11 U	3 J
TOLUENE	11 U	11 U	2 J

Notes:
U - Not detected at detection limit value shown.
J - Estimated value.

TABLE 10-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL - SITE 51
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 51

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Residential (5)	EPA SSLs Soil to Air(6)	U.S. EPA Region 3 SSLs Soil to Groundwater(7)	COPC Flag	Rationale for Contaminant Deletion or Selection(8)
Volatile Organic Compounds																	
108-88-3	Toluene	2	J	2	J	ug/kg	S51SB0010201	1/2	11	3.75	2	NA	16000000 N	650000	8800	No	BSL
71-43-2	Benzene	3	J	3	J	ug/kg	S51SB0010201	1/2	11	4.25	3	NA	12000 C	800	1.8	Yes	ASL

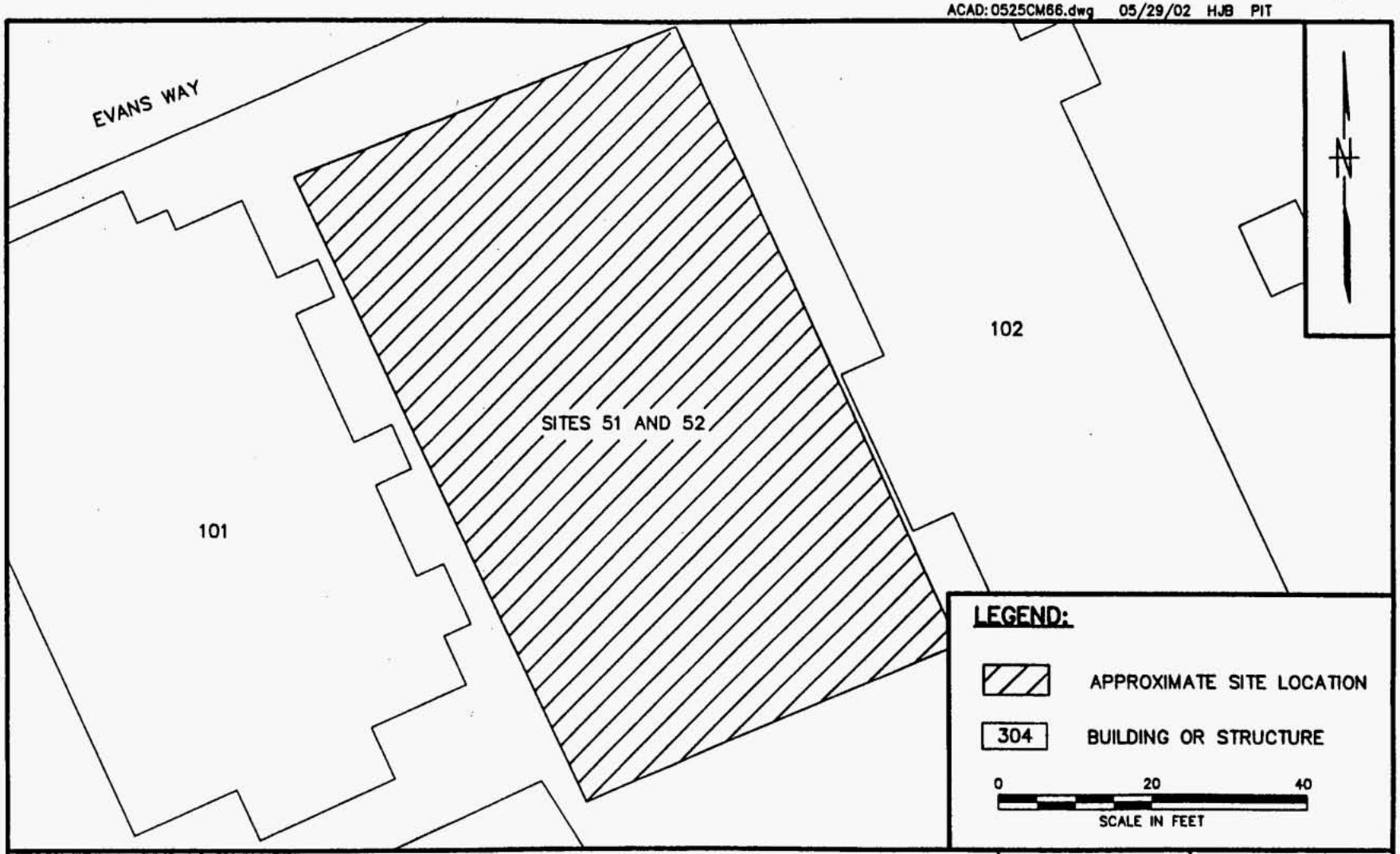
Notes:
1 - Minimum and maximum detected concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
5 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
6 - Soil Screening Levels for Inhalation U.S. EPA, May 1996. Soil Screening Guidance.
7 - EPA Region 3 Risk-Based Concentration Table, April 2, 2002. DAF (Dilution attenuation factor) of 20.
8 - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)

Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
C = Carcinogenic.
N = Noncarcinogenic.

Associated Samples:
S51SB0010101
S51SB0010101-D
S51SB0010201

ACAD: 0525CM66.dwg 05/29/02 HJB PIT



DRAWN BY HJB DATE 5/15/02	Tetra Tech NUS, Inc.	CONTRACT NO. 0525	OWNER NO. 0325
CHECKED BY DATE	SITE LAYOUT SITES 51 AND 52 – DRY WELLS INDIV–NSWC, INDIAN HEAD, MARYLAND	APPROVED BY	DATE 11/25/02
COST/SCHED–AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 10–1	REV. 0

FORM CADD NO. TtNUS_AH.DWG - REV 0 - 1/22/98

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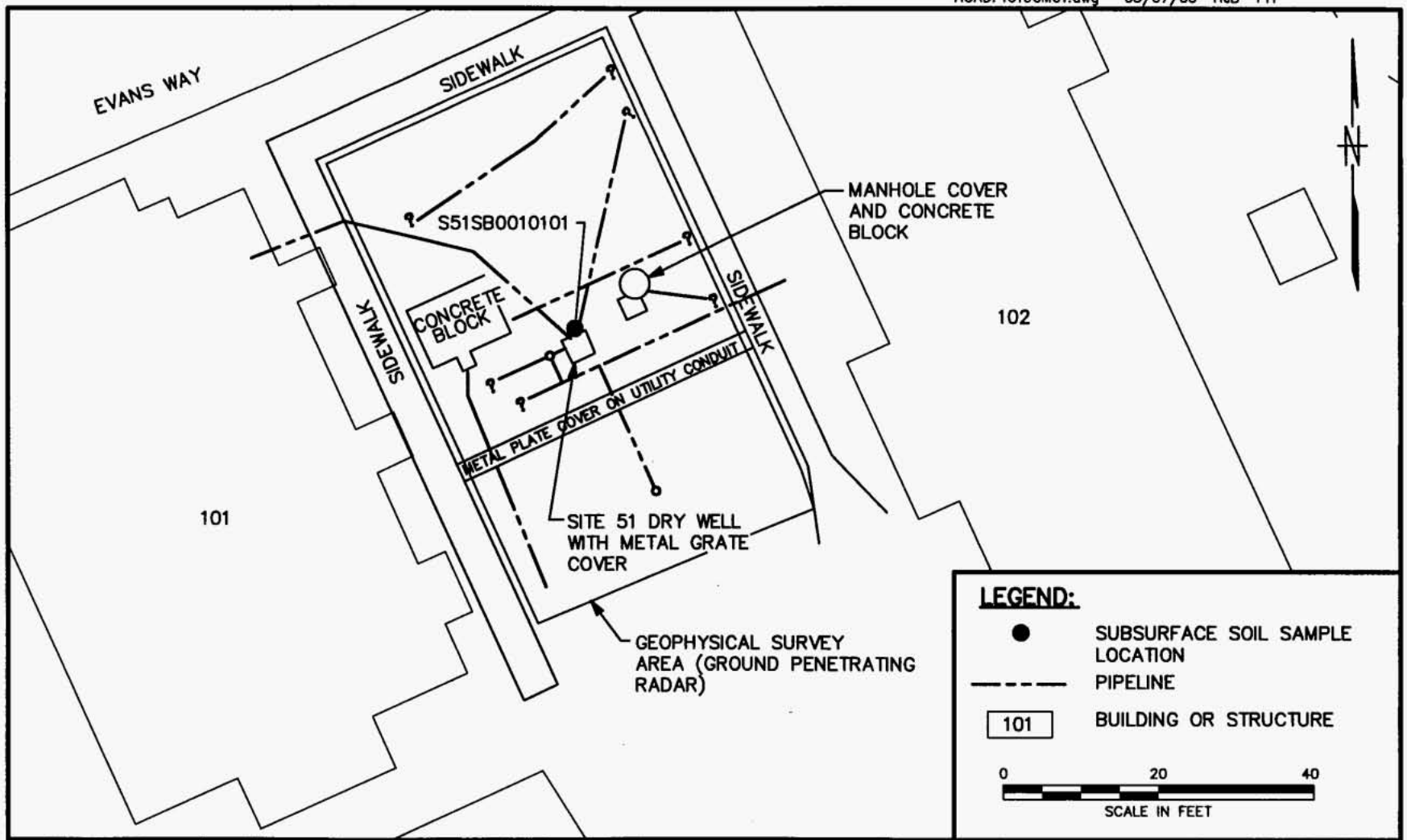
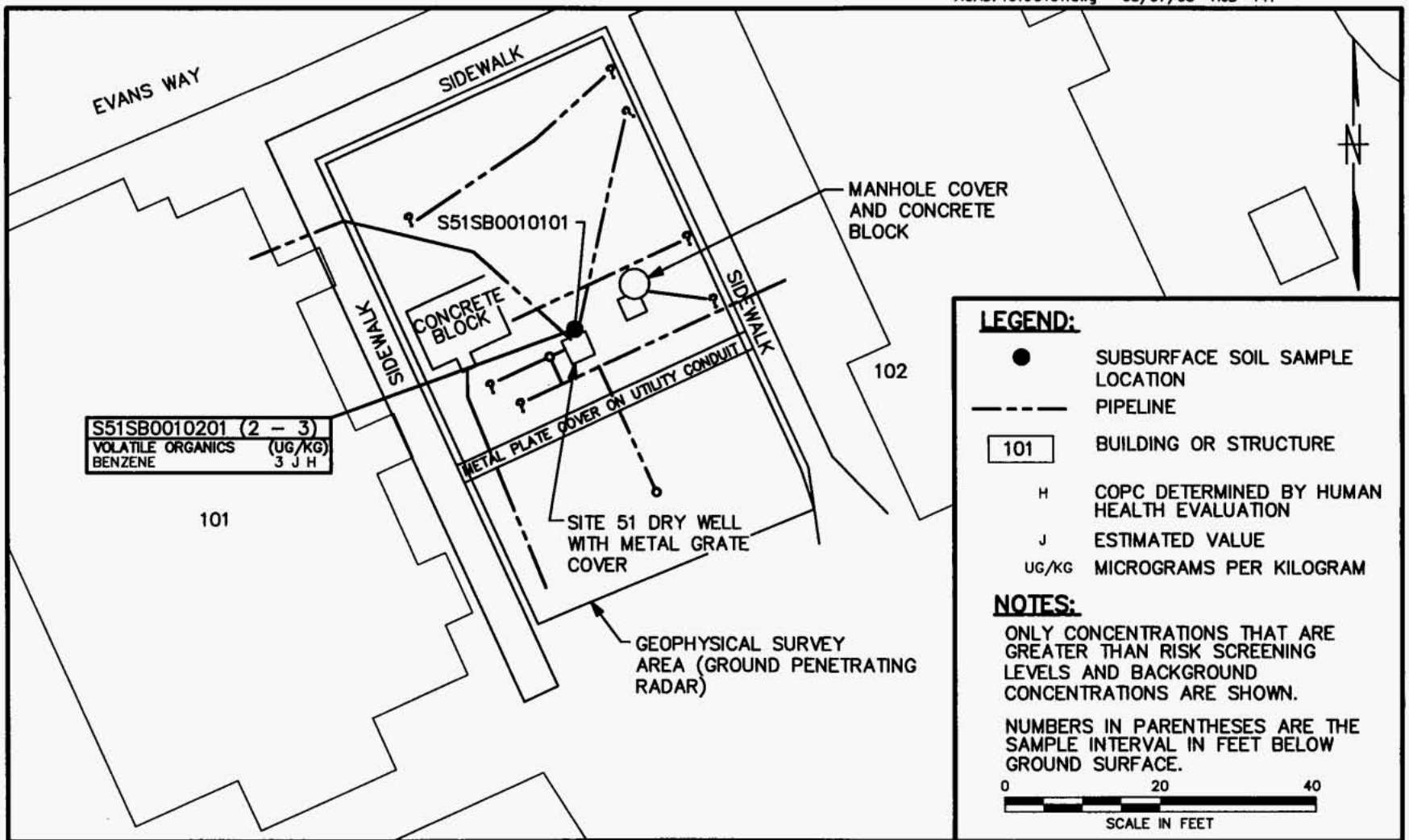


DRAWN BY HJB DATE 3/7/03	Tetra Tech NUS, Inc.	CONTRACT NO. 4019	OWNER NO. 0803
CHECKED BY DATE	SAMPLE LOCATION MAP SITES 51 AND 52 – DRY WELLS INDIV–NSWC, INDIAN HEAD, MARYLAND	APPROVED BY	DATE
COST/SCHED–AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 10–2	REV. 0

FORM CADD NO. T+NUS_AH.DWG - REV 0 - 1/22/98

ACAD: 4019GT01.dwg 03/07/03 HJB PIT



LEGEND:

- ● SUBSURFACE SOIL SAMPLE LOCATION
- — — — PIPELINE
- 101 BUILDING OR STRUCTURE
- H COPC DETERMINED BY HUMAN HEALTH EVALUATION
- J ESTIMATED VALUE
- UG/KG MICROGRAMS PER KILOGRAM

NOTES:

ONLY CONCENTRATIONS THAT ARE GREATER THAN RISK SCREENING LEVELS AND BACKGROUND CONCENTRATIONS ARE SHOWN.

NUMBERS IN PARENTHESES ARE THE SAMPLE INTERVAL IN FEET BELOW GROUND SURFACE.

0 20 40

SCALE IN FEET

DRAWN BY HJB DATE 3/7/03	Tetra Tech NUS, Inc.	CONTRACT NO. 4019	OWNER NO. 0803
CHECKED BY DATE	SUBSURFACE SOIL COPC CONCENTRATIONS SITES 51 AND 52 – DRY WELLS INDIV–NSWC, INDIAN HEAD, MARYLAND	APPROVED BY	DATE
COST/SCHED–AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 10–3	REV. 0

FORM CADD NO. T+NUS_AH.DWG – REV 0 – 1/22/98

11.0 SITE 52 - BUILDING 102 DRY WELL

11.1 BACKGROUND

Building 102 is located in the restricted area of the base near, Thames and Evans Roads next to Building 101, as shown on Figure 10-1. Site 52 was reportedly located within the same general area shown on Figure 10-2 between Buildings 101 and 102.

Naval Ordnance Station Indian Head personnel who were interviewed about the laboratory area buildings spoke of a flash tank room and a dry well near Building 102. There was some speculation as to whether the flash tank was used to vaporize volatile components of a laboratory waste stream and whether the dry well had received the remaining liquid phase of the waste (NEESA, 1991).

Department of the Navy, Bureau of Yards and Docks drawings 1028836, 1028837, and 1028839 (from the 1994 PA) show a dry well at Building 102. The flash tank detail, dry well detail, and the utilities site plan show a 1-inch steam condensate line leading to the dry well. No wastewater lines on the drawings lead to the dry well. Furthermore, the crushed stone of the dry well was 2 feet below grade, making it difficult to locate and access. It was therefore determined unlikely that any surface disposal took place at the well location (NEESA, 1991).

The flash tank/steam condensate system no longer exists (NEESA, 1991).

Based on the drawings, the 1994 PA concluded that there is a lack of evidence to indicate the dry well was used for laboratory waste and that no hazardous waste disposal was suspected in the dry well. Therefore, the PA recommended no further work under the Navy Installation Restoration program (NEESA, 1991). However, this Site Screening investigation is being performed at Site 52 to field-verify the results of the PA. This site is not listed as an SSA in the FFA.

11.2 SITE CHARACTERISTICS

As described below, there is only one dry well between Buildings 101 and 102. The site characteristics of this area are included in Section 10.2.

11.3 FIELD INVESTIGATION

Observations made during the field investigation showed that there was only one dry well serving both Building 101 and Building 102. This dry well was arbitrarily designated as Site 51. Therefore, there is no Site 52 dry well. See the Site 51 discussion in Section 10.3 for details.

11.4 ANALYTICAL RESULTS

Based on field observations described in Section 10.0, there is only one dry well in the vicinity of Buildings 101 and 102, and that dry well was designated as Site 51. The results of samples that were collected at the dry well are described in Section 10.0.

11.5 HUMAN HEALTH SCREENING EVALUATION

As noted in Section 10.0, there is only one dry well in the vicinity of Buildings 101 and 102. The human health risk evaluation of the results from the single dry well, designated as Site 51, are included in Section 10.0 and that evaluation determined that there is no unacceptable risk to human health.

11.6 ECOLOGICAL RISK EVALUATION

As noted in Section 10.0, there is only one dry well in the vicinity of Buildings 101 and 102. The ecological risk evaluation of the results from the single dry well, designated as Site 51, are included in Section 10.0, and that evaluation determined that there is no unacceptable risk to ecological receptors.

11.7 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

11.7.1 Summary and Conclusions

There is only one dry well in the vicinity of Buildings 101 and 102. This dry well has been designated as Site 51. Because there is no dry well specifically associated with Building 102, Site 52 does not exist, and, therefore, no action needs to be taken at Site 52.

11.7.2 Recommendations

No action is required for Site 52, and a no action decision document should be prepared, following the same procedures as for an SSA.

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APPENDIX A

WELL ABANDONMENT REPORTS AND COMPLETION REPORTS

A.1 TtNUS Monitoring Well Completion Forms
A.2 State of Maryland Well Reports and Abandonment Reports

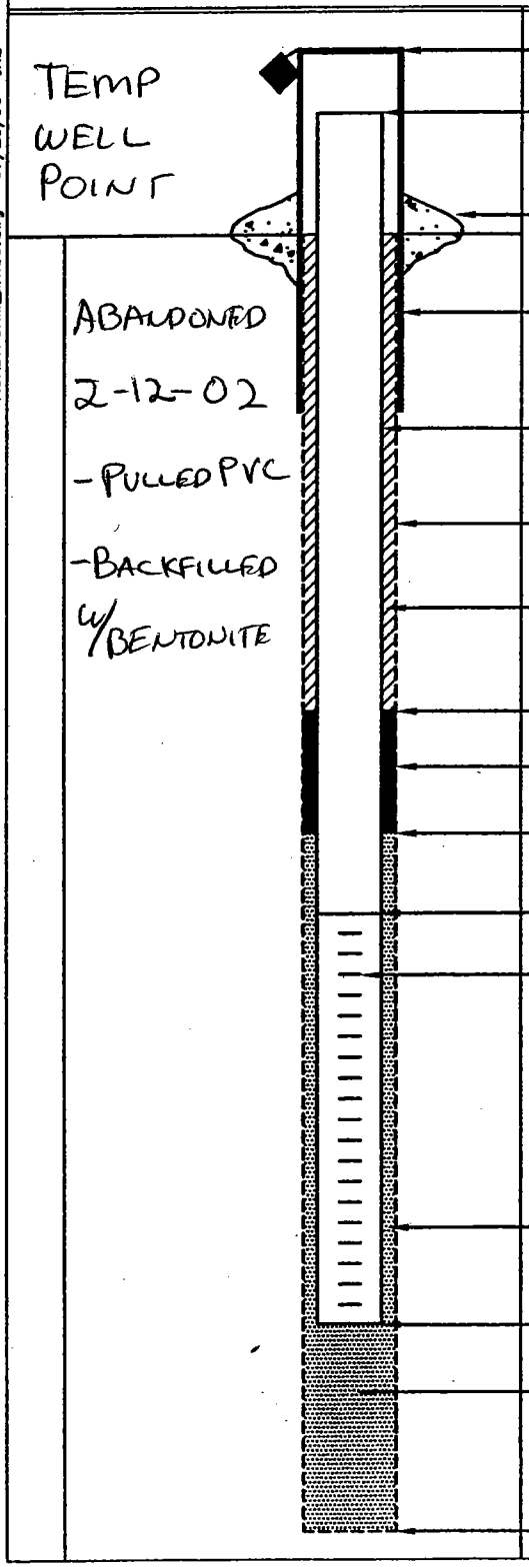
A.1 TtNUS MONITORING WELL COMPLETION FORMS

WELL NO.: S33TW001

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV.	LOCATION IHDIV STUMPNECK	DRILLER AARON F.
PROJECT NO. 0525	BORING S33TW001	DRILLING METHOD HSA
DATE BEGUN 2-7-02	DATE COMPLETED 2-7-02	DEVELOPMENT METHOD PUMP
FIELD GEOLOGIST FRED W RAMSER		
GROUND ELEVATION 80.96	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA/NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 82.11/1.15

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 69.96/11'

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 16

ELEVATION/DEPTH TOP OF SCREEN: 62.96/18'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: 52.96/28

ELEVATION/DEPTH BOTTOM OF SAND PACK: 50.96/30

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: 50.96/30

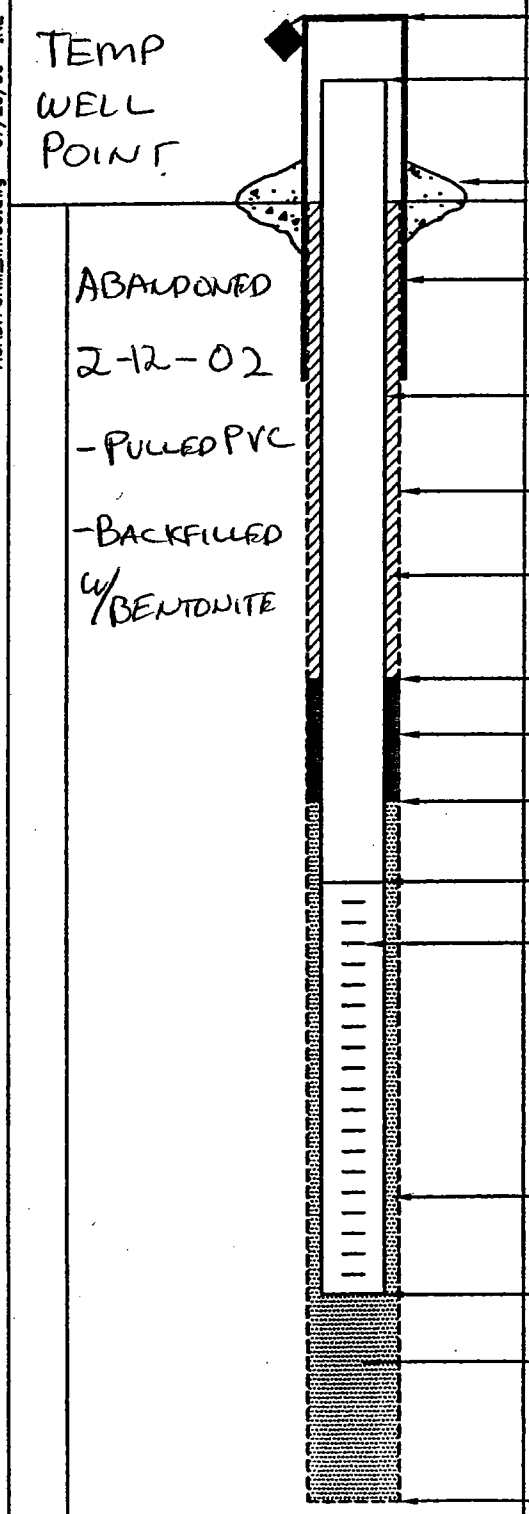
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S33TW002

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV.	LOCATION IHDIV STUMPNECK	DRILLER AARON F.
PROJECT NO. 0525	BORING S33TW002	DRILLING METHOD HSA
DATE BEGUN 2-8-02	DATE COMPLETED 2-8-02	DEVELOPMENT METHOD PUMP
FIELD GEOLOGIST FRED W RAMSER		
GROUND ELEVATION 81.35	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA/NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 82.82/1.47

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 68.35/13

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 66.35/15

ELEVATION/DEPTH TOP OF SCREEN: 63.35/18

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: 53.35/28

ELEVATION/DEPTH BOTTOM OF SAND PACK: 51.35/30

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: 51.35/30

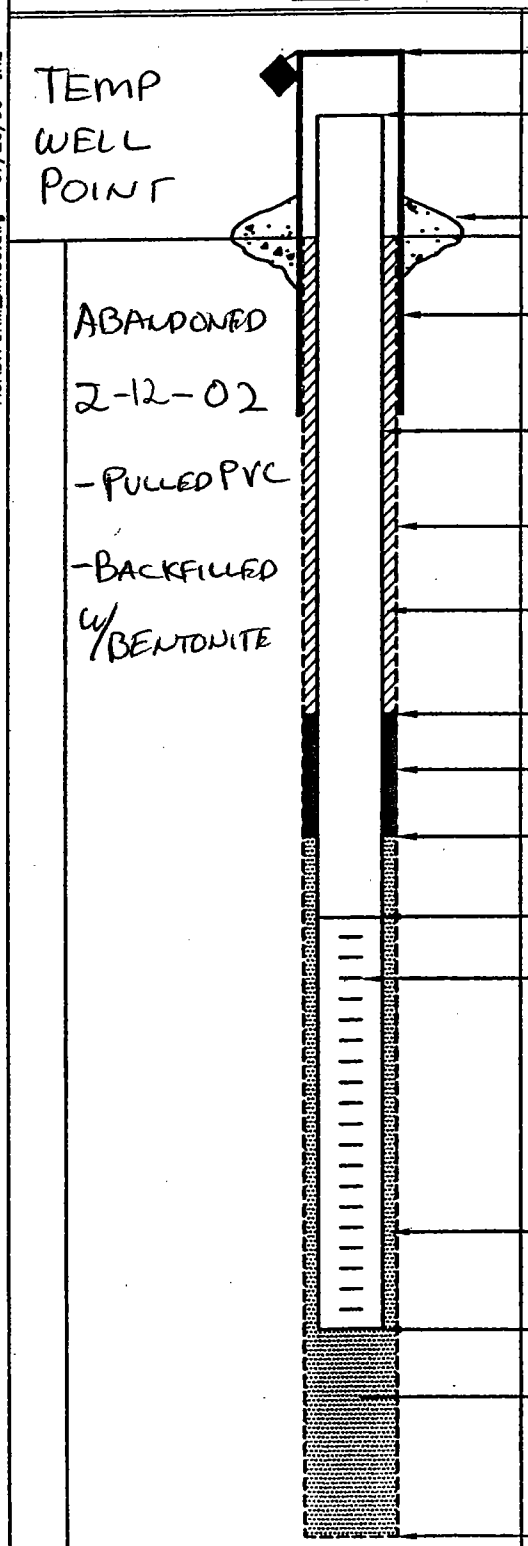
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S33TW003

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV.	LOCATION IHDIV STUMPNECK	DRILLER AARON F.
PROJECT NO. 0525	BORING S33TW003	DRILLING METHOD HSA
DATE BEGUN 2-6-02	DATE COMPLETED 2-6-02	DEVELOPMENT METHOD PUMP
FIELD GEOLOGIST FRED W RAMSER		
GROUND ELEVATION 78.78	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA/NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 79.50/0.72

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 64.78'/14'

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 60.78'/18'

ELEVATION/DEPTH TOP OF SCREEN: 58.78'/20'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: 48.78'/30'

ELEVATION/DEPTH BOTTOM OF SAND PACK: 48.78'/30'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: 48.78'/30'

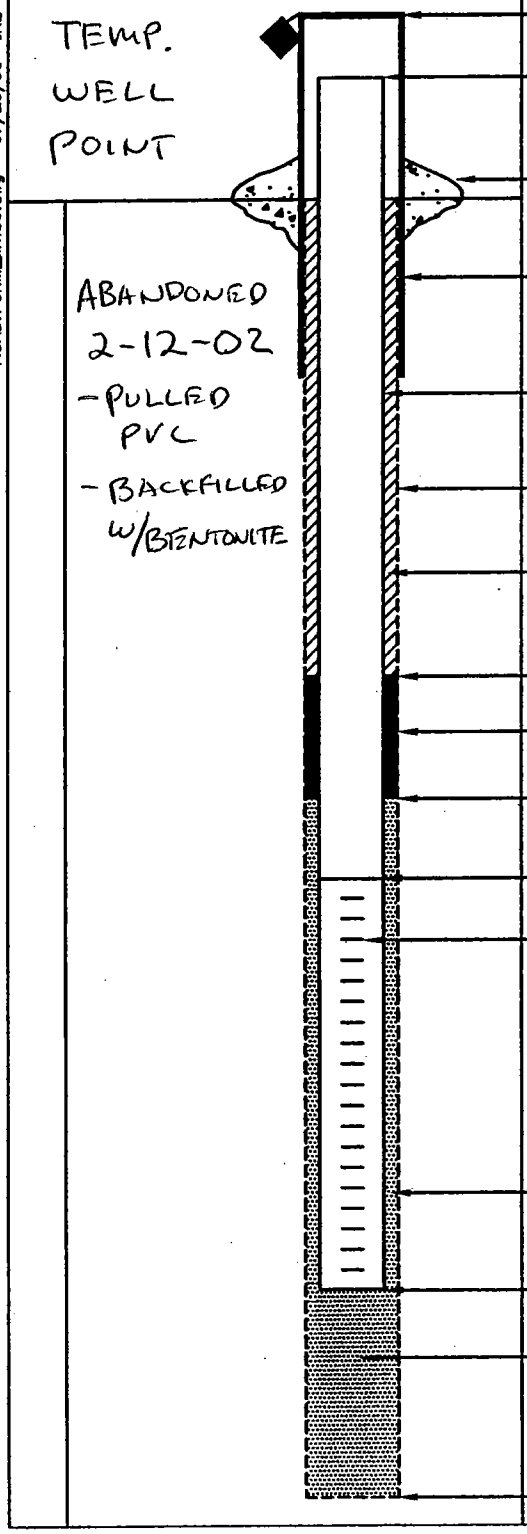
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S34TW001

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV	LOCATION IHDIU STUMPNECK	DRILLER AARON E.
PROJECT NO. 0525	BORING S34TW001	DRILLING METHOD HSA
DATE BEGUN 2-1-02	DATE COMPLETED 2-1-02	
FIELD GEOLOGIST FRED WRAMSER		DEVELOPMENT METHOD PUMP
GROUND ELEVATION 4.72	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA / NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 7.20 / 2.48

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: ~1"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: ~8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 4.72' / 0'

TYPE OF SEAL: BENTONITE CHIPS SHUR-PLUG 3/8" DSE

DEPTH TOP OF SAND PACK: 2'

ELEVATION/DEPTH TOP OF SCREEN: 0.72' / 4'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 X 5'

I.D. OF SCREEN: 1"

TYPE OF SAND PACK: RICCI BROS #00 N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -4.28 / 9'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -5.28 / 10'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -5.28 / 10'

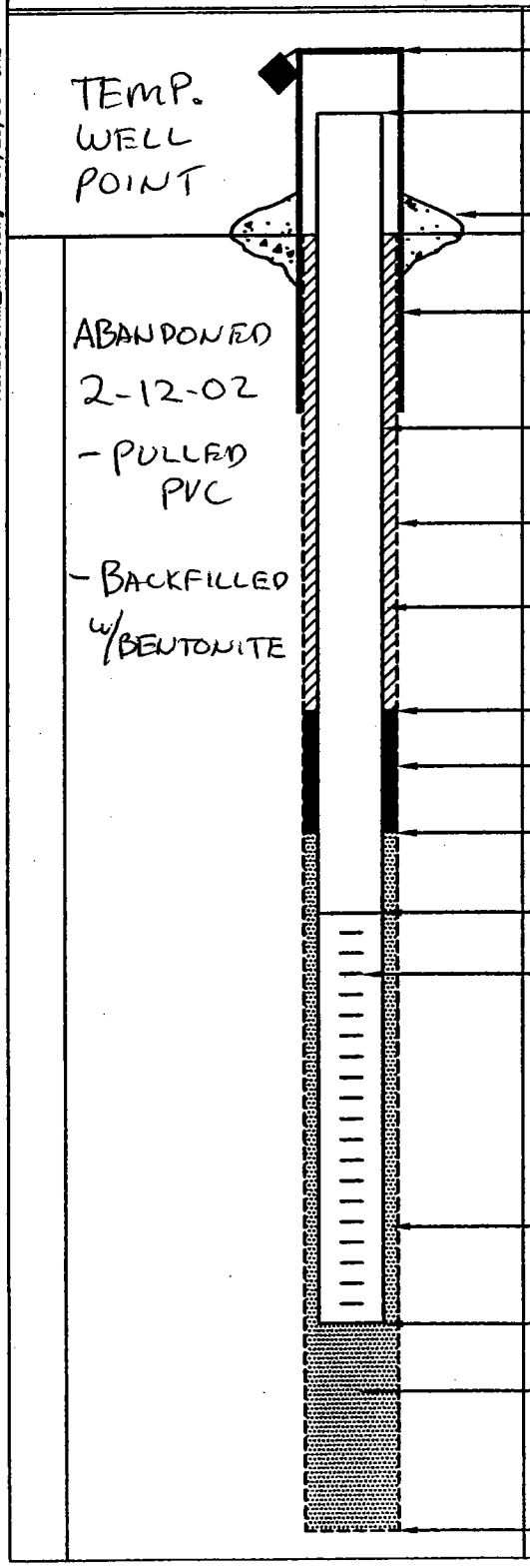
ACAD:FORM_MWSU.dwg 07/28/99 INL

WELL NO.: S34TW002

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV	LOCATION IHDIV STUMP NECK	DRILLER AARON E.
PROJECT NO. 0525	BORING S34TW002	DRILLING METHOD HSA
DATE BEGUN 2-1-02	DATE COMPLETED 2-1-02	
FIELD GEOLOGIST FRED W. RAMSER		DEVELOPMENT METHOD PUMP
GROUND ELEVATION 2.72	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA/NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 5.30/2.58

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING: —

RISER PIPE I.D.: 1"

TYPE OF RISER PIPE:

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 2.72/0'

TYPE OF SEAL: BENTONITE CHIPS SHUR-PLUG 3/8" DSI

DEPTH TOP OF SAND PACK: 2'

ELEVATION/DEPTH TOP OF SCREEN: -1.28/4'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 X 5'

I.D. OF SCREEN: 1"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -6.28/9'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -7.28/10'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -7.28/10'

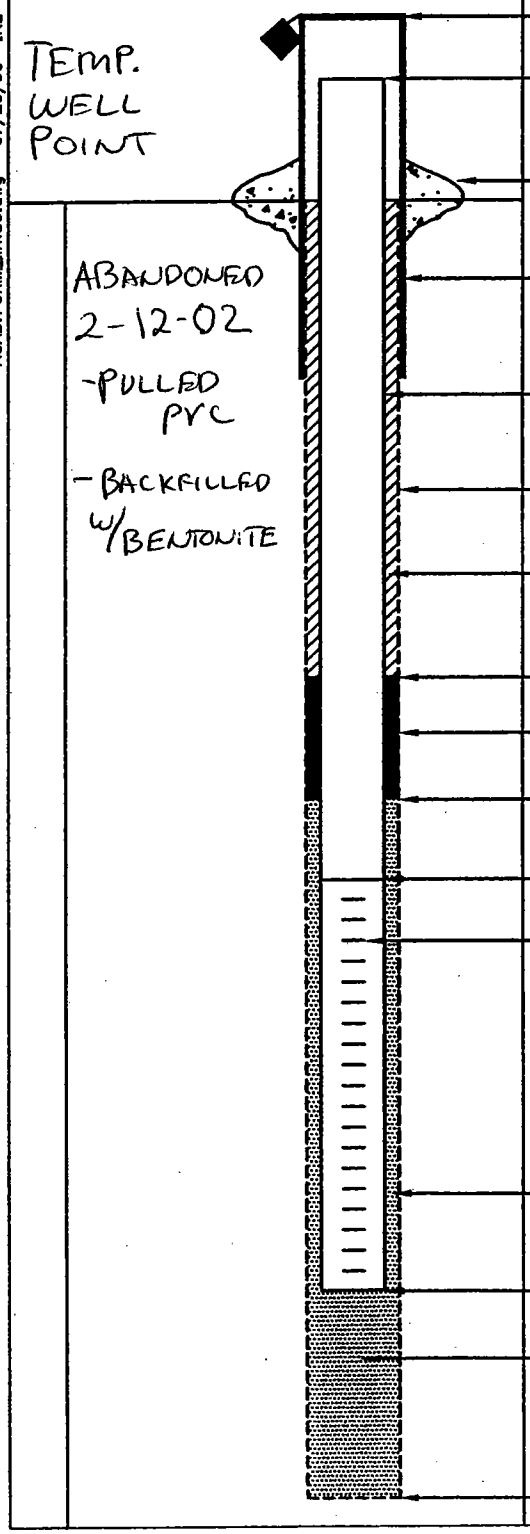
ACAD:FORM_MWSU.dwg 07/28/99 INL

WELL NO.: S34TW003

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV	LOCATION IHDV STUMPNECK	DRILLER AARON E.
PROJECT NO. 0525	BORING S34TW003	DRILLING METHOD HSA
DATE BEGUN 2-1-02	DATE COMPLETED 2-4-02	
FIELD GEOLOGIST FRED W RAMSER		DEVELOPMENT METHOD PUMP
GROUND ELEVATION 4.97	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA / NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 7.40/2.43

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING: —

RISER PIPE I.D.: ~1"

TYPE OF RISER PIPE:

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 4.97'/ 0'

TYPE OF SEAL: BENTONITE CHIP SHUR-PLUG 3/8 DSI

DEPTH TOP OF SAND PACK: 3'

ELEVATION/DEPTH TOP OF SCREEN: 0.97'/ 4'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 X 10'

I.D. OF SCREEN: ~1"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -9.03/ 14'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -10.03/ 15'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -10.03/ 15'

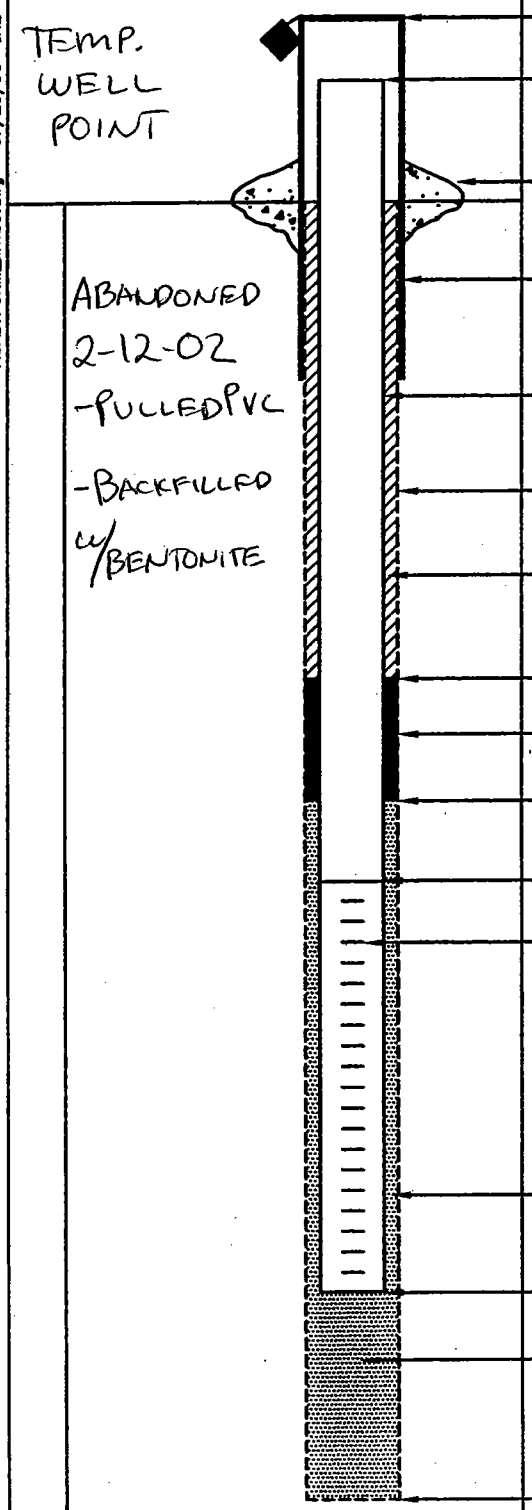
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S37TW001

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT: SEVEN SITE INV	LOCATION: IHDIV STUMPNECK	DRILLER: AARON E.
PROJECT NO.: 0525	BORING: S37TW001	DRILLING METHOD: HSA
DATE BEGUN: 2-5-02	DATE COMPLETED: 2-5-02	
FIELD GEOLOGIST: FRED W. RAMSER		DEVELOPMENT METHOD: PUMP
GROUND ELEVATION: 3.93	DATUM: NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA / NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 6.89/2.96

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: 1"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: —

ELEVATION/DEPTH TOP OF SEAL: 3.93/ 0'

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 3'

ELEVATION/DEPTH TOP OF SCREEN: -1.07/ 5'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 5'

I.D. OF SCREEN: 1"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -6.07/ 10'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -6.07/ 10'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -6.07/ 10'

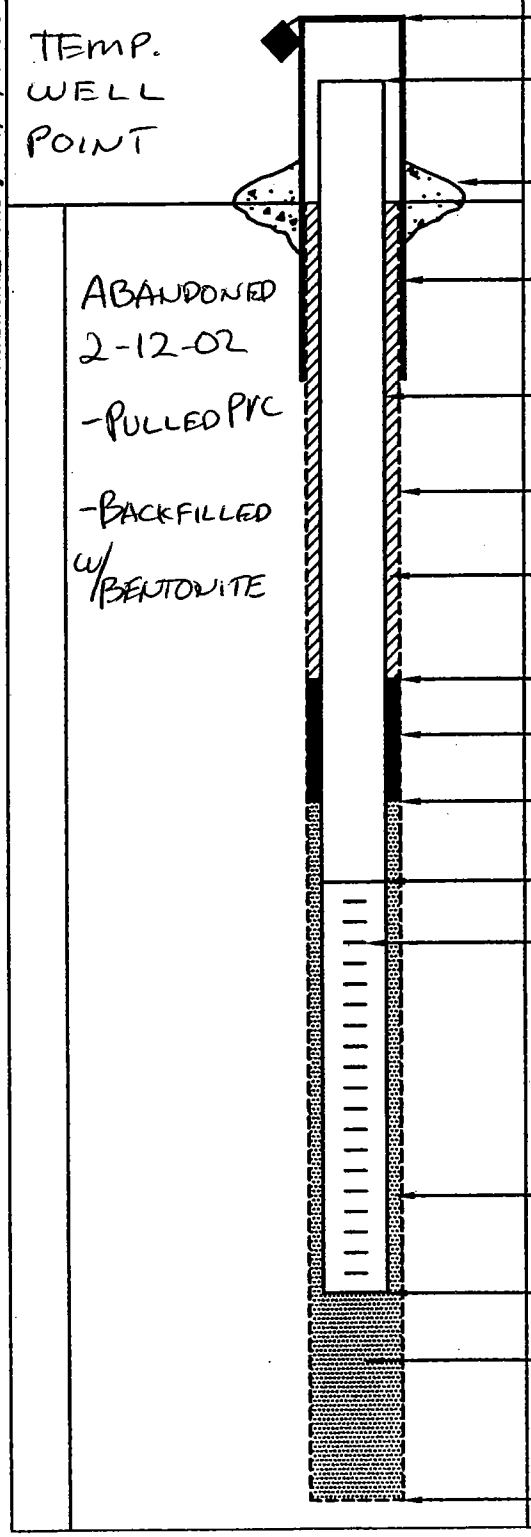
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S37TW002

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV	LOCATION INDIV STUMPNECK	DRILLER AARON E.
PROJECT NO. 0525	BORING S37TW002	DRILLING METHOD HSA
DATE BEGUN 2-5-02	DATE COMPLETED 2-5-02	
FIELD GEOLOGIST FRED W RAMSER		DEVELOPMENT METHOD PUMP
GROUND ELEVATION 3.63	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA / NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 6.24/2.61

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING: —

RISER PIPE I.D.: 1"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: BENTONITE

ELEVATION/DEPTH TOP OF SEAL: 3.63/ 0'

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 0.63'/ 3'

ELEVATION/DEPTH TOP OF SCREEN: -1.37/ 5'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 5'

I.D. OF SCREEN: 1"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -6.37/ 10'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -6.37/ 10'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -6.37/ 10'

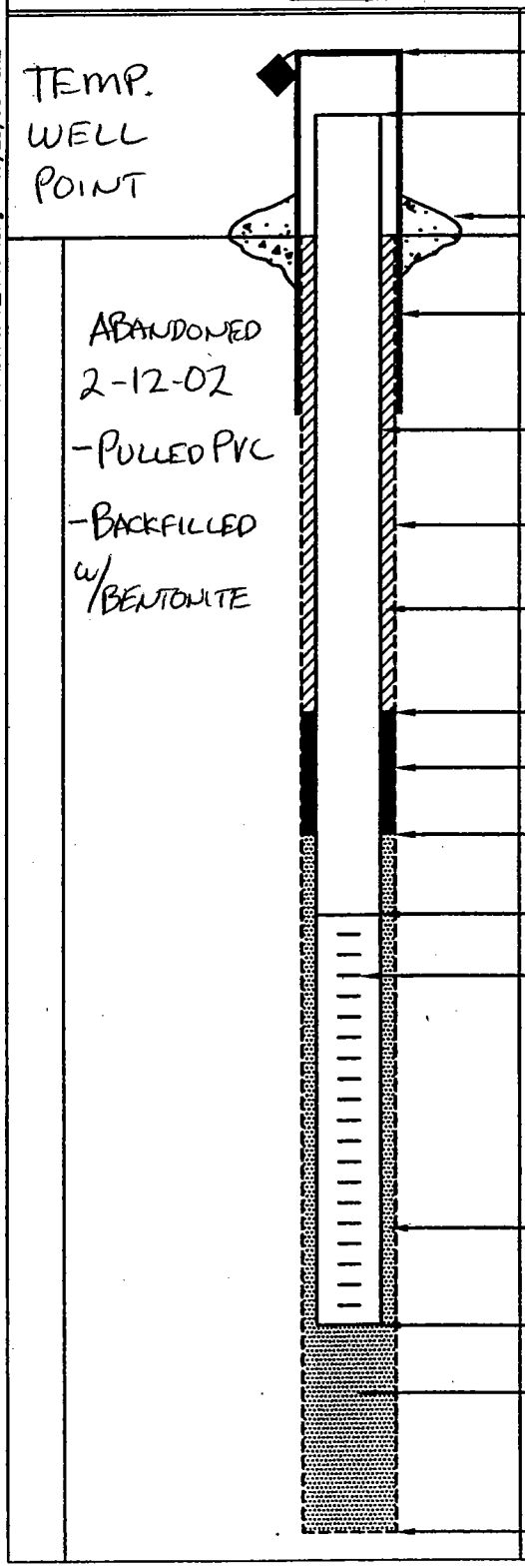
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: S37TW003

Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT SEVEN SITE INV.	LOCATION I HDIV STUMPNECK	DRILLER AARON E.
PROJECT NO. 0525	BORING S37TW003	DRILLING METHOD HSA
DATE BEGUN 2-5-02	DATE COMPLETED 2-5-02	
FIELD GEOLOGIST FRED W RAMSER		DEVELOPMENT METHOD PUMP
GROUND ELEVATION 4.21	DATUM NGVD 29	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: NA / NA

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 6.98 / 2.77

TYPE OF SURFACE SEAL: —

I.D. OF SURFACE CASING: —

TYPE OF SURFACE CASING:

RISER PIPE I.D.: 1"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: BENTONITE

ELEVATION/DEPTH TOP OF SEAL: 4.21 / 0'

TYPE OF SEAL: BENTONITE 3/8" CHIPS

DEPTH TOP OF SAND PACK: 3'

ELEVATION/DEPTH TOP OF SCREEN: -0.79 / 5'

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: .010 x 5'

I.D. OF SCREEN: 1"

TYPE OF SAND PACK: RICCI BROS #00N SILICA SAND

ELEVATION/DEPTH BOTTOM OF SCREEN: -5.79 / 10'

ELEVATION/DEPTH BOTTOM OF SAND PACK: -5.79 / 10'

BACKFILL MATERIAL BELOW SAND:

ELEVATION/DEPTH OF HOLE: -5.79 / 10'

ACAD:FORM_MWSU.dwg 07/20/99 INL

A.2 STATE OF MARYLAND WELL REPORTS AND ABANDONMENT REPORTS

APR-09-2002 11:05 Chesapeake Geosystems Inc 4107895029 P.02/15

U0293 (MDE USE ONLY)

1 2 3 6
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

WELL COMPLETION REPORT

FILL IN THIS FORM COMPLETELY
PLEASE TYPE

COUNTY NUMBER 02-14500-W(M)

ST/CO USE ONLY
DATE Received MM DD YY
8 13

DATE WELL COMPLETED MM 02 DD 06 YY 02
15 20

Depth of Well 22 30 26
(TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL"
CH - 94 - 4453
26 29 30 31 32 33 34 35 36 37

OWNER Naval Surface Warfare Center (7th/29/11/6)
STREET OR RFD Indian Head Division (first name) TOWN Indian Head, MD 20640
SUBDIVISION SECTION LOT

WELL LOG

Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Wet, Black & green, very soft clay	0	3	
Dry, Gray Meddence clay	3	8	
Moist, Tan, clay with some very fine sand	8	12	
Dry, Brown to Gray, clay	12	~~12~~ 30	
water @ 6'			
S33TW001			
~~S33TW002~~			
S33TW003			

NUMBER OF UNSUCCESSFUL WELLS none

WELL HYDROFRACTURED yes Y no N

CIRCLE APPROPRIATE LETTER
A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
E ELECTRIC LOG OBTAINED
P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. W 3 3 6

DRILLERS SIGNATURE
(MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. D

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD

WELL HAS BEEN GROUTED (Circle Appropriate Box) yes Y 44 no N 44

TYPE OF GROUTING MATERIAL (Circle one)
CEMENT CM 45 46 BENTONITE CLAY BC 15 16

NO. OF BAGS 12 NO. OF POUNDS 1,128
GALLONS OF WATER 84

DEPTH OF GROUT SEAL (to nearest foot)
from 0 ft. to 18 ft.
48 TOP 52 54 BOTTOM 58
(enter 0 if from surface)

CASING RECORD

casing types insert appropriate code below

ST STEEL CO CONCRETE PL PLASTIC OT OTHER

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL	2	20
60 61	63 64	66 70

OTHER CASING (if used)

EACH CASING	diameter inch	depth (feet) from	to

SCREEN RECORD

screen type or open hole insert appropriate code below

ST STEEL BR BRASS BRONZE HO OPEN HOLE PL PLASTIC OT OTHER

C 2 1 2

EACH SCREEN		DEPTH (nearest ft.)	
1	PL	20	30
	8 9	11 15	17 21
2			
	23 24	26 30	32 36
3			
	38 39	41 45	47 51

SLOT SIZE 1 010 2 3

DIAMETER OF SCREEN 2 (NEAREST INCH)
56 60

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68

from	to
18	30

68

MDE USE ONLY
(NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 72 74 75 76
TELESCOPE CASING LOG INDICATOR OTHER DATA

STATE

C 3 1 2 N/A

PUMPING TEST

HOURS PUMPED (nearest hour) 8 9

PUMPING RATE (gal. per min.) 11 15

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING 17 20 ft.

WHEN PUMPING 22 25 ft.

TYPE OF PUMP USED (for test)
A air 27 P piston 27 T turbine 27
C centrifugal 27 R rotary 27 O other (describe below) 27
J jet 27 S submersible 27
Monitoring

PUMP INSTALLED

DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. 29

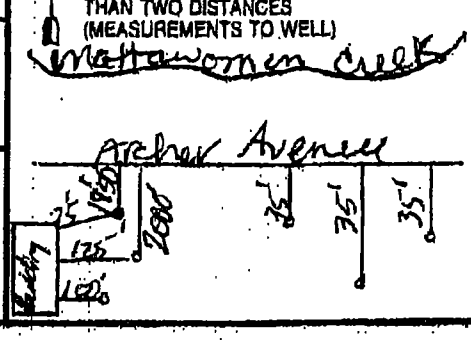
CAPACITY: GALLONS PER MINUTE (to nearest gallon) 31 35

PUMP HORSE POWER 37 41

PUMP COLUMN LENGTH (nearest ft.) 43 47

CASING HEIGHT (circle appropriate box and enter casing height)
+ above
– below
48
LAND SURFACE 2 (nearest) foot)
50 51

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 | 06292 | (MDE USE ONLY)

1 2 3 6
(THIS NUMBER IS TO BE PUNCHED IN COLS. 3-6 ON ALL CARDS)

WELL COMPLETION REPORT

FILL IN THIS FORM COMPLETELY
PLEASE TYPE

45 DAYS AFTER WELL IS COMPLETED.

COUNTY NUMBER

PERMIT NO. FROM "PERMIT TO DRILL WELL" 02-15402-W(M)

ST/CO USE ONLY
DATE Received MM DD YY 8 13

DATE WELL COMPLETED MM 02 DD 05 YY 02 (15 20)

Depth of Well 22 10 26 (TO NEAREST FOOT)

CH 04 4452 (28 29 30 31 32 33 34 35 36 37)

OWNER Naval Surface Warfare Center (7th/2911/6)
STREET OR RFD Indian Head Division (first name) TOWN Indian Head, MD 20640
SUBDIVISION SECTION LOT

WELL LOG

Not required for driven wells

STATE THE KIND OF FORMATIONS PENETRATED, THEIR COLOR, DEPTH, THICKNESS AND IF WATER BEARING

DESCRIPTION (Use additional sheets if needed)	FEET FROM	FEET TO	check if water bearing
Wet, Blanck and green very soft clay	0	3	
Dry, Gray Meddence Clay	3	8	
Moist, Tan Clay with some very fine sands	8	10	
water @ 6'			
S34TW001			
S34TW002			
S34TW003			
S37TW001			
S37TW002			
S37TW003			

NUMBER OF UNSUCCESSFUL WELLS: none

WELL HYDROFRACTURED YES Y NO N

CIRCLE APPROPRIATE LETTER
A A WELL WAS ABANDONED AND SEALED WHEN THIS WELL WAS COMPLETED
E ELECTRIC LOG OBTAINED
P TEST WELL CONVERTED TO PRODUCTION WELL

I HEREBY CERTIFY THAT THIS WELL HAS BEEN CONSTRUCTED IN ACCORDANCE WITH COMAR 26.04.04 "WELL CONSTRUCTION" AND IN CONFORMANCE WITH ALL CONDITIONS STATED IN THE ABOVE CAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC NO. 3 36

DRILLERS SIGNATURE
(MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. D

SITE SUPERVISOR (sign. of driller or journeyman responsible for sitework if different from permittee)

GROUTING RECORD

WELL HAS BEEN GROUTED (Circle Appropriate Box) YES Y 44 NO N 44

TYPE OF GROUTING MATERIAL (Circle one)
CEMENT CM 45 46 BENTONITE CLAY BC

NO. OF BAGS 6 NO. OF POUNDS 564 46

GALLONS OF WATER 36

DEPTH OF GROUT SEAL (to nearest foot)
from 0 (48 TOP 52) ft. to 3 (54 BOTTOM 58) ft.
(enter 0 if from surface)

CASING RECORD

casing types insert appropriate code below

ST STEEL CO CONCRETE PL PLASTIC OT OTHER

MAIN CASING TYPE PL (60 61) Nominal diameter top (main) casing (nearest inch) 2 (63 64) Total depth of main casing (nearest foot) 5 (66 70)

OTHER CASING (If used) EACH CASING — diameter inch — depth (feet) from — to

SCREEN RECORD

screen type or open hole insert appropriate code below

ST STEEL BR BRASS BRONZE HO OPEN HOLE PL PLASTIC OT OTHER

C 2 (1 2) DEPTH (nearest ft.)

EACH SCREEN
1 PL 5 10 (8 9 11 15 17 21)
2 (23 24 26 30 32 36)
3 (38 39 41 45 47 51)

SLOT SIZE 1 010 2 3

DIAMETER OF SCREEN X 1 (56 60) (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68 — from 3 to 10

MDE USE ONLY
(NOT TO BE FILLED IN BY DRILLER)
T (E.R.O.S.) W Q
70 72 74 75 76
TELESCOPE CASING LOG INDICATOR OTHER DATA

C 3 (1 2) N/A

PUMPING TEST

HOURS PUMPED (nearest hour) (8 9)

PUMPING RATE (gal. per min.) (11 15)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING (17 20) ft.

WHEN PUMPING (22 26) ft.

TYPE OF PUMP USED (for test)
A air (27) P piston (27) T turbine (27)
C centrifugal (27) R rotary (27) O other (describe below) (27)
J jet (27) S submersible (27) Monitoring

PUMP INSTALLED

DRILLER INSTALLED PUMP (CIRCLE) (YES or NO) YES NO

IF DRILLER INSTALLS PUMP, THIS SECTION MUST BE COMPLETED FOR ALL WELLS.

TYPE OF PUMP INSTALLED PLACE (A,C,J,P,R,S,T,O) IN BOX 29. (29)

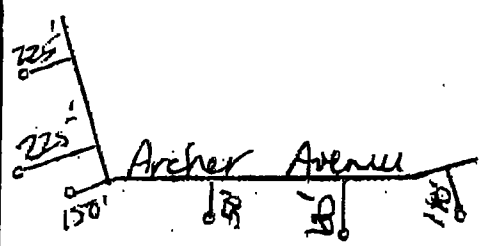
CAPACITY: GALLONS PER MINUTE (to nearest gallon) (31 35)

PUMP HORSE POWER (37 41)

PUMP COLUMN LENGTH (nearest ft.) (43 47)

CASING HEIGHT (circle appropriate box and enter casing height)
+ above (48) — LAND SURFACE
− below (48) — 2 (nearest foot) (50 51)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

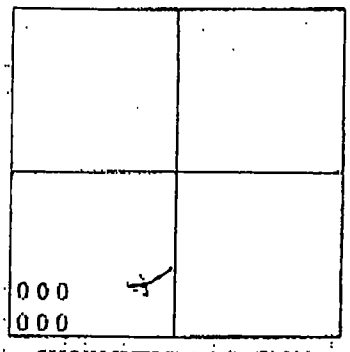
WATER WELL ABANDONMENT-SEALING REPORT FORM

SUBMIT COPIES OF COMPLETED FORM TO:
- COUNTY ENVIRONMENT AGENCY (contact MDE, WMA if address needed)
- WELL OWNER
- MDE, WATER MANAGEMENT ADMINISTRATION, WELL PROGRAM

DATE WELL ABANDONED: 02/13/2002 (month/day/year)

- PERMIT NUMBER OF ABANDONED WELL (if any) CH — 94 — 4452
- PERMIT NUMBER OF REPLACEMENT WELL — —
- PERSON ABANDONING WELL: A. Eichelberger
- WELL DRILLERS LICENSE NUMBER: AWD 709
  CIRCLE: MWD/MSD/MGD
- OWNER'S NAME: Naval Surface Warfare Center
- WELL LOCATION:
  COUNTY: Charles
  NEAREST TOWN: Indian Head
  TAX MAP ____ BLOCK ____ PARCEL ____
  SUBDIVISION: ____
  SECTION: ____ LOT: ____
  NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

- TYPE OF WELL BEING ABANDONED:
  ____ DRILLED ____ JETTED
  X BORED/AUGUERED ____ HAND DUG
  ____ OTHER (specify) ____

USE CODE:
  ____ DOMESTIC ____ MUNICIPAL/PUBLIC
  ____ IRRIGATION ____ INDUSTRIAL
  X TEST/OBSERVATION

TYPE OF CASING:
  ____ STEEL X PLASTIC
  ____ CONCRETE ____ OTHER (specify) ____

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 10 FEET DEEP

WAS ANY CASING REMOVED? X YES ____ NO
if yes, length removed, in feet: 10

WAS CASING RIPPED OR PERFORATED? ____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	10

Michael W. Kelly 336 MWD/MSD/MGD
SIGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

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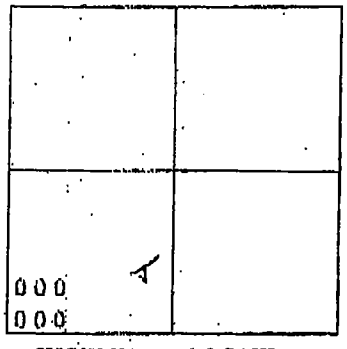
DATE WELL ABANDONED: 02/13/2002 (month/day/year)

* PERMIT NUMBER OF ABANDONED WELL (if any): CH — 94 — 4452
* PERMIT NUMBER OF REPLACEMENT WELL: — —
* PERSON ABANDONING WELL: A. Eichelberger
WELL DRILLERS LICENSE NUMBER: AWD 709
CIRCLE: MWD/MSD/MGD
* OWNER'S NAME: Naval Surface Warfare Center
* WELL LOCATION:
COUNTY: Charels
NEAREST TOWN: Indian Head
TAX MAP ____ BLOCK ____ PARCEL ____
SUBDIVISION: ____
SECTION: ____ LOT: ____
NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

* TYPE OF WELL BEING ABANDONED:
____ DRILLED ____ JETTED
X BORED/AUGUERED ____ HAND DUG
____ OTHER (specify) ____

* USE CODE:
____ DOMESTIC ____ MUNICIPAL/PUBLIC
____ IRRIGATION ____ INDUSTRIAL
X TEST/OBSERVATION

* TYPE OF CASING:
____ STEEL X PLASTIC
____ CONCRETE ____ OTHER (specify) ____

* SIZE OF CASING: 1 INCHES IN DIAMETER
* DEPTH OF WELL: 10 FEET DEEP
* WAS ANY CASING REMOVED? X YES ____ NO
if yes, length removed, in feet: 10
* WAS CASING RIPPED OR PERFORATED? ____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	10

SIGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN — LICENSE # 336 — MWD/MSD/MGD CIRCLE ONE — DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

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* WELL OWNER
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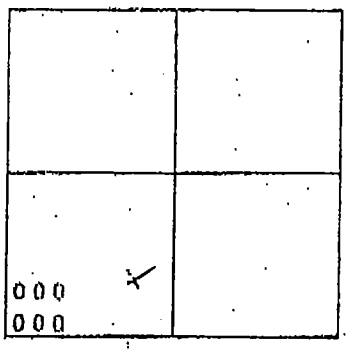
DATE WELL ABANDONED: 02/13/2002 (month/day/year)

* PERMIT NUMBER OF ABANDONED WELL (if any) CH — 94 — 4452
* PERMIT NUMBER OF REPLACEMENT WELL — —
* PERSON ABANDONING WELL: A. Eichelberger
WELL DRILLERS LICENSE NUMBER: _____
CIRCLE: MWD/MSD/MGD
* OWNER'S NAME: Naval Surface Warfare Center
* WELL LOCATION:
COUNTY: Charels
NEAREST TOWN: Indian Head
TAX MAP _____ BLOCK _____ PARCEL _____
SUBDIVISION: _____
SECTION: _____ LOT: _____
NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

* TYPE OF WELL BEING ABANDONED:
_____ DRILLED _____ JETTED
X BORED/AUGUERED _____ HAND DUG
_____ OTHER (specify) _____

* USE CODE:
_____ DOMESTIC _____ MUNICIPAL/PUBLIC
_____ IRRIGATION _____ INDUSTRIAL
X TEST/OBSERVATION

* TYPE OF CASING:
_____ STEEL X PLASTIC
_____ CONCRETE _____ OTHER (specify)

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 10 FEET DEEP

WAS ANY CASING REMOVED? X YES _____ NO
if yes, length removed, in feet: 10

WAS CASING RIPPED OR PERFORATED? _____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	10

Michael W. Kuhn 336 MWD/MSD/MGD
SIGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

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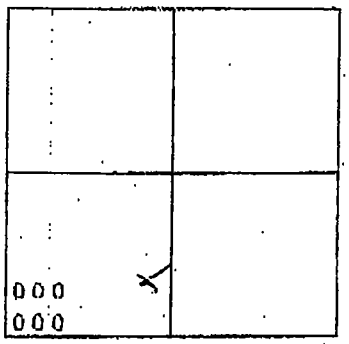
- PERMIT NUMBER OF REPLACEMENT WELL: — —
- PERSON ABANDONING WELL: A. Eichelberger
- WELL DRILLERS LICENSE NUMBER: AWD 709
  CIRCLE: MWD/MSD/MGD
- OWNER'S NAME: Naval Surface Warfare Center
- WELL LOCATION:
  COUNTY: Charles
  NEAREST TOWN: Indian Head
  TAX MAP _____ BLOCK _____ PARCEL _____
  SUBDIVISION: _____
  SECTION: _____ LOT: _____
  NEAREST ROAD: Archer Raod

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

- TYPE OF WELL BEING ABANDONED:
  _____ DRILLED _____ JETTED
  X BORED/AUGUERED _____ HAND DUG
  _____ OTHER (specify) _____

- USE CODE:
  _____ DOMESTIC _____ MUNICIPAL/PUBLIC
  _____ IRRIGATION _____ INDUSTRIAL
  X TEST/OBSERVATION

- TYPE OF CASING:
  _____ STEEL X PLASTIC
  _____ CONCRETE _____ OTHER (specify)

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 15 FEET DEEP

WAS ANY CASING REMOVED? X YES _____ NO
if yes, length removed, in feet: 15

WAS CASING RIPPED OR PERFORATED? YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	15

Michael W. Ruhe 336 MWD/MSD/MGD
IGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

WATER WELL ABANDONMENT-SEALING REPORT FORM

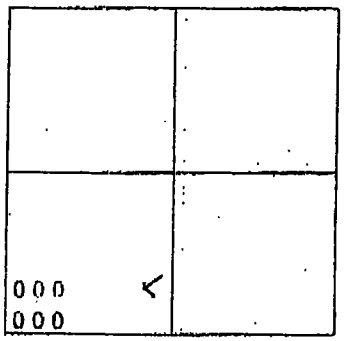
SUBMIT COPIES OF COMPLETED FORM TO:

- COUNTY ENVIRONMENT AGENCY (contact MDE, WMA if address needed)
- WELL OWNER
- MDE, WATER MANAGEMENT ADMINISTRATION, WELL PROGRAM

DATE WELL ABANDONED: 02/13/2002 (month/day/year)

- PERMIT NUMBER OF ABANDONED WELL (if any): CH — 94 — 4452
- PERMIT NUMBER OF REPLACEMENT WELL: — —
- PERSON ABANDONING WELL: A. Eichelberger
- WELL DRILLERS LICENSE NUMBER: AWD 709
  CIRCLE: MWD/MSD/MGD
- OWNER'S NAME: Naval Surface Warfare Center
- WELL LOCATION:
  COUNTY: Charles
  NEAREST TOWN: Indian Head
  TAX MAP ____ BLOCK ____ PARCEL ____
  SUBDIVISION: ____
  SECTION: ____ LOT: ____
  NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

TYPE OF WELL BEING ABANDONED:

____ DRILLED ____ JETTED
X BORED/AUGUERED ____ HAND DUG
____ OTHER (specify) ____

USE CODE:

____ DOMESTIC ____ MUNICIPAL/PUBLIC
____ IRRIGATION ____ INDUSTRIAL
X TEST/OBSERVATION

TYPE OF CASING:

____ STEEL X PLASTIC
____ CONCRETE ____ OTHER (specify) ____

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 9 FEET DEEP

WAS ANY CASING REMOVED? X YES ____ NO
if yes, length removed, in feet: 9

WAS CASING RIPPED OR PERFORATED? ____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	9

Michael W. Kuhn 336 MWD/MSD/MGD
SIGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY, BALTIMORE, MARYLAND 21224, (410) 631-3784

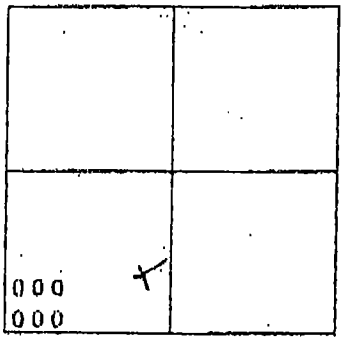
WATER WELL ABANDONMENT-SEALING REPORT FORM

SUBMIT COPIES OF COMPLETED FORM TO:
- COUNTY ENVIRONMENT AGENCY (contact MDE, WMA if address needed)
- WELL OWNER
- MDE, WATER MANAGEMENT ADMINISTRATION, WELL PROGRAM

DATE WELL ABANDONED: 02/13/2002 (month/day/year)

- PERMIT NUMBER OF ABANDONED WELL (if any): CH — 94 — 4452
- PERMIT NUMBER OF REPLACEMENT WELL: — —
- PERSON ABANDONING WELL: A. Eichelberger
- WELL DRILLERS LICENSE NUMBER: AWD 709
  CIRCLE: MWD/MSD/MGD
- OWNER'S NAME: Naval Surface Warfare Center
- WELL LOCATION:
  COUNTY: Charles
  NEAREST TOWN: Indian Head
  TAX MAP _____ BLOCK _____ PARCEL _____
  SUBDIVISION: _____
  SECTION: _____ LOT: _____
  NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

TYPE OF WELL BEING ABANDONED:

_____ DRILLED _____ JETTED
X BORED/AUGUERED _____ HAND DUG
_____ OTHER (specify) _____

USE CODE:

_____ DOMESTIC _____ MUNICIPAL/PUBLIC
_____ IRRIGATION _____ INDUSTRIAL
X TEST/OBSERVATION

TYPE OF CASING:

_____ STEEL X PLASTIC
_____ CONCRETE _____ OTHER (specify) _____

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 9 FEET DEEP

WAS ANY CASING REMOVED? X YES _____ NO
if yes, length removed, in feet: 9

WAS CASING RIPPED OR PERFORATED? _____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	9

Michael W. Kehr 336 MWD/MSD/MGD
SIGNATURE MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

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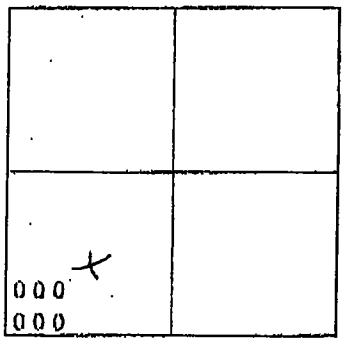
WELL DRILLERS LICENSE NUMBER: AWD 709
CIRCLE: MWD/MSD/MGD
* OWNER'S NAME: Naval Surface Warfare Center
* WELL LOCATION:
COUNTY: Charles
NEAREST TOWN: Indian Head
TAX MAP ____ BLOCK ____ PARCEL ____
SUBDIVISION: ____
SECTION: ____ LOT: ____
NEAREST ROAD: Archer Road

MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

* TYPE OF WELL BEING ABANDONED:
____ DRILLED ____ JETTED
X BORED/AUGUERED ____ HAND DUG
____ OTHER (specify) ____

* USE CODE:
____ DOMESTIC ____ MUNICIPAL/PUBLIC
____ IRRIGATION ____ INDUSTRIAL
X TEST/OBSERVATION

* TYPE OF CASING:
____ STEEL X PLASTIC
____ CONCRETE ____ OTHER (specify) ____

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 28 FEET DEEP

WAS ANY CASING REMOVED? X YES ____ NO
if yes, length removed, in feet: 28

WAS CASING RIPPED OR PERFORATED? ____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	28

336 MWD/MSD/MGD
IGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER MANAGEMENT ADMINISTRATION
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  SECTION: ____ LOT: ____
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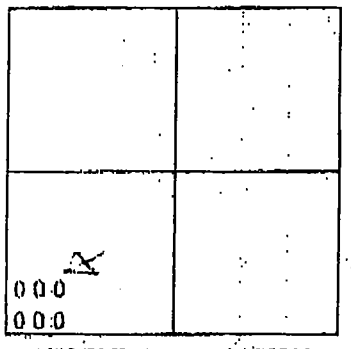
MARYLAND GRID COORDINATES
BOX NUMBER E 740 N 262



SHOW WELL LOCATION BY X WITHIN BOX

- TYPE OF WELL BEING ABANDONED:
  ____ DRILLED ____ JETTED
  X BORED/AUGUERED ____ HAND DUG
  ____ OTHER (specify) ____
- USE CODE:
  ____ DOMESTIC ____ MUNICIPAL/PUBLIC
  ____ IRRIGATION ____ INDUSTRIAL
  X TEST/OBSERVATION
- TYPE OF CASING:
  ____ STEEL X PLASTIC
  ____ CONCRETE ____ OTHER (specify) ____
- SIZE OF CASING: 1 INCHES IN DIAMETER
- DEPTH OF WELL: 28 FEET DEEP
- WAS ANY CASING REMOVED? X YES ____ NO
  if yes, length removed, in feet: 28
- WAS CASING RIPPED OR PERFORATED? ____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	28

[signature] 336 MWD/MSD/MGD

IGNATURE-MASTER WELL DRILLER OR SUPERVISING SANITARIAN LICENSE # CIRCLE ONE DATE

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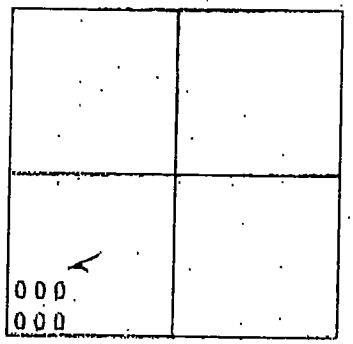

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_____ DRILLED _____ JETTED
X BORED/AUGUERED _____ HAND DUG
_____ OTHER (specify) _____

USE CODE:
_____ DOMESTIC _____ MUNICIPAL/PUBLIC
_____ IRRIGATION _____ INDUSTRIAL
X TEST/OBSERVATION

TYPE OF CASING:
_____ STEEL X PLASTIC
_____ CONCRETE _____ OTHER (specify)

SIZE OF CASING: 1 INCHES IN DIAMETER

DEPTH OF WELL: 30 FEET DEEP

WAS ANY CASING REMOVED? X YES _____ NO
if yes, length removed, in feet: 30

WAS CASING RIPPED OR PERFORATED? _____ YES X NO

LOG OF SEALING MATERIAL

MATERIAL	FEET FROM	FEET TO
Bentonite Slurry	0	30

[illegible] 336 (MWD/MSD/MGD) DATE

APPENDIX B

TEST PIT AND SOIL BORING LOGS

B.1 Test Pit Logs
B.2 Soil Boring Logs

B.1 TEST PIT LOGS

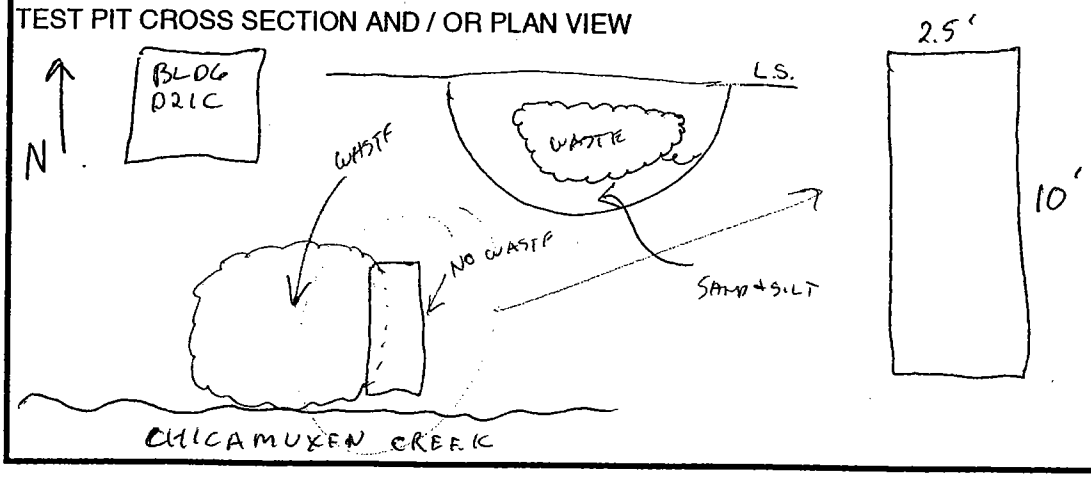
Tetra Tech NUS, Inc.

TEST PIT LOG

PROJECT NAME: SEVEN SITES SCREENING INV. TEST PIT No.: S34TP001
PROJECT NUMBER: 0525 DATE: 1-30-02
LOCATION: INDIAN HEAD NSWC (STUMP NECK) GEOLOGIST: FRED W RAMSER

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
1		YEL BRN SAND + SILT	SM		0	0
2						
3						
4		ENCOUNTER METAL DEBRIS @ 3'		-GREEN OXIDIZED ~~TOOLS AND~~		
5		COLLECTED SAMPLES		FE TOOLS		
6		@ 4-4.5' ABUNDANT		COPPER WIRE MISC WASTE		
7		WASTE FOUND TO DEPTH H_2O ~4.5		PLASTIC		
8		-5' BELOW GS WITHIN SILTY SAND	SM	OUT OFF		
		W/TR CLAY.		WASTE @ 7' BGS		
		SOME H_2O WITHIN THE				
		WASTE, SAND + SILT WET 7-8'				
		LOOKS NATURAL				
		NO WASTE ON THE				
		EAST WALL OF				
		TEST PIT				

TEST PIT CROSS SECTION AND / OR PLAN VIEW



REMARKS: STOPPED DIGGING DEBRIS MAY BE SOME TYPE OF ORDINANCE JACK MYER ARR AT SITE SAYS OK TO CONTINUE DIG.

PHOTO LOG: NONE

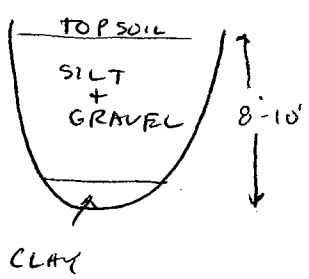
Tetra Tech NUS, Inc.

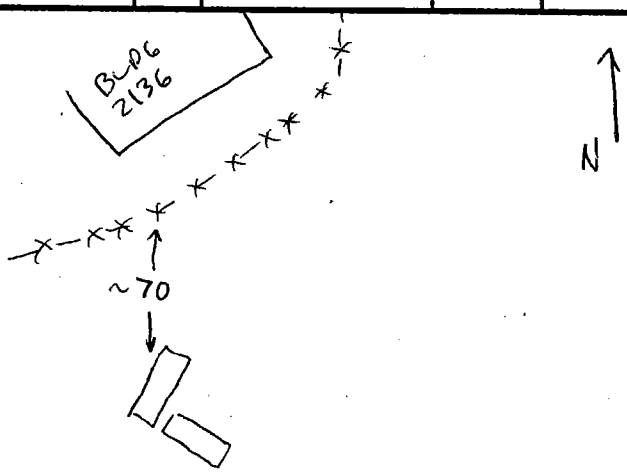
TEST PIT LOG

PROJECT NAME: SEVEN SITE SCREENING
PROJECT NUMBER: 0525
LOCATION: IHDIV STUMPNECK
TEST PIT No.: S33TP001
DATE: 2-11-02
GEOLOGIST: FRED W RAMSER

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
1		DK BRN SILT + SAND (TOPSOIL)	OL/SC			
2		MED YEL BRN SILT, SAND	GM			
3		+ GRAVEL	GM	LARGE GRAVELS		
4		CLAY CONTENT INC		≤ 15cm dia		
5		DOWNWARD	GC	well ROUNDED		
6				TO SUBRD.		
7						
8						
9		GREY CLAY MOTTED YEL	CL			
10		BRN, GREENISH GREY				
		+ LARGE DIAMETER				
		REBAR ~ 6"-1' BELOW				
		GROUND SURFACE				
		~ 40' LONG				

TEST PIT CROSS SECTION AND / OR PLAN VIEW
(BOTH TEST PITS)





REMARKS: EXCAVATED AT LARGE MAG ANOMALLY AS PER GEOPHYSICAL SURVEY. NO WASTE FOUND. WE DECIDED TO DIG ANOTHER PIT PERPINDICULAR TO THE 1ST TOWARD NORTH

PHOTO LOG: NONE

Tetra Tech NUS, Inc.

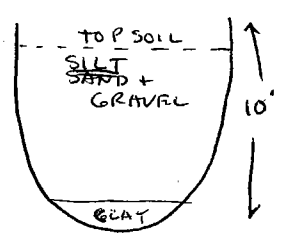
TEST PIT LOG

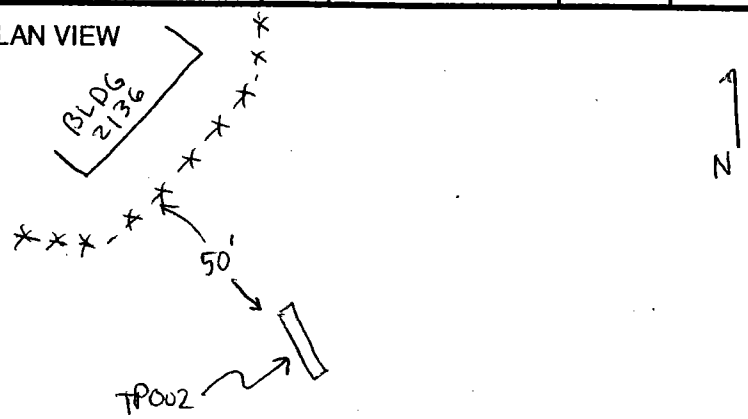
PROJECT NAME: SEVEN SITE SCREENING
PROJECT NUMBER: 0525
LOCATION: IHDIV STUMPNECK
TEST PIT No.: S33TP002
DATE: 2-11-02, 2-12-02
GEOLOGIST: FRED W. RAMSER

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
1		DR BRN TOP SOIL	OL/SC			
2		MED BRN TO YEL BRN SILT,	↓			
3		SAND + GRAVEL TR CLAY	GM	LARGE GRAVELS		
4		MOSTLY SILT + GRAVEL	↓	≤ 15cm dia		
5		INC CLAY CONT. DRY	GC	well ROUNDED		
6		↓	↓	TO SUBROUNDED		
7		GRAVELLY CLAY	↓	NO WASTE		
8		↓	↓	↓		
9		↓	↓	↓		
10		GREENISH GREY CLAY + SILT	CL	↓ MOIST		

TEST PIT CROSS SECTION AND / OR PLAN VIEW

4' x 2' x 10'





REMARKS: EXCAVATED AT SMALL MAG. ANOMALLY AS PER GEOPHYSICAL SURVEY NO WASTE FOUND. HYDRAULIC LINE BROKE RIG DOWN

PHOTO LOG: NONE

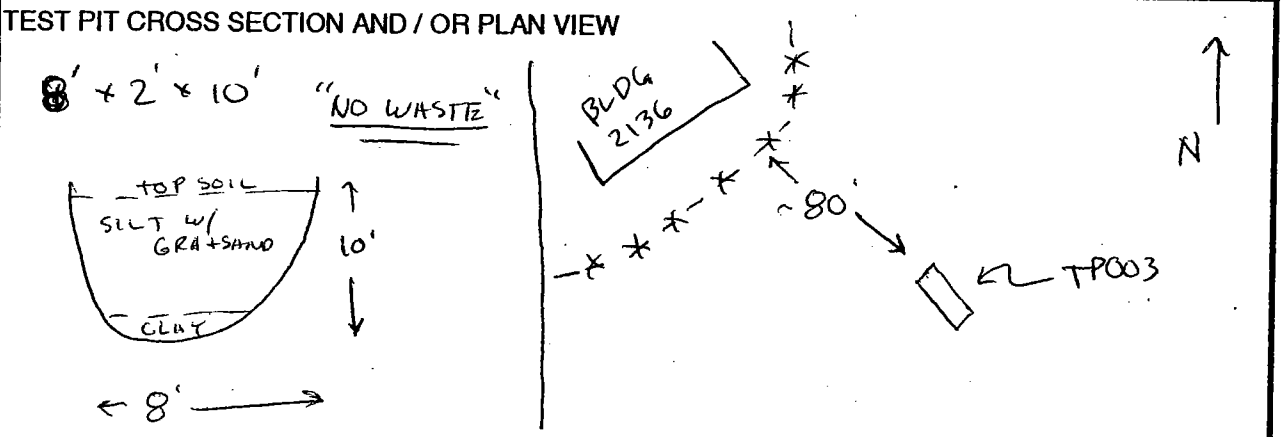
Tetra Tech NUS, Inc.

TEST PIT LOG

PROJECT NAME: SEVEN SITE SCREENING
PROJECT NUMBER: 0525
LOCATION: IHDIV STUMPNECK
TEST PIT No.: S33TP003
DATE: 2-12-02
GEOLOGIST: FRED W. RAMSER

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION: Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING: Source (ppm)	PID/FID READING: BZ (ppm)
1		DR BRN TOP SOIL	OL/SC			
2		MED BRN TO YEL BRN SILT	GM			
3		W/ GRAVEL AND SAND				
4				COLLECTED S33SB0030101		
5		INC CLAY CONTENT DOWN	GC	@ 4'-5' FROM		
6		WARD.		BUCKET.		
7						
8						
9				COLLECTED S33SB0030201		
10		GREENISH GREY CLAY + SILT	CL	8-10'		
		MOTTED GREY		+ DUP,		
		TD = 10'		S33SBDUP0101		
		NO WASTE				

TEST PIT CROSS SECTION AND / OR PLAN VIEW



REMARKS: EXCAVATED AT SMALL MAG ANOMALLY AS PER GEOPHYSICAL SURVEY NO WASTE FOUND

PHOTO LOG: NONE

B.2 SOIL BORING LOGS

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SEVEN SITES INV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAKE GEOSYSTEMS
DRILLING RIG: ATV B-47
BORING NUMBER: S33TW001
DATE: 2-7-02
GEOLOGIST: FRED WRAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						YEL BRN	SILT, SAND + GRAVEL						
	2												
S-1 0830		2/2			MED STIFF	YEL BRN	SILT w/SOME GRAVEL	SM	MOIST	0		0	
	4	9/12	1.8/2.0				TR SAND CLAY						
	6												
S-2 0846		6/9			STIFF	V GREY	SILT w/CLAY TR f-g SAND	SM	DRY	0		0	
	8	12/30	2.0/2.0						MOTTLED YEL BRN				
									COLLECTED S33SB0010016-8'				
	10												
S-3 0900		12/12			STIFF	LT	GREENISH GREY AS ABOVE	SM	SLIGHTLY MORE f-g SAND	0		0	
	12	14/14	1.8/2.0				w/ SAND STRINGERS	(SP)	DRY, SLIGHTLY MOTTLED YEL BRN				
	14												
S-4 0916		9/12		▽	STIFF	GREY	AS ABOVE	SM	MOIST TO WET	0		0	
	16	12/15	2.0/2.0				TR GRAVEL		WATER DRAINING FROM SAND STRINGERS COLLECTED				
	18								S33SB0010201 @ 14-16				
S-5 0915		5/7			MED	LT GREY	SILT w/f-g SAND TR CLAY	SM	WET, MOTTLED	0		0	
	20	20/24	2.0/2.0		STIFF		TR GRAVEL	SP	LT BRN + BLK				
	22												
S-6 0925		4/4		▽	LOOSE		f-g SAND w/ SILT + GRA	SP	SPOON SATURATED				
	24	5/6	1.0/2.0										

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks: COLLECTED S33SB0010101 FOR CHEM ANALYSIS
(RAINY NO PID USED) BEGIN COLLECTING SPLIT SPOONS @ 2'-4' 2" SPLIT SPOONS
BELOW 20' BGS

Converted to Well: Yes X (TEMP) No ____ Well I.D. #: S33TW001

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SEVEN SITES INV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAKE
DRILLING RIG: ATV B-47

BORING NUMBER: S33TW001
DATE: 2-7-02
GEOLOGIST: FRED W. RAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26												
S-7 0948		3/4			LOOSE/	DK GREY	f·g SAND	SP	WET				
	28	6/12	2.0/2.0		MED DENSE								
									PLACE SCREEN				
							DRILLER OVER		@ 18-28				
							DRILLED TO 30'		BEGIN TO INSTALL				
									PVC @ 0956				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks:

Converted to Well: Yes X No

Well I.D. #: S33TW001

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: FHDIV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: ATV MOBIL B-57
BORING NUMBER: S33TW002
DATE: 2-8-02
GEOLOGIST: FRED W RAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	2												
S-1 0900		4 / 5			MED STIFF	YEL BRN	SILT W/SOME F-g SAND TR GRAVEL	SM	MOIST	0		0	
	4	4 / 9	1.0 / 2.0										
S-2 0915	6	9 / 12			DENSE	LT GREY	f-g SAND + SILT (6-8')	SP/SM	MOIST (6-8') COLLECTED	0		0	
		15 / 18	2.0 / 2.0				(S-2 = 6-8')		(S33SB0020101 6-8')				
	8												
S-3 0920		12 / 15			DENSE	LT GREY	f-g SAND + SILT FR CLAY TR GRAV	SP/SM	MOIST	0		0	
	10	12 / 24	1.8 / 2.0				GRAVEL CONTACTS		SLIGHTLY MOTTLED				
		7 / 24					DRY S-3 (10-12')						
S-4	12												
							CUTTINGS MOIST						
	14						NOT WET						
S-4 0930		3								0.2		0	
	16	5 / 9	2.0		MED DENSE	GREY	f-g SAND + SILT + CLAY	SM	MOTTLE YEL BRN				
		17 / 21	1.8 / 2.0						W BLK STRINGERS COLLECTED				
	18								S33SB0020201 (4-16')				
S-5 0940		12 / 20			DENSE	YEL BRN	f-g SAND + SILT	SM/SP	MOTTLED ORG	0		0	
	20	30 / 35	1.8 / 2.0		VERY DENSE		GRAVEL + f-g SAND + SILT	GP/SP	BLK STAINED GREY GRAVEL CONTACTS				
									MOIST TO WET				
	22												
S-6 0950		6 / 9			MED DENSE	MED BRN TO GREY	f-g SAND + SILT	SP/SM	WET MOTTLED ORANGE	0.2		0	
	24	12 / 15	2.0 / 2.0										
	25												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks: TEMPORARY WELL

Converted to Well: Yes Y No

Well I.D. #: S33TW002

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: THDIV STUMPNECK
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK
DRILLING RIG: B-57
BORING NUMBER: S33TW002
DATE: 2-8-02
GEOLOGIST: FRED WRAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26												
S-7 1004		5 / 9			MED. DENSE	GREY	F-g SAND + SILT	SP/SM	WET MOTTLED ORANGE				
	28	12 / 15	2.0 / 2.0										
									OVER DRILLED				
									TO 30' BGS				
				TD = 30'					PLACE SCREEN				
									18-28				
									SAND				
									15-30				
									BENTONITE				
									13-15				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes X No

Well I.D. #: S33TW002

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SEVEN SITES INV. IHDIV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAKE GEOSYSTEMS
DRILLING RIG: MOBIL B-47 ATV

BORING NUMBER: S33TW~~003~~ 003
DATE: 2-6-02
GEOLOGIST: FRED W RAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
							CLAY + SILT + GRAVEL						
	2						↓						
S-1 1045		18 / 27			MED STIFF	YEL BRN	CLAY + SILT w/ TR GRAVEL	CL		0		0	
	4	32 / 50/1	1.2 / 2.0		VERY DENSE	YEL BRN	GRAVEL w/ TR SILT + CLAY SAND		MOIST				
S-2 1100		8 / 8			DENSE	YEL BRN	f-g SAND + SILT	SP	MOTTLED GREY	0		0	
	6	10 / 13	1.0 / 2.0				TR GRA						
S-3 1108		5 / 9			STIFF	YEL BRN	SILT TR f-g SAND TR CLAY	SM	DRY MOTTLED GREY	0		0	
	8	12 / 18	1.8 / 2.0		↓	↓	↓	↓	↓				
S-4 1113		6 / 12					AS ABOVE LESS MOTTLED			0		0	
	10	15 / 20	0.6 / 2.0		↓	↓	↓	↓	↓				
1124 S-5		8 / 12			VERY STIFF	GREY	CLAY + SILT TR f-g SAND	SM	SLIGHT MOTTLING YEL BRN	0		0	
	12	22 / 20	2.0 / 2.0										
S-6 1134		6 / 7			STIFF		SILT + CLAY TR f-g SAND			0		0	
	14	13 / 19	1.5 / 2.0			↓		↓	↓				
S-7 1140		6 / 6				GREY	SILT + CLAY TR f-g SAND		MOTTLED YEL BRN	0.2		0	
	16	16 / 17	1.6 / 2.0		↓		TR GRAVEL		MOISTURE SURFACE OF GRAVEL				
S-8 1239		6 / 9			STIFF	GREY	SILT + CLAY + f-g SAND	SM	SLIGHT MOTTLING				
	18	12 / 20	1.5 / 2.0				TR GRAVEL		MOIST				
S-9 1242		5 / 9					AS ABOVE		MOTTLED YEL.				
	20	15 / 18	1.8 / 2.0		↓	↓		↓	BRN				
S-10 1257		3 / 3			LOOSE/	GREY	f-g SAND + SILT TR	SW/SP	MOIST TO WET				
	22	6 / 8	2.0 / 2.0	▽	SOFT		CLAY + GRAVEL		AT 21.5'				
S-11 1305		5 / 5		▽		DK OL	f-g SAND + CLAY + SILT		MOIST TO WET				
	24	10 / 10	2.0 / 2.0		↓	GRN		↓	SAND STRINGERS DRAIN WATER				
S-12 1310	25	3 / 5					AS ABOVE						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: DOWN GRADIENT WELL NO CHEM. ANALYSIS SAMPLE

Drilling Area Background (ppm):

Converted to Well: Yes X No

Well I.D. #: S33TW003

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SEVEN SITES INV. JH DIV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK
DRILLING RIG:

BORING NUMBER: S33TW003
DATE: 2-6-02
GEOLOGIST: FRED W RAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	26	5 / 9	2.0 / 2.0		DENSE	DK OLIVE GREEN	F-g SAND + SILT	SP	WET				
S-13 1330		4 / 5					CLAY + SILT	CL		0.2		0	
	28	9 / 12	2.0 / 2.0			MAROON	CLAYEY F-g SAND TR GRA	SP	WET				
S-14 1335		12 / 9					NO RECOVERY			0.3		0	
	30	9 / 14	2.0 / 2.0				YEL BRN SAND GRAVEL IN SHOE		WET				
S-15 1345		6 / 15				LT BRN	M-g SAND TR SILT	SP	SATURATED				
	32	21 / 35	2.0 / 2.0				↓		WATER IN HOLE				
									MEASURED H_2O				
									IN HOLE TO 17'				
									BGS.				
									PLACE SCREEN				
									20-30				
									SAND 30-18				
									BENTONITE 14-18'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: HSA TO 30'
SAMPLED TO 32

Drilling Area Background (ppm):

Converted to Well: Yes X No ____ Well I.D. #: S33TW003

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: SEVEN SITES NV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK - GEOSYSTEMS
DRILLING RIG: B-57 ATV

BORING NUMBER: S34TW001
DATE: 2-1-02
GEOLOGIST: FRED WRAMSER
DRILLER: AARON EICHELBERGER

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DK BRN			ROOT MATL.				
	2					YEL BRN	f-g SAND TR SILT						
S-1 0735		4/4			MED DENSE	YEL BRN	f-g SAND TR SILT	SP	MOIST	0.1		0	
	4	7/6	2.0/2.0				↓		MOIST				
S-2 0738		6/4		▽			AS ABOVE	SP	WET @ 5'	0.1		0	
	6	4/2	1.5/2.0										
S-3 0742		3/5			↓		AS ABOVE	↓					
	8	32/14	1.5/2.0		DENSE		GRAVEL + SAND	GP		0.2		0	
S-4 0750		9/12											
	10	16/12	1.9/2.0		STIFF	GREY	CLAY + SILT	ML	MOTTLED YEL	0.3		0	
S-5 0800		6/9			↓		CLAY W/SOME SILT	↓					
	12	12/14	1.8/2.0						APPEARS DRY				
	14						TD @ 10'		SCREEN 4'-9'				
									SAND 2'-10'				
									BENT. 0'-2'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes X No ____ Well I.D. #: S34TW001

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: SEVEN SITES INV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: B-57

BORING NUMBER: S34TW002
DATE: 2-1-02
GEOLOGIST: FRED W RAMSER
DRILLER: AARON EIGLEBERGER

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DK BRN	SAND + SILT						
	2												
S-1 0900		2/2				MED BRN	CLAYEY F-g SAND & SILT	SP	MOTTLED WET	0		0	
	4	4/3	1.2/2.0				↓						
S-2 0905		2/3			LOOSE	GREENISH GRAY	CLAYEY f-g SAND	SP	SATURATED	0.2		0	
	6	3/4	1.2/2.0				↓						
S-3 0910		6/6			MED DENSE		AS ABOVE			0.2		0	
	8	9/12	1.8/2.0				↓						
S-4 0915		5/7					↓						
	10	9/10	/2.0		VERY STIFF	GREY	CLAY MOTTLED YEL BRN	ML	APPEARS DRY	0.3		0	
	12												
									SCREEN 4-9				
									SAND 2-10				
									BENTONITE 0'-2'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: 1ST SPOON COLLECTED @ 2'-4'

Converted to Well: Yes ✓ No ____ Well I.D. #: S34TW002

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: SEVEN SITES SSP
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: MOBIL B-57
BORING NUMBER: S34TW003
DATE: 1-31-02
GEOLOGIST: FRED WRAMSER
DRILLER: ARON EICHELBERGER

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks *	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DK BRN	SILT + SAND TR CLAY		TR ROOT MATL.				
	2					YEL BRN	f.g SAND TR SILT	SP					
S-1 1536		3 / 3			LOOSE		↓		MOIST	0.0		0	
	4	4 / 5	20 / 2.0			YEL BRN	m.g SAND	SP					
S-2 1539		4 / 4							MOIST TO WET	0.2		0	
	6	7 / 10	1.8 / 2.0	▽					WET				
S-3 1545		7 / 7			MED DENSE		m.g - c.g SAND		SATURATED	0.2		0	
	8	9 / 13	1.5 / 2.0				GRAVEL @ 6.5'-6.8'						
S-4 1551		7 / 12			VERY DENSE	BRN	GRAVEL + SAND	GW		0.3		0	
	10	50/3"	1.0/1.3 / 2.0										
							AS ABOVE		AUGER TO 12'	0.0		0	
	12						PER CUTTINGS		PAST GRAVEL				
S-5 1600		14 / 8		?	DENSE		NO RECOVERY	?	GRAVEL IN	0.0		0	
	14	10 / 12	0.2 / 2.0					?	TIP OF SPOON				
									SCREEN 4'-14'				
									SAND 3-15'				
									BENT - 0-3				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: 1ST SPOON TAKEN @ 2'-4' *NO PID MEASURED

TEMP WELL

Converted to Well: Yes X No ____ Well I.D. #: S34TW003

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV STUMPNECK
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: B-57 ATV

BORING NUMBER: S37TW001
DATE: 2-5-02
GEOLOGIST: FRED WRAMSER
DRILLER: A. EIGLBERGER

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DK BRN	SAND + SILT + GRA						
	2												
S-1 0830		6/6			MED	MED BRN	C-M SAND	SP	COLLECTED	0		0	
	4	9/12	2.0/2.0		DENSE		MOIST		S37SB001010 1 2-4'				
S-2 0845		14/36			DENSE		AS ABOVE			0		0	
	6	39/42	2.0/2.0	▽					WET @ 5.5'				
S-3 0900		12/16			DENSE		AS ABOVE		COLLECTED S37SB001020 1 (4'-6')				
	8	18/14	1.6/2.0				TR GRAVEL			0		0	
S-4 0905		1/1						↓					
	10	1/1	1.2/2.0			DK BRN	CLAY AT 9.5' BLK	OL					
									PLACE SCREEN				
									@ 5'-10'				
									SAND 3'-10'				
									BENT. 0-3'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: S-1 3" SPLITSPOON

Converted to Well: Yes X No ____ Well I.D. #: S37TW001

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: INDIAN HEAD
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: B-57 ATV

BORING NUMBER: S37TW002
DATE: 2-5-02
GEOLOGIST: FRED WILLIAMS
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
						DK BRN	SAND & GRAVEL						
	2												
S-1 1115		6 / 12			DENSE	BRN	GRAVEL + SAND	GW	VARIEGATED COLLECTED	0		0	
	4	16 / 18	1.0 / 2.0						S37SB0020101				
S-2 1130		50/2"					REFUSAL		GRAVEL IN SHOE				
	6			▽			AUGER REFUSAL		BLK SAND +				
							MOVE HOLE ~100'		SILT TR GRAVEL				
	8						TO THE WEST		SEVERAL ATTEMPT				
									HSA = 12'				
	10								PLUS 10' = 22'				
									SCREEN 5-10				
									SAND 3-10				
									BENTONITE 0-3				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: S-1 - 3" SPLIT SPOON
+ S-2 3" SPLIT SPOON

Drilling Area Background (ppm): ____

Converted to Well: Yes X No ____ Well I.D. #: S37TW002

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: THDIV STUMPNECK
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAKE GEOSYSTEMS
DRILLING RIG: MOBIL B-57 ATV

BORING NUMBER: S37TW003
DATE: 2-5-02
GEOLOGIST: FRED W. RAMSER
DRILLER: AARON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0			G.S.									
						MED BRN	SAND + SILT			0		0	
	2						↓						
S-1 1000		8 / 10			DENSE	MED BRN	M-g SAND TRGRA.	SP	COLLECTED S37SB0030101	0		0	
	4	12 / 14	1.0 / 2.0				↓						
S-2 1015		16 / 19			VERY		AS ABOVE						
	6	25 / 31	1.0 / 2.0	▽	DENSE				COLLECTED S37SB0030201	0		0	
S-3 1030		7 / 8			DENSE		AS ABOVE						
	8	9 / 12	0.4 / 2.0					↓					
S-4 1040		1 / 2			SOFT	DK GRN	SANDY CLAY	SW/CL		0		0	
	10	1 / 2	1.8 / 2.0										
									SCREEN 5-10				
									SAND 3-10				
									BENT. 0'-3'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: S-1 + S-2 3" SPLIT SPOONS
S-2 + S-4 2" SPLIT SPOONS

Drilling Area Background (ppm): ____

Converted to Well: Yes X No ____ Well I.D. #: S37TW003

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: SEVEN SITES INV
PROJECT NUMBER: 0525
DRILLING COMPANY: CHESAPEAK GEOSYSTEMS
DRILLING RIG: HAND AUGER

BORING NUMBER: S51SB001
DATE: 2-11-02
GEOLOGIST: FWRAMSER
DRILLER: ARRON E.

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1					BRN	SILT + CLAY						
1754	2						↓		COLLECTED				
1830	3					BRN	GRAVEL		S51SB0010101 @ 1.5-2'	0.5		0	
							AUGER REFUSAL @ 2'		S51SB0010201				
							SEVERAL ATTEMPS		@ 2'-3'	0.5		0	
							ARE MADE AT						
							DIFFERENT LOCATIONS						
							THIS GRAVEL EXTENTS						
							LATERALY FROM THE						
							GRATE BY AT LEAST						
							2' FEET						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: HAND AUGER

Drilling Area Background (ppm): ____

Converted to Well: Yes ____ No X Well I.D. #: ____

APPENDIX C

SAMPLE LOG SHEETS AND CHAIN OF CUSTODY FORMS

C.1 Groundwater
C.2 Surface Water
C.3 Sediment
C.4 Soil
C.5 Chain of Custody Forms

C.1 GROUNDWATER

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: N0525

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S33TW001 0001
Sample Location: S33TW001
Sampled By: KEITH SIMPSON
C.O.C. No.: MK/STL 009
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	~~TDS~~
Date: 2-8-02								
Time: 0835								
Method: BLADDER PUMP	CLEAR	5.58	0.043	10.0	9.2	0.07	191	NA

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2-8-02								
Method: BLADDER PUMP								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 2" PVC TW								
Total Well Depth (TD): 29.40	T OF PVC							
Static Water Level (WL): 10.22	"							
One Casing Volume (gal/l): 3.1								
Start Purge (hrs): 0718								
End Purge (hrs): 0835								
Total Purge Time (min): 77								
Total Vol. Purged (gal/l): 2.3								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TAL METALS	HNO_3	2 - 500 ML PE	✓
DISS. TAL METALS	4°C	2 - 500 ML PE	✓
EXPLOSIVES	4°C	5 - QTS	✓
— NO NITROCELLULOSE —			

OBSERVATIONS / NOTES:

RISER STICK-UP = 1.10' ABOVE GS

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S33TW001
DATE: 2-8-07

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
0718	10.22	0	115								START PURGE
0730	11.05			5.25	0.049	81	0.23	8.70	220	CLOUDY	NO ODOR
0740	11.07			5.40	0.046	66	0.	9.3	218		
0750	11.10			5.53	0.044	50	0.13	9.9	198	CLEARING	
0800	11.12			5.54	0.043	39	0.11	9.9	197		
0810	11.16			5.54	0.043	28	0.10	9.9	197		
0820	11.21			5.59	0.043	19	0.09	10.0	195		
0830	11.22			5.56	0.043	13	0.07	10.0	192		
0835	11.23	2.3		5.58	0.043	9.2	0.07	10.0	191	END PURGE	

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 533TW002 0001
Sample Location: 533TW002
Sampled By: KEITH SIMPSON
C.O.C. No.: NA
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	~~TDS~~
Date: 2.12.02								
Time: 0925								
Method: BLADDER PUMP	CLEAR	5.50	0.040	10.3	15	0.12	251	NA

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2.12.02								
Method: BLADDER PUMP								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 2" PVC TW								
Total Well Depth (TD): 29.60	TOC PVC							
Static Water Level (WL): 10.05	"							
One Casing Volume (gal/l): 3.2								
Start Purge (hrs): 0805								
End Purge (hrs): 0925								
Total Purge Time (min): 80								
Total Vol. Purged (gal/l): 2.6								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TAL METALS	HNO_3	2 500 ML PE	✓
DISS. TAL METALS	4°C	2 500 ML PE	✓
EXPLOSIVES	4°C	6 QT GLASS	✓

OBSERVATIONS / NOTES:

PUMP SET ≈ 4' OFF BTM. LATE 2.11.02

RISER STICK-UP = 1.30' ABOVE GS

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	KS SL

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: 533TW002
DATE: 2-12-02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
0805	10.05	0	125							START	PURGE
0815	10.70			5.27	0.065	16	2.13	9.4	268	CLEAR,	NO ODOR
0825	10.90			5.50	0.054	23	0.17	10.1	253		
0835	10.98			5.52	0.046	35	0.15	10.3	251		
0845	11.16			5.50	0.044	25	0.32	10.3	254		
0855	11.13			5.48	0.042	22	0.08	10.3	247		
0905	11.10			5.49	0.042	20	0.07	10.3	248		
0915	11.14			5.50	0.041	18	0.19	10.3	252		
0925	11.15	2.6		5.50	0.040	15	0.12	10.3	251	END	PURGE

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: N 0525

[] Domestic Well Data
[X] Monitoring Well Data 2" TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S33TW003000 1
Sample Location: S33TW003
Sampled By: K. SIMPSON
C.O.C. No.: SFL/MR 008
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 2.7.02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	~~TDS~~
Time: 1450	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method: BLADDER	TAN	5.84	0.046	12.7	>999	1.17	123	—

PURGE DATA:

Date: 2.7.02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Method: BLADDER PUMP								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" PVC TW								
Total Well Depth (TD): 30.00	TOF PVC							
Static Water Level (WL): 9.35	"							
One Casing Volume (gal/l): 3.4								
Start Purge (hrs): 1310								
End Purge (hrs): 1450								
Total Purge Time (min): 100								
Total Vol. Purged (gal/l): 2.9								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TAL METALS	~~1%HCL~~ HNO_3	500 ML PE (2)	✓
DISS. TAL METALS	4°C	500 ML PE (2)	✓
EXPLOSIVES	4°C	—	
↳ NO NITROCELLULOSE	4°C	5 QTS > (5)	✓

OBSERVATIONS / NOTES:

RISER STICK-UP = 0.8' ABOVE GS

HIGH TSS PUMPED 30MIN, 1ST TO CLEAR UP

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: 533 TW 003
DATE: 2.7.02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
1310	9.35	0	110	—	—	>999	—	—	—	START	PURGE
1315	10.09	↓	↓	—	—	↓	—	—	—	LT. TAN	NO ODOR
1320	10.31			—	—		—	—	—		
1340	10.40			5.92	0.058	>999	0.03	12.6	121		
1350	10.28			5.90	0.052	>999	0.02	12.5	102		
1400	10.19			5.89	0.050	>999	0.28	12.6	104		
1410	10.13			5.88	0.048	>999	0.02	12.6	101		
1420	10.12			5.87	0.047	>999	0.38	12.7	108		
1430	10.15			5.86	0.046	>999	1.00	12.7	115		
1440	10.18			5.85	0.046	>999	1.16	12.7	120		
1445	10.16			5.84	0.046	>999	1.16	12.7	122		
1450	10.14	2.9		5.84	0.046	>999	1.17	12.7	123	END	PURGE

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: N0525
SITE 34

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S34TW001 0001
Sample Location: S34TW001
Sampled By: R. SIMPSON
C.O.C. No.: MK008
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	~~TDS~~
Date: 2.7.02								NA
Time: 0910								
Method: PERISTALTIC	CLEAR	4.64	0.382	9.6	5.0	0.06	274	—

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2.7.02								
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 1" PVC TW	12.35							
Total Well Depth (TD): 7.4	T.OF PVC							
Static Water Level (WL): 7.41	T.OF PVC							
One Casing Volume (gal/l): 0.4								
Start Purge (hrs): 0800								
End Purge (hrs): 0910								
Total Purge Time (min): 70								
Total Vol. Purged (gal/l): 2.4	+ DEV. VOL.							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BERYLLIUM & COPPER	HNO_3	500 ML PE	✓
			✓
DISS. BERYLLIUM & COPPER	4°C	500 ML PE	

OBSERVATIONS / NOTES:

RISER STICK-UP ≈ 2.50± ABOVE GS
1ST 5 MIN PUMPED @ ≥500 ML/MIN TO DEV./CLEAN OUT LINE

1" TW = 0.082 GAL/FT

Circle if Applicable:

MS/MSD — Duplicate ID No.:

Signature(s): RL/SL

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S34TW001
DATE: 2.7.02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
0800	7.41	0	130							START	PURGE
0810	7.80	↓	↓	4.42	0.614	320	2.27	9.8	282	LT TAN., NO ODOR	
0820	7.77	↓	↓	4.49	0.451	34	0.27	9.8	285	CLEARING	
0830	7.77	↓	↓	4.53	0.429	32	0.31	9.8	283		
0840	7.77	↓	↓	4.56	0.410	30	0.35	9.7	282		
0850	↓	↓	↓	4.58	0.399	19	0.12	9.6	280		
0900	↓	↓	↓	4.60	0.388	11	0.08	9.6	278		
0905	↓	↓	↓	4.63	0.383	7.2	0.08	9.6	275		
0910	↓	2.4	↓	4.64	0.382	5.0	0.06	9.6	274	END	PURGE

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: 0525 SITE 34

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S34TW002000/
Sample Location: S34TW002
Sampled By: K. SIMPSON
C.O.C. No.: MK007
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	TDS
Date: 2.4.02								NA
Time: 1710								
Method: PERISTALTIC	CLEAR	6.31	1.29	9.0	1.1	0.03	4	

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2.4.02								
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 1" PVC TW								
Total Well Depth (TD): 7.50	TOF PVC							
Static Water Level (WL): 3.93	TOF PVC							
One Casing Volume(gal/L): 0.3								
Start Purge (hrs): 1620								
End Purge (hrs): 1710								
Total Purge Time (min): 50	+ DEV.							
Total Vol. Purged (gal/L): 1.3	"							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BERYLLIUM & COPPER	HNO_3	500 ML PE	✓
DISS. BERYLLIUM & COPPER	4°C	500 ML PE	✓

OBSERVATIONS / NOTES:

RISER STICK-UP = 2.50 ABOVE GS

1ST 7 MIN PUMPED @ 500 ML/MIN TO DEV/CLEAN OUT WELL

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	KJS

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S34TW002
DATE: 2.4.02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ RSA ( )	Notes:
1620	5.14	0	100	6.21	1.22	7.4	0.11	9.11	14	START	PURGE
1630	↓	↓	↓	6.27	1.26	5.8	0.08	9.0	10	CLEAR,	NO ODOR
1640				6.27	1.26	4.3	0.07	9.1	11		
1650	5.12			6.28	1.27	2.5	0.04	9.0	8		
1700	5.09			6.30	1.28	1.8	0.04	9.0	7		
1705	5.05			6.31	1.28	1.3	0.05	8.9	5		
1710	5.03	1.3		6.31	1.28	1.1	0.03	9.0	4	END	PURGE

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: SITE 34

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S34TW003 0001
Sample Location: S34TW03
Sampled By: KEITH SIMPSON
C.O.C. No.: MK007
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	TDS
Date: 2.4.02								
Time: 1540								
Method: PERISTALTIC	CLEAR	4.74	0.326	10.3	14	0.25	260	NA

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2.4.02								
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 1" PVC TW								
Total Well Depth (TD): 17.3	T OF PVC		14.8 BGS					
Static Water Level (WL): 8.19	T OF PVC							
One Casing Volume (gal/L): 0.8								
Start Purge (hrs): 1430								
End Purge (hrs): 1540								
Total Purge Time (min): 70								
Total Vol. Purged (gal/L): 2.6	+ DEV.							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BERYLLIUM & COPPER TOTAL	HNO_3	500 ML PE	✓
BERYLLIUM & COPPER DISS.	4°C	500 ML PE	✓

OBSERVATIONS / NOTES:

1" TW = 0.082 GAL/FT
DEVELOPED & PURGED SAME DAY
1ST 5 MIN. PUMPED @ 500 ML/MIN TO DEV./CLEAN WELL
RISER STICK-UP = 2.5' ABOVE GS

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): KTS

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245 SITE 34

WELL ID.: S34TW003
DATE: 2.4.02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
1430	8.19	0	140	4.75	0.358	190	0.02	10.4	248	START PURGE	
1440	8.33			4.67	0.362	55	0.02	10.3	263	LT TAN, NO ODOR	
1450	8.34			4.57	0.360	46	0.57	10.1	274	CLEARING	
1500				4.59	0.351	32	0.23	10.2	275		
1510				4.59	0.348	25	0.18	10.2	275		
1520				4.63	0.340	20	0.19	10.1	273		
1530				4.70	0.331	17	0.22	10.2	270		
1535				4.73	0.327	15	0.28	10.2	267		
1540				4.74	0.326	14	0.25	10.3	266	END PURGE	

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD SITE 37
Project No.: N 0525

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S37TW001001
Sample Location: S37TW001
Sampled By: R. SIMPSON
C.O.C. No.: MK007/STL007
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	TDS
Date: 2.5.02								NA
Time: 1440								
Method: PERISTALTIC	CLEAR	6.58	1.63	7.5	3.9	0.07	-42	—

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Date: 2.5.02								
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 1" PVC								
Total Well Depth (TD): 8.20	TOF PVC →		12.40					
Static Water Level (WL): 6.47	TOF PVC		AFTER DEV.					
One Casing Volume (gal/L): 0.5								
Start Purge (hrs): 1350								
End Purge (hrs): 1440								
Total Purge Time (min): 50								
Total Vol. Purged (gal/L): 1.7	+ DEV.							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOC	HCL	2 VIALS	✓
SVOC	4°C	1 QT	✓
PEST/PCB	4°C	2 QTS	✓
TAL METALS	HNO3	2 500 ML PE	✓
DIS. TAL METALS	4°C	2 500 ML PE	✓
EXPLOSIVES	4°C	4 QTS	✓
NITROCELLULOSE	4°C	1 QT	✓
NITROGUANIDINE	4°C	2 QTS	✓
~~NITRO~~			
		2X VOL FOR DUP	

OBSERVATIONS / NOTES:

PUMPED @ ≥500 ML/MIN TO DEV./CLEAN 1ST 5 MIN.
STICK-UP = 2.5' ABOVE GS

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	S37TW DUP 001	[signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S37TW001
DATE: ~~5-25~~ 2-5-02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
1350	RS ~~8.20~~ 6.47	0	125	—	—	—	—	—	—	START	PURGE
1400	7.09	↓	↓	6.54	1.62	167	0.61	7.0	-15	CLEAR,	NO ODOR
1410	7.05			6.57	1.63	13	0.13	7.4	-35		
1420	7.08			6.57	1.63	8.7	0.12	7.5	-34		
1430	7.12			6.58	1.64	5.1	0.11	7.5	-39		
1440	7.15	1.7		6.58	1.63	3.9	0.07	7.5	-42	END PURGE	

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: N 0525

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S37TW002 0001
Sample Location: S37TW002
Sampled By: R. SIMPSON
C.O.C. No.: ST2008/MK008
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 2.6.02	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	~~TDS~~
Time: 1700	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	NA
Method: PERISTALTIC	CLEAR	6.43	2.85	8.2	2.2	0.04	-5	—

PURGE DATA:

Date: 2.6.02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 1" PVC TW								
Total Well Depth (TD): 12.35	TOP PVC							
Static Water Level (WL): 5.04	"							
One Casing Volume (gal/L):								
Start Purge (hrs): 1540								
End Purge (hrs): 1700								
Total Purge Time (min): 80	+ DEV.							
Total Vol. Purged (gal/L): 2.8	"							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOC	HCL	2 VIALS	✓
SVOC	4°C	1 QT	✓
PEST/PCB	4°C	2 QTS	✓
TAL METALS	HNO_3	2 500 ML PE	✓
DISS. TAL METALS	4°C	2 500 ML PE	✓
EXPLOSIVES	4°C	2 QTS	✓

OBSERVATIONS / NOTES:

DEV. 1ST FOR 7 MIN. PUMPED @ ≥ 500 ML MIN, ON/OFF

END SAMPLING @ 1830

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
—	—	[signature]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S37TW002 0001
DATE: 2-6-02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
1540	5.04	0	130							START	PURGE
1545	5.17			5.39	3.83	25	5.58	9.0	108	CLEAR,	NO ODOR
1555	5.17			5.73	3.51	21	0.87	8.8	77		
1605	5.18			5.94	3.37	16	0.14	8.6	57		
1615	5.20			6.07	3.28	12	0.11	8.5	39		
1625	5.19			6.22	3.10	11	0.11	8.4	22		
1635	5.19			6.34	2.94	5.2	0.12	8.2	4		
1645	5.19			6.37	2.92	3.8	0.07	8.2	-1		
1650	5.20			6.39	2.88	3.3	0.05	8.2	-2		
1655	5.21			6.42	2.86	3.0	0.04	8.2	-3		
1700	5.21	2.8		6.43	2.85	2.2	0.04	8.2	-5	END	PURGE

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD, MD
Project No.: N 0525

[] Domestic Well Data
[X] Monitoring Well Data TW
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: S37TW003 0001
Sample Location: S37TW003
Sampled By: KEITH SIMPSON
C.O.C. No.: MK008/STL008
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 2.6.02	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	~~TDS~~ NA
Time: 0925								
Method: PERISTALTIC	CLEAR	6.36	4.84	7.6	1.5	0.04	-30	—

PURGE DATA:

Date: 2.6.02	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	TDS
Method: PERISTALTIC								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 1" PVC TW								
Total Well Depth (TD): 12.25	TOF	PVC						
Static Water Level (WL): 6.51	TOF	PVC						
One Casing Volume (gal/l): 0.5								
Start Purge (hrs): 0810								
End Purge (hrs): 0925								
Total Purge Time (min): 75	+ DEV.							
Total Vol. Purged (gal/l): 2.7	"							

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	MS/MSD	Collected
VOC	HCL	2 VIALS	6	—
SVOC	4°C	1 QT GLASS	3	—
PEST/PCBs	4°C	2 QT GLASS	6	—
TAL METALS	HNO_3	2 500 ML PE	~~3~~ 6	—
DISS. TAL METALS	4°C	2 500 ML PE	~~3~~ 6	—
EXPLOSIVES	4°C	7 QTS	21	✓
		3X VOL. FOR MS/MSD		

OBSERVATIONS / NOTES:

DEV. 1ST FOR 10 MIN. PUMPED @ ≥500 ML MIN, ON/OFF
END SAMPLING @ 1330

TW 2.5' RISER

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):
YES		KS/SL

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 0245

WELL ID.: S37TW003
DATE: 2.6.02

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (gal/L)	Flowrate (mL/min)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	~~TDS~~ NA ( )	Notes:
0810	6.51	0	135							START	PURGE
0830	6.69			6.34	5.05	40	1.46	7.3	1	CLEAR,	NO ODOR
0840				6.34	5.10	18	0.08	7.4	-11		
0850				6.34	5.07	9.4	0.06	7.5	-17		
0900	6.69			6.35	5.01	6.2	0.08	7.5	-21		
0910	6.69			6.36	4.91	3.4	0.05	7.6	-25		
0915				6.36	4.86	2.2	0.08	7.6	-26		
0920				6.36	4.85	1.7	0.03	7.6	-29		
0925		2.7		6.36	4.84	1.5	0.04	7.6	-30	END PURGE	
										CELL FROZEN @	
										TIME OF 1ST	
										READING (0920)	

SIGNATURE(S): [illegible]

C.2 SURFACE WATER

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: 7 SITES INDIAN HEAD
Project No.: 0525

Sample ID No.: S37SW0010001
Sample Location: S37SW/SD01
Sampled By: R. SIMPSON
C.O.C. No.: MC006/STL006

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: RIVER/CREEK
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 1.31.02 Time: 1630 Depth: 0-6" Method: DIRECT FILL	CLEAR	7.08	6.56	9.6	2.7	5.91	0.34	—

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	2 VIALS	MK
TCL SVOC	4°C	1 QT	↓
TAL METALS	HNO3	2 500 ML PE	
PEST/PCBs	4°C	2 QT	
EXPLOSIVES	4°C	7 QT	STL

OBSERVATIONS / NOTES:

SAME AS SW/SD02

45' W OF UTILITY POLE #3255

MAP:

SEE FIG 4-5 + 02 SED LOG SHEET

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD013102 02

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: 7 SITES INDIAN HEAD
Project No.: 0525

[] Stream
[] Spring
[] Pond
[] Lake
[X] Other: RIVER/CREEK
[] QA Sample Type:

Sample ID No.: 537SW002 0001
Sample Location: 537SW002
Sampled By: R. SIMPSON
C.O.C. No.: MC006/STC006

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 1.31.02	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1510								
Depth: 0 - 6"	CLEAR	6.99	6.34	10.0	2.9	6.38	0.33	NA
Method: DIRECT FILL								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL VOC	HCL	2 VIALS	MK
TCL SVOC	4°C	1 QT	↓
TAL METALS	HNO_3	2 500 ML PE	↓
PEST/PCBs	4°C	2 QT	↓
EXPLOSIVES	4°C	2 QT	STC

OBSERVATIONS / NOTES:

SAMPLES COLLECTED
≈ 30' N OF GABION BASKETS
≈ 4' FROM WATERS EDGE

MAP:

SEE FIG 4-5
+ SED. LOG SHEET

Circle if Applicable:

MS/MSD	Duplicate ID No.:
YES	—

Signature(s):

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD MD, 7 SITES
Project No.: N0525

[] Stream
[] Spring
[] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: S3754W003 0001
Sample Location: S3754W003
Sampled By: R. SIMPSON
C.O.C. No.: MK007/SR007

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 2.5.02	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1030								
Depth: 0 TO 4"	CLEAR *	6.36	0.940	0.8	12	1.38		—
Method: DIRECT FILL								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOC	HCL	2 VIALS	✓
SVOC	4°C	1 QT GLASS	✓
PEST/PCB	4°C	2 QT GLASS	✓
TAL METALS BE, CU	HNO_3	1 500 ML PE	✓
EXPLOSIVES	4°C	7 QT GLASS	✓

OBSERVATIONS / NOTES:

LOW FLOW ≈ 1 gpm

* TRACE FINES STIRRED-UP DURING SAMPLING.
SMALL PONDED AREA

1/4" OF ICE ON SURFACE

MAP:

SEE SED. LOG FORM

Circle if Applicable:

MS/MSD — Duplicate ID No.: —

Signature(s): [illegible]

C.3 SEDIMENT

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: SEVEN SITES INDIAN HEAD NSWC
Project No.: SITE SCREENING INV. 0525

Sample ID No.: S37SD001 0001
Sample Location: S37 SW/SD01
Sampled By: R SIMPSON
C.O.C. No.: MC006/STL006

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1-31-02 Time: 1650 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0 - 6"	BRN	WET, F - C. SAND TR F. GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X 3	—	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG X 1	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG X 1	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG X 1	✓	
NITROCELLULOSE	4OZ WMG X 1	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

MAP:

SEE FIG. 4-5 & 02 LOG SHEET

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	FD 01310201

Signature(s): RT/SL

LOCATION S37 SW/SD 02

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S37SD002 0001
Sample Location: S37SD02
Sampled By: K. SIMPSON
C.O.C. No.: MC006/STL006

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1.31.02 Time: 1605 Method: PLASTIC TROWEL Monitor Reading (ppm): —	0-6"	BRN	WET SAND SOME F. GRAVEL (F TO C SAND)

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X 5	✓	
TCL SVOA	4OZ WMG X 1	—	
TAL METALS 8	4OZ WMG X 1	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG X 1	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG X 1	✓	
NITROCELLULOSE 8	4OZ WMG X 1	✓	
Be + Cu	4OZ WMG X 1	—	
	X VOC FOR MS/MSD		
	TOTAL		

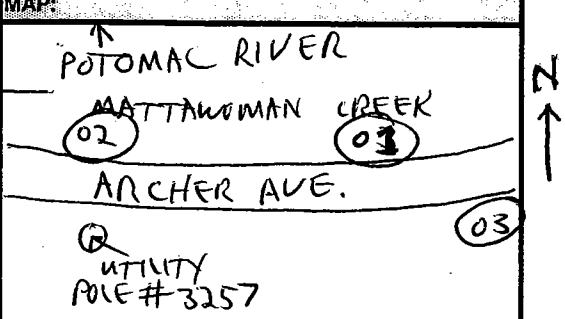
OBSERVATIONS / NOTES:

LOW TIDE @ 1526

COLLECTED CLOSE TO WATER EDGE

SEE FIG. 4-5

MAP:



Circle if Applicable:

MS/MSD: YES

Duplicate ID No.: —

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S37SD 003 0001
Sample Location: S37SD003
Sampled By: K. SIMPSON
C.O.C. No.: MK007/STL007

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2.5.02 Time: 1050 Method: PLASTIC TRAVEL Monitor Reading (ppm): —	0 - 6"	DK BRN BLK	SILT + SAND WET PLANT MATL.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
~~TCL SVOA~~	~~4OZ WMG~~		
TAL METALS + BE, CU	4OZ WMG		
TCL PEST/PCBS / TCL SVOA	8OZ WMG		
EXPLOSIVES/8332/NITROG	8OZ WMG		
NITROCELLULOSE	4OZ WMG		
~~Be + Cu~~	~~4OZ WMG~~		

OBSERVATIONS / NOTES:

MAP:

SEE FIG. 4-5
MOVED 50YD ± SOUTH OF LOCATION ON FIG.

NO WATER @ FIG. LOCATION

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

C.4 SOIL

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S33SB0010101
Sample Location: S33SB001
Sampled By: FWR
C.O.C. No.: MK/STL 008

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-7-02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0846	6'-8'	GREY	SILT W/CLAY TR SAND
Method: SPLIT SPOON			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

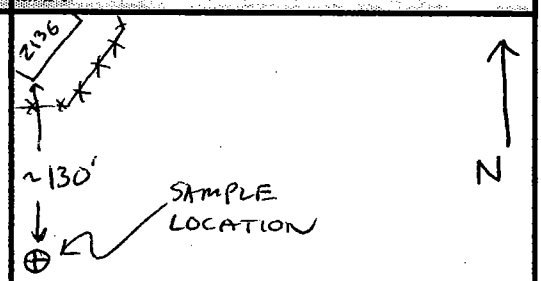
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
TCL SVOA	4OZ WMG		
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG		
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG		
Be + Cu	4OZ WMG		

OBSERVATIONS / NOTES:

THIS SAMPLE WAS COLLECTED FROM S33TW001 LOCATION.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S33SB0010201
Sample Location: S33SB001
Sampled By: FUR
C.O.C. No.: MK/STL008

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-7-02 Time: 0910 Method: SPLIT SPOON Monitor Reading (ppm):	14'-16'	GREY	SILT w/CLAY TR SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

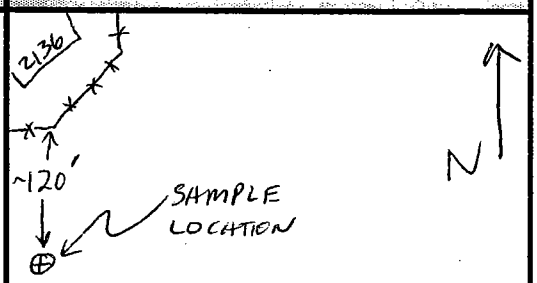
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	—	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	—	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	—	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

THIS SAMPLE WAS COLLECTED FROM S33TW001 LOCATION.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Ulamser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S33SB0020101
Sample Location: S33SB002
Sampled By: FWR
C.O.C. No.: STL/MK 009

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-8-02 Time: 0915 Method: SPLIT SPOON Monitor Reading (ppm): —	6-8'	LT. GREY	f-g SAND AND SILT

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

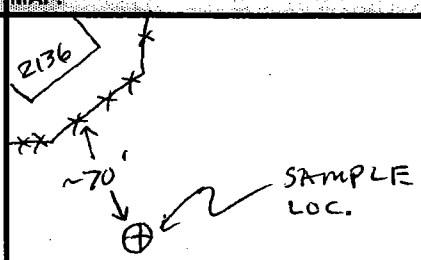
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	—	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	—	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	—	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED FROM S33TW002 LOCATION.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S335B0020201
Sample Location: S335B002
Sampled By: FYR
C.O.C. No.: MK/STL 009

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-8-02 Time: 0930 Method: SPLIT SPOON Monitor Reading (ppm): —	14'-16'	GREY	MOIST SAND + SILT + CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

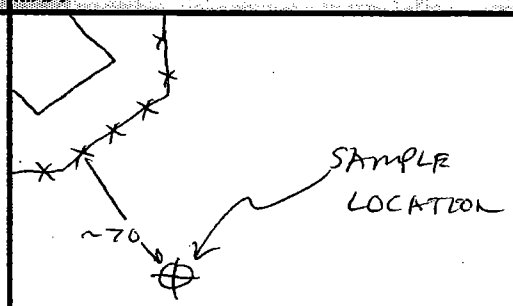
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	—	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	—	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	—	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED FROM S33TW002 LOCATION

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred M Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S33SB0030101
Sample Location: S33SB003
Sampled By: FLR
C.O.C. No.: NA

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-12-02 Time: 1225 Method: BACK HOE Monitor Reading (ppm): —	3-5'	YEL BRN	SILT + F-g SAND + GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

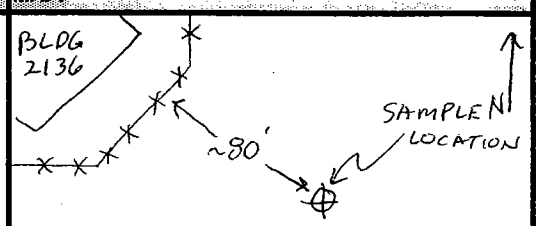
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
TCL SVOA	4OZ WMG		
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG		
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG		
Be + Cu	4OZ WMG		

OBSERVATIONS / NOTES:

THIS SAMPLE WAS COLLECTED FROM TEST PIT #3.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S33SB0030201
Sample Location: S33SB003
Sampled By: FWR
C.O.C. No.: NA

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-12-02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1245	8'-10'	YEL/GRN BRN/GREY	CLAY, SILT + SAND
Method: BACK HOE			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				FWR

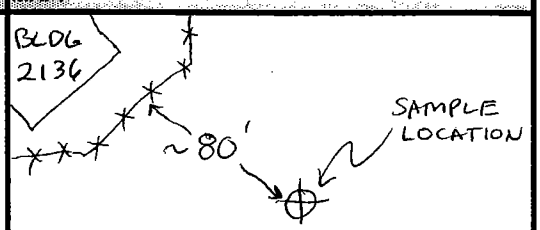
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
TCL SVOA	4OZ WMG		
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS/TCL SVOA	8OZ WMG		
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG		
Be + Cu	4OZ WMG		

OBSERVATIONS / NOTES:

THIS SAMPLE WAS COLLECTED FROM TEST PIT #3.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	S33SBDUP0101

Signature(s): Fred M Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S34SB0010101
Sample Location: S34SB001
Sampled By: FWR
C.O.C. No.: MC004/STL004

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1-30-02 Time: 1400 Method: DIRECT FILL Monitor Reading (ppm):	4'-4.5'	YEL BRN	MOIST SAND + SILT TR GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

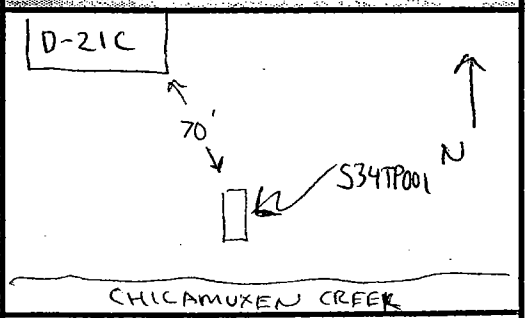
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
TCL SVOA	4oz WMG		
TAL METALS	4oz WMG		
TCL PEST/PCBS / TCL SVOA	8oz WMG		
EXPLOSIVES/8332/NITROG	8oz WMG	✓	
NITROCELLULOSE	4oz WMG	✓	
Be + Cu	4oz WMG	✓	

OBSERVATIONS / NOTES:

COLLECTED SAMPLE FROM S34TP001

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	S34SBDUP0101

Signature(s): Fred M Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S34SB0010201
Sample Location: S34SB001
Sampled By: FLR
C.O.C. No.: MC004/STL004

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1-30-02 Time: 1445 Method: DIRECT FILL Monitor Reading (ppm): —	7'-8'	YEL BRN	SAND, SILT + CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

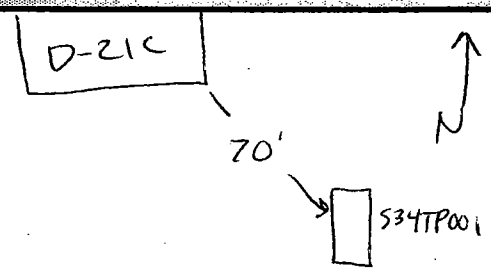
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3		
TCL SVOA	4OZ WMG		
TAL METALS	4OZ WMG		
TCL PEST/PCBS/TCL SVOA	8OZ WMG		
EXPLOSIVES/8332/NITROG	8OZ WMG		
NITROCELLULOSE	4OZ WMG		
Be + Cu	4OZ WMG		

OBSERVATIONS / NOTES:

THIS SAMPLE IS PLACED ON HOLD PENDING RESULTS OF SHALLOW SAMPLE (4-4.5') COLLECTED FROM THE SAME TEST PIT S34TP001.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Williams

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S37SB0010101
Sample Location: S37SB001
Sampled By: FWR
C.O.C. No.: MK/STL 007

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-5-02 Time: 0830 Method: SPLIT SPOON Monitor Reading (ppm): —	2'-4'	BRN	SAND MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

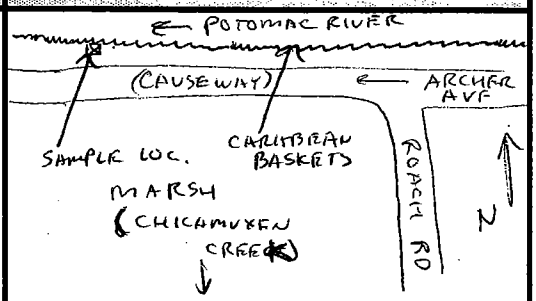
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	✓	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

THIS SAMPLE COLLECTED FROM S37TW001 BORING.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S37SB0010201
Sample Location: S37SB001
Sampled By: FWR
C.O.C. No.: MK/STL007

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-5-02 Time: 0845 Method: SPLIT SPOON Monitor Reading (ppm): —	4-6'	BRN	SAND MOIST TO WET

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

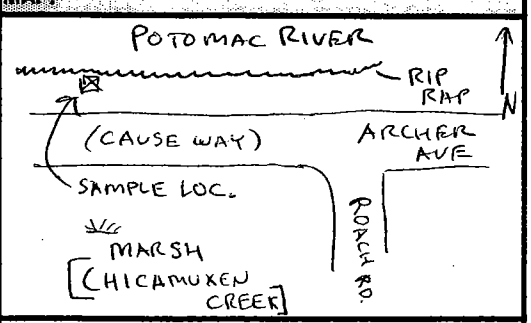
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	✓	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED FROM S37TW001

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S37SB0020101
Sample Location: S37SB002
Sampled By: FWR
C.O.C. No.: MK/STL 007

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-5-02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1115			
Method: SPLIT SPOON	2'-4'	BRN	SAND+GRA MOIST
Monitor Reading (ppm): –			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

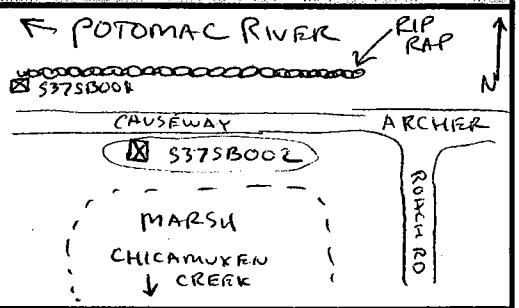
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	✓	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED @ S37TW002 BORING.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S37SB0030101
Sample Location: S37SB003
Sampled By: FUR
C.O.C. No.: MK/STL 007

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-5-02 Time: 1000 Method: SPLIT SPOON Monitor Reading (ppm): —	2'-4'	BRN	MOIST SAND TR GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

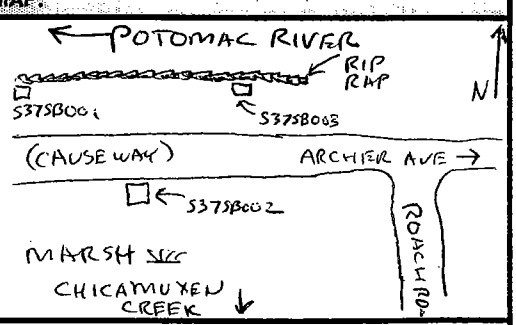
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	✓	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED FROM S37TW003 BORING

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred M Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIAN HEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S37SB0030201
Sample Location: S37SB003
Sampled By: FWR
C.O.C. No.: MK/STL007

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-5-02 Time: 1015 Method: SPLIT SPOON Monitor Reading (ppm): —	4'-6' ~~2'-4'~~ FWR	BRN	SAND TR GRAVEL MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

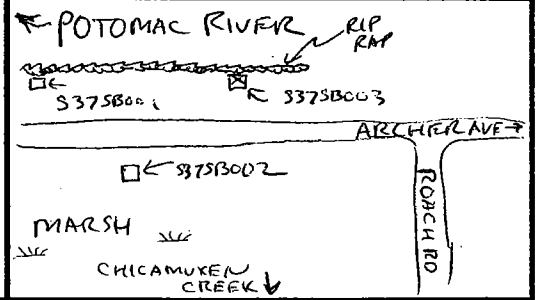
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	ENCORE X3	✓	
TCL SVOA	4OZ WMG	—	
TAL METALS	4OZ WMG	✓	
TCL PEST/PCBS / TCL SVOA	8OZ WMG	✓	
EXPLOSIVES/8332/NITROG	8OZ WMG	✓	
NITROCELLULOSE	4OZ WMG	✓	
Be + Cu	4OZ WMG	—	

OBSERVATIONS / NOTES:

SAMPLE COLLECTED FROM S37TW003 BORING.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S51SB0010101
Sample Location: S51SB001
Sampled By: PUR
C.O.C. No.: NA

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 2-11-02	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1754	1.5'-2'	BRN	SILT + CLAY MOIST
Method: HANDAUGER			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

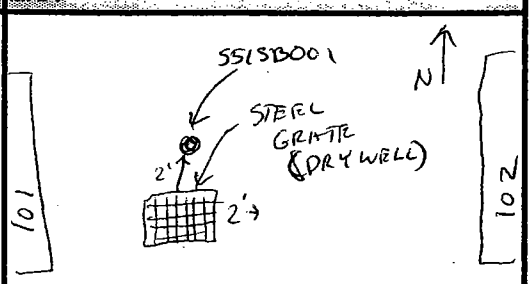
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	~~ENCORE X3~~ 1x4oz	✓	
TCL SVOA	4oz WMG	—	
TAL METALS	4oz WMG	—	
TCL PEST/PCBS / TCL SVOA	8oz WMG	—	
EXPLOSIVES/8332/NITROG	8oz WMG	—	
NITROCELLULOSE	4oz WMG	—	
Be + Cu	4oz WMG	—	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Williamson

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SEVEN SITES INDIANHEAD NSWC SITE SCREENING INV.
Project No.: 0525

Sample ID No.: S51SB001Q01
Sample Location: S51SB001
Sampled By: FWR
C.O.C. No.: NA

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 2-11-02			
Time: 1830			
Method: HAND AUGER			
Monitor Reading (ppm): —	2-3'	BRN	SILT + CLAY WET

COMPOSITE SAMPLE DATA:

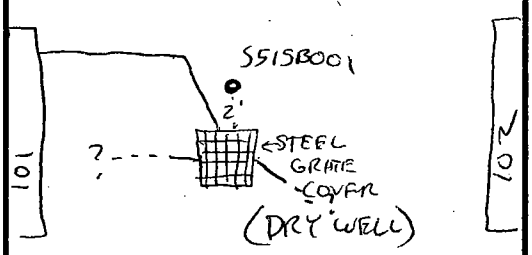
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	~~ENCORE X3~~ 1X4oz	✓	
TCL SVOA	4oz WMG	—	
TAL METALS	4oz WMG	—	
TCL PEST/PCBS/TCL SVOA	8oz WMG	—	
EXPLOSIVES/8332/NITROG	8oz WMG	—	
NITROCELLULOSE	4oz WMG	—	
Be + Cu	4oz WMG	—	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	S51SBDUP0101

Signature(s):

C.5 CHAIN OF CUSTODY FORMS

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER MC006 | PAGE ____ OF _____

PROJECT NO: 0525	SITE NAME: INDIAN HEAD STUMP NECK	PROJECT MANAGER AND PHONE NUMBER: GEORGE LATULIPPE	LABORATORY NAME AND CONTACT: MITKEM CORP BEN DODGE
SAMPLERS (SIGNATURE): Fred URamser		FIELD OPERATIONS LEADER AND PHONE NUMBER: FRED URAMSER	ADDRESS: 175 METRO CTR BLVD
		CARRIER/WAYBILL NUMBER: FED EX # 828074027919	CITY, STATE: WARWICK RI 02886

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED: HCL-AQ 4°C; 4°C; HNO3 AQ; 4°C

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TCL VOA + ~~ETHYL ETHER~~	TCL SVOA	TAL METALS	TCL PEST/PCBS	~~EXPLOSIVES + NITROCELLULOSE~~	~~NITROGLYCERIN~~			COMMENTS
1/31	0800	S37TB013102	AQ	G	2	✓								
1/31	1510	S37SW0020001	AQ	G	21	✓	✓	✓	✓					RUN MS/MSD
1/31	1605	S37SD0020001	SO	G	7	✓	✓	✓	✓					RUN MS/MSD
1/31	1630	S37SW0010001	AQ	G	7	✓	✓	✓	✓					
1/31	1650	S37SD0010001	SO	G	5	✓	✓	✓	✓					
1/31	0000	FD01310201	SO	G	5	✓	✓	✓	✓					
1/31	0000	FD01310202	AQ	G	7	✓	✓	✓	✓					

1. RELINQUISHED BY: Fred URamser	DATE: 1/31/02	TIME: 1900	1. RECEIVED BY: FED EX	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER STL006 | PAGE ___ OF _____

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	INDIAN HEAD STUMPNECK	GEORGE LATULIPPE	STL KNOXVILLE JAMIE KCKINNEY
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W. RAMSER	5815 MIDDLEBROOK PIKE
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED EX 828074027908	KNOXVILLE TN 37921

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	EXPLOSIVES	NITROCELLULOSE	NITROGUANIDINE	NITROGLYCERINE					COMMENTS
1/31	1510	S37SW0020001	AQ	G	21	✓	✓	✓	✓					RUN MS/MSD
1/31	1605	S37SD0020001	SO	G	2	✓	✓	✓	✓					RUN MS/MSD
1/31	1630	S37SW0010001	AQ	G	7	✓	✓	✓	✓					~~RUN~~ PR
1/31	1650	S37SD0010001	SO	G	2	✓	✓	✓	✓					
1/31	0000	FD01310201	SO	G	2	✓	✓	✓	✓					
1/31	0000	FD01310202	AQ	G	7	✓	✓	✓	✓					

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Fred W Ramser	1/31/02	1900	1. RECEIVED BY		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER mc 004 | PAGE ____ OF _____

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	INDIAN HEAD	GEORGE LATULIPPE	MITKEM CORP
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W RAMSER	175 METRO CTR BLVD
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED Ex 828074027882	WARWICK RI 02886

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☒ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: 4°C

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: Cu + Beryl.								COMMENTS
1/30	1400	S34SB0010101	SO	G	1	✓								
1/30	1445	S34SB0010201	SO	G	1	✓								*HOLD, DO NOT ANALYZE
1/30	0000	S34SBDUP0101	SO	G	1	✓								

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
Fred W Ramser	1/30/02	1900	FEDEX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS *DO NOT ANALYZE UNTIL NOTIFIED BY TtNUS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER STL 004 | PAGE ___ OF ___

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	INDIAN HEAD	GEORGE LATULIPPE	STL KNOXVILLE JAMIE McKINNEY
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W RAMSER	
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED EX 828074027893	

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☒ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: EXPLOSIVES	NITROCELL.	NITROGUAN.	NITROGLY.					COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)														
PRESERVATIVE USED						4°C	4°C	4°C	4°C					
1/30	1400	S34SB0010101	SO	G	1	✓	✓	✓	✓					
1/30	1445	S34SB0010201	SO	G	1	✓	✓	✓	✓					HOLD, DO NOT ANALYZE UNTIL NOTIFIED *
1/30	0000	S34SBDUP0101	SO	G	1	✓	✓	✓	✓					

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
Fred W Ramser	1-30-02	1900	FEDEX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS
* HOLD, DO NOT ANALYZE UNTIL NOTIFIED BY TtNUS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MK007 | PAGE ___ OF ___

PROJECT NO: 0525	SITE NAME: THDIV STUMPNECK	PROJECT MANAGER AND PHONE NUMBER: GEORGE LATULIPPE	LABORATORY NAME AND CONTACT: MITKEM CORP
SAMPLERS (SIGNATURE): FWRamser		FIELD OPERATIONS LEADER AND PHONE NUMBER: FRED W. RAMSER	ADDRESS: 175 METRO CENTER BLVD
		CARRIER/WAYBILL NUMBER: FEDEX 828074027920	CITY, STATE: WARWICK, RI 02886

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): P, P, G/EnCore, G, G/PE

PRESERVATIVE USED: HNO3 4°C, 4°C, 4°C, 4°, 4°

TYPE OF ANALYSIS

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	Be+Cu (TOTAL)	Be+Cu (DISSOLVED)*	TCL VOA	TCL S-VOA, PEST, PCBS	TAL METALS TOT + DISS*				COMMENTS
2-4	1540	S34TW0030001	AQ	G	2	✓	✓							
2-4	1710	S34TW0020001	AQ	G	2	✓	✓							
2-5	0800	S34TB020502-1	AQ	G	2			✓						
2-5	0830	S37SB0010101	SO	G	5			✓	✓	✓				
2-5	0845	S37SB0010201	SO	G	5			✓	✓	✓				
2-5	1000	S37SB0030101	SO	G	5			✓	✓	✓				
2-5	1015	S37SB0030201	SO	G	5			✓	✓	✓				
2-5	1115	S37SB0020101	SO	G	5			✓	✓	✓				
2-5	1600	S37RB020502-1	AQ	G	7			✓	✓	✓				SPLIT SPOON
2-5	1030	S37SW0030001	AQ	G	6			✓	✓	✓				TAL METALS TOTAL ONLY
2-5	1050	S37SD0030001	SO	G	5			✓	✓	✓				
2-5	1440	S37TW0010001	AQ	G	9			✓	✓	✓				
2-5	0000	S37TWDUP001	AQ	G	9			✓	✓	✓				

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: FWRamser	2-5-02	1900	1. RECEIVED BY: FEDEX		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS: * TO BE FILTERED BY LAB

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER STL007 | PAGE ___ OF ___

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	IHDIV/STUMPNECK	GEORGE LATULIPPE	STL KNOXVILLE
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
F W Ramser		FRED WRAMSER	5815 MIDDLEBROOK PIKE
		CARRIER/WAYBILL NUMBER FEDEX	CITY, STATE
		828074027930	KNOXVILLE, TN 37921

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED: 4°C, 4°C, 4°C, 4°C

TYPE OF ANALYSIS

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	EXPLOSIVES	NITROCELLULOSE	NITROGUANIDINE	NITROGLYCERINE					COMMENTS
2-5	0830	S37SB0010101	SO	G	2	✓	✓	✓	✓					
2-5	0845	S37SB0010201	SO	G	2	✓	✓	✓	✓					
2-5	1000	S37SB0030101	SO	G	2	✓	✓	✓	✓					
2-5	1015	S37SB0030201	SO	G	2	✓	✓	✓	✓					
2-5	1115	S37SB0020101	SO	G	2	✓	✓	✓	✓					
2-5	1600	S37RB020502-1	AQ	G	7	✓	✓	✓	✓					SPLIT SPOON
2-5	1030	S37SW0030001	AQ	G	7	✓	✓	✓	✓					
2-5	1050	S37SD0030001	SO	G	2	✓	✓	✓	✓					
2-5	1440	S37TW0010001	AQ	G	7	✓	✓	✓	✓					
2-5	0000	S37TWDUP001	AQ	G	7	✓	✓	✓	✓					

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
F W Ramser	2-5-02	1400	FED EX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

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TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MK 008 | PAGE ___ OF ___

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	IHDIV STUMPNECK	GEORGE LATULIPPE	MIT KEM CORP BEN DODGE
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W. RAMSER	175 METRO CTR BLVD
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED EX AB 828074027941	WARWICK RI 02886

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TCL VOA	TCL S-VOA	TAL METALS (DISS)*	TAL METALS (TOT)	TCL PEST/PCB	Be + Cu (TOT)	Be + Cu (DISS)*	COMMENTS
2/6	0800	S37TB020602-1	AQ	G	2	✓							
2/6	0925	S37TW0030001	AQ	G	27	✓	✓	✓	✓	✓			RUN MS/MSD
2/6	1700	S37TW0020001	AQ	G	9	✓	✓	✓	✓	✓			
2/7	0846	S33SB0010101	SO	G	1				✓				
2/7	0910	S33SB0010201	SO	G	1				✓				
2/7	0910	S34TW0010001	AQ	G	2						✓	✓	
2/7	1400	S33RB020702-1	AQ	G	2				✓				
2/7	1450	S33TW0030001	AQ	G	24			✓	✓				

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Fred W Ramser	2-7-02	1900	1. RECEIVED BY		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS *TO BE FILTERED BY LABORATORY PRIOR TO ANALYSIS.

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

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FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER STL008 | PAGE ___ OF ___

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	IHDIV STUMPNECK	GEORGE LATULIPPE	STL KNOXVILLE JAMIE McKINNEY
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
S W Ramser		FRED W RAMSER	5815 MIDDLEBROOK PIKE
		CARRIER/WAYBILL NUMBER	CITY, STATE
		FED Ex # 828074027952	KNOXVILLE, TN 37921

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: EXPLOSIVES	NITROCELLULOSE	NITROGUANIDINE	NITROGLYCERINE					COMMENTS
		CONTAINER TYPE PLASTIC (P) or GLASS (G)												
		PRESERVATIVE USED												
2/6	0925	S37TW0030001	AQ	G	21	✓	✓	✓	✓					RUN MS/MSD
2/6	1700	S37TW0020001	AQ	G	7	✓	✓	✓	✓					
2/7	0846	S33SB0010101	SO	G	1	✓		✓	✓					
2/7	0910	S33SB0010201	SO	G	1	✓		✓	✓					
2/7	1450	S33TW0030001	AQ	G	5	✓		✓	✓					
2/7	1400	S33RB020702-1	AQ	G	6	✓		✓	✓					
		~~S34TW001000T~~ PLR												

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
S W Ramser	2/7/02	1900	FED EX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

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FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER MK 009 | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	IHDIV STUMPNECK	GEORGE LATULIPPE	BEN DODGE MITKEM CORP
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS
K. S. Simp		FRED W RAMSER	175 METRO CTR BLVD
		CARRIER/WAYBILL NUMBER	CITY, STATE
		1ED EX AB# 828074027163	WARWICK RI 02886

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

INDIAN HEAD
STUMP NECK
SITE 33

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: TAL METALS (TOT)	TAL METALS (DISS)							COMMENTS
					CONTAINER TYPE PLASTIC (P) or GLASS (G)									
					PRESERVATIVE USED									
2/8	0835	S33TW001 0001	AQ	G	4	2	2							
↓	0915	S33SB002 0101	S	G	1	✓	—							
↓	0930	S33SB002 0201	S	G	1	✓	—							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY K. S. Simp	2.8.02	1330	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

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TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER STL009 | PAGE 1 OF 1

PROJECT NO: 0525	SITE NAME: IHDIV STUMP NECK	PROJECT MANAGER AND PHONE NUMBER: GEORGE LATULIPPE	LABORATORY NAME AND CONTACT: STL KNOXVILLE JAMIE McKIN
SAMPLERS (SIGNATURE): [signature]		FIELD OPERATIONS LEADER AND PHONE NUMBER: FRED WRAMSER	ADDRESS: 5815 MIDDLEBROOK PIKE
		CARRIER/WAYBILL NUMBER: FED EX 828074027974	CITY, STATE: KNOXVILLE, TN 37921

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

DATE YEAR 2002	TIME	SAMPLE ID (INDIAN HEAD STUMP NECK SITE 33)	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: EXPLOSIVES	NITROGUANIDINE	NITROGLYCERINE						COMMENTS
2/8	0835	S33TW001 0001	AQ	G	6	2	2	2						
↓	0915	S33SB002 0101	S	G	1	✓	✓	✓						
↓	0930	S33SB002 0201	S	G	1	✓	✓	✓						

1. RELINQUISHED BY [signature]	DATE 2-8-02	TIME 1230	1. RECEIVED BY FEDEX	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

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TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE ___ OF _____

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	THDIV STUMPNECK	GEORGE LATULIPPE	MITKEM CORP BEN DODGE
SAMPLERS (SIGNATURE):		FIELD OPERATIONS LEADER AND PHONE NUMBER: FRED WRAMSER	ADDRESS: 175 METRO CTR BLVD
		CARRIER/WAYBILL NUMBER: FED EX 830334177288	CITY, STATE: WARWICK RI 02886

STANDARD TAT ☑
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P P
PRESERVATIVE USED: HCL 4°C HNO3

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TCL VOA	TAL METAL (TOT)	TAL METAL (DISS) *						COMMENTS
2/11	1300	S51TB021102-1	AQ	G	2	✓	—							
2/11	1754	S51SB0010101	SO	G	1	✓	—							
2/11	1830	S51SB0010201	SO	G	1	✓	—							
2/11	0000	S51SBDUP0101	SO	G	1	✓	—							
2/12	0925	S33TW002 0001	AQ	G	4	—	2	2						
2/12	1225	S33SB0030101	SO	G	1		✓							
2/12	1245	S33SB0030201	SO	G	1		✓							
2/12	0000	S33SBDUP0101	SO	G	1		✓							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	2-12-02	1800	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS * TO BE FILTERED BY LABORATORY

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FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE ___ OF _____

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
0525	THDIV STUMPNECK	GEORGE LATULIPPE	STL KNOXVILLE JAMIE McKINNEY
SAMPLERS (SIGNATURE):		FIELD OPERATIONS LEADER AND PHONE NUMBER: FRED W. RAMSER	ADDRESS: 5815 MIDDLEBROOK PIKE
		CARRIER/WAYBILL NUMBER: FEDEX 830334177299	CITY, STATE: KNOXVILLE, TN 37921

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2002	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: EXPLOSIVES	NITROGUANIDINE	NITROGLYCERINE						COMMENTS
		CONTAINER TYPE PLASTIC (P) or GLASS (G)				G	G	G						
		PRESERVATIVE USED				4°C	4°C	4°C						
2/12	0925	S33TW002 0001	AQ	G	6	2	2	2						
2/12	1225	S33SB0030101	SO	G	1	✓	✓	✓						
2/12	1245	S33SB0030201	SO	G	1	✓	✓	✓						
2/12	0000	S33SBDUP0101	SO	G	1	✓	✓	✓						

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	2-12-02	1900	1. RECEIVED BY FEDEX		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

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FORM NO. TtNUS-001

APPENDIX D

GEOPHYSICAL REPORT

Earth Resources Technology, Inc.

February 6, 2002

Fred Ramser
Tetra Tech NUS, Inc.
661 Anderson Drive
Pittsburgh, PA 15220-2745

Re: Results of Geophysical Surveys
Indian Head Division – Naval Surface Warfare Center
Indian Head, MD 20640-5035

Dear Fred:

Earth Resources Technology, Inc. (ERT) performed electromagnetic (EM), magnetic, and GPR surveys at the above referenced site on Tuesday, January 22, 2002, through Thursday, January 24, 2002. These surveys were conducted at four separate sites to determine the locations of specific features and targets. EM surveys were conducted at sites 34 and 36. The EM survey at site 34 was conducted to determine the location of beryllium-copper alloy tools. The EM survey at site 36 was conducted to determine the extent of a closed landfill. A magnetic survey was conducted at site 33 to determine the location of buried scrap metal. A GPR survey was conducted at site 51/52 to determine the location and depths of steam lines entering dry wells.

1.0 Principle And Instrumentation

The Geonics EM31 was used for the electromagnetic survey. The EM31 measures the changes in the ground conductivity using a patented electromagnetic inductive technique that makes the measurements without electrodes or ground contact. The unit of conductivity used is millisiemens per meter (mS/m). Conductivity changes are used to infer the geological variations, or groundwater contamination. The EM31 has two analog meters, which display the quadrature-phase (conductivity) and inphase components, respectively. Inphase measurements are the ratio of the induced secondary magnetic field to the primary magnetic field in parts per thousand (ppt). The inphase component is especially useful for searching for buried metal drums, pipes, and other ferrous and non-ferrous metallic debris. The effective depth of exploration of the equipment is about twenty (20) feet.

A Geometrics Portable Cesium Magnetometer, Model G-858, was used for the magnetic survey. Using self-oscillating split-beam Cesium Vapor (non-radioactive CS-133), this magnetometer measures the earth's total geomagnetic field at a particular location in units of nanoTeslas (nT) with an accuracy of ±1.0 nT. It collects a maximum of 10 magnetic readings per second. The total field consists of three components: the main field, the external field, and local variations. The main field and external field remain fixed over the period of time of a field investigation. Local variations are attributable to anomalies near the surface such as buried metal objects or above ground objects containing ferrous metallic substance. The effective penetration depth of the instrument is 50 feet. The horizontal detection range of the magnetometer varies with targets but is generally larger than that of the EM31.

The pulseEKKO 1000 radar from Sensors & Software, Inc. was used to conduct the GPR survey. During the survey, the device radiates a 450 MHz electromagnetic wave from a transmitter antenna into the earth

8305 Stayton Drive, Suite B ♦ Jessup, MD 20794 ♦ (301) 604-2883Fax: (301) 604-2884 ♦ Email: phli@ertcorp.net

and receives at a receiving antenna the reflection of the wave from subsurface interfaces at which changes in the electrical properties (dielectric permittivity and electrical conductivity) of the subsurface materials occur. Dielectric permittivity controls wave speed; and conductivity determines the signal attenuation. Radar reflections occur when the radio waves encounter a change in the velocity or attenuation. The bigger the change in properties the more signal reflected. These properties are sometimes controlled by water in the material, hence by the porosity and quantity of dissolved solids in the water. Metallic objects usually exhibit strong subsurface reflection character due to their high electrical impedance, or contrast, versus surrounding soil or fill. Depth of penetration of the radar signal is inversely proportional to the conductivity of the soil. As a result, electrically resistive earth materials such as coarse-grained, unsaturated sediments allow a deeper radar penetration than the conductive finer-grained soils such as clay and silt. Similarly, reinforced concrete and shallow groundwater are conductive and thus attenuate the radar signals.

2.0 Field Design and Operation

2.1 Site 33 – Scrap Metal Area:

The goal of the survey was to locate areas within a pre-determined site that may contain buried ferrous metal. The suspect area for site 33 is located near Buildings 2116 and 2136 in the southern portion of the Stump Neck Annex. The area was for the most part wooded and sloped to the west. As shown in Figure 1, the magnetic survey was conducted along a grid that was based on a Cartesian coordinate system with fiducial marks every 10 feet. The grid was 100 feet by 200 feet. For example, the origin of the coordinate system on the grid is located outside the fence in the northwest corner of the designated site and has the coordinates {100, 100}. The grid lines decreased from 100 in an easterly direction and increased from 100 in a southerly direction. During the data collection, the G-858 Magnetometer collected data continuously along each north-to-south transect line. Survey lines were spaced five feet apart.

2.2 Site 34 – Beryllium-Copper Alloy Tool Area:

The goal of the survey was to locate areas within a pre-determined site that may contain buried beryllium-copper alloy tools. The suspect area for site 34 is located near Building D-21C on Stump Neck Annex. The area for the most part was open except for the eastern and southern edges of the grid, which were heavily wooded. As shown in Figure 2, the EM survey was conducted along a grid that was based on a Cartesian coordinate system with fiducial marks every 10 feet. The grid was 80 feet by 190 feet. For example, the origin of the coordinate system on the grid is located 40 feet west of the building for the designated site and has the coordinates {100, 100}. The grid lines increase from 100 in an easterly direction and increased from 100 in a southerly direction. During the data collection, the EM31 was set in a manual mode with readings collected at 5-feet centers along each survey line in both quadrature-phase and inphase. Prior to the survey, scrap metal on the surface was gathered and placed into a pile to minimize interference and erroneous anomalies.

2.3 Site 36 – Closed Landfill Area

The goal of the survey was to define the extent of a closed landfill. The suspect area for site 36 is located near along Roach Road on Stump Neck Annex. The area for the most part was covered with thick brush and woods that bordered a swamp. As shown in Figure 3, the EM survey was conducted along 15 transects that were spaced 30 feet apart. During the data collection, the EM31 was set in a manual mode

with readings collected at 10-feet centers along each survey line in both quadrature-phase and inphase.

2.4 Site 51/52 Dry Well and Steam Line Area

The goal of the survey was to determine the location of steam lines that lead from two buildings to two dry wells. The suspect area for site 51/52 is located between Buildings 101 and 102 in the restricted area of the base near Thames and Evans road. The area was open for the most part except for some surface objects, which can be seen on Figure 4. The GPR data were collected along 8 N-S lines and 10 E-W lines (Figure 4). The collection of the GPR data was performed by pulling the antenna along each grid line while the positions of each radar reading were recorded with an odometer attached to a survey wheel. The odometer was set up such that one radar reading would be acquired every 0.05 m (0.164 ft). Because the subject property is underlain by the artificial fill or clay/silt/sand, the average velocity of the radar is estimated around 0.1 m (0.328 ft) per nanosecond (ns). The time range was thus selected as 70 ns and would allow a penetration depth of about 10 feet. The GPR data were recorded digitally in a portable computer for instant display and subsequent processing.

3.0 Results and Interpretations

3.1 Site 33 – Scrap Ferrous Metal Area:

Figure 5 presents the contour map of magnetic readings measured in nanoTeslas (nT). The approach to interpreting the magnetic data is to distinguish the local variations from the main and external fields. The main field is created by the earth's magnetic field; while the external field is created by the sun and/or moon. To interpret the data, magnetic readings collected based on the survey grid were used to construct a magnetic contour map. The average of the readings (background), or those readings with little fluctuation usually represent the main field. In contrast, the local anomalies often occur as closed or elongated contours that have readings either above or below the background. The closed or elongated contours with readings above the background are considered as the magnetic highs; while the contours with readings below the background are considered as magnetic lows.

Magnetic anomalies occur in several areas (A, B, C, D, E, F, and G) as shown in Figure 5. The magnitudes of some of these anomalies are not particularly high (or low), suggesting that they are most likely created by small ferrous objects buried in the subsurface (such as anomalies D and E on Figure 5). The two anomalies along the southwest edge of the map (A and B) are rather large anomalies. Anomaly B is accounted for by surface metal. However, there is no evidence for surface metal near anomaly A. Therefore this is an area of concern for buried ferrous metal. There are five other anomalies (C and G) marked on Figure 1 that are most likely caused by large concrete blocks on the ground. The linear anomaly (F) along the northwest edge of the site is most likely associated with the fence.

3.2 Site 34 – Beryllium-Copper Alloy Tool Area:

In Figure 6 and Figure 7, the EM anomalies are shown with the highest readings in orange and the lowest readings in blue. Background readings fall between the orange and blue colors. Note that the low or high conductivity/inphase values are not absolute, but relative, reflecting a deviation from the background values. The positive or negative values reflect the change of the dipole orientation of the local electromagnetic field. Both the high and low deviations are used to locate buried materials.

There are several large anomalies in the grid area that are associated with known surface features. The anomaly that extends from 140 easting to 190 easting (A) along the north edge of Figures 6 and 7 is associated with the building on the property. The anomaly that extends from 220 easting to 240 easting and 120 southing to 140 southing (B) of Figures 6 and 7 is associated with a large scrap metal pile on the ground surface. There are several anomalous low readings that show up on Figures 6 and 7 that cannot be accounted for by surface features and therefore are areas of concern for buried tools. The anomaly that is centered around 210 (easting), 155 (southing) (C) shows up as anomalous lows on both Figures 2 and 3. The anomaly that is centered around 262 (easting), 102 (southing) (D) shows up as an anomalous low on Figure 7. The closed contours on Figure 6 labeled E an F are also anomalous areas of concern for buried tools.

3.3 Site 36 – Closed Landfill Area

In Figure 8 and Figure 9, the EM anomalies are shown with the highest readings in orange and the lowest readings in blue. The location of readings is shown as black dots on Figure 4. Background readings fall between the orange and blue colors. Note that the low or high conductivity/inphase values are not absolute, but relative, reflecting a deviation from the background values. The positive or negative values reflect the change of the dipole orientation of the local electromagnetic field. Both the high and low deviations are used to locate buried materials.

Figure 8 presents the in-phase data showing the occurrence of ferrous or non-ferrous debris on or below the ground surface. Figure 9 presents the quadrature conductivity data. Both figures indicate a similar pattern with isolated or scattered anomalies in the west half of the survey and linear continuous anomaly along the east boundary of the survey area. Some of the isolated anomalies in the east half are associated with surface metallic debris. However, no surface debris was observed along the east boundary. The linear anomaly is likely created by subsurface ferrous or non-ferrous debris. In summary, the entire survey area may contain landfill material with the concentrated volume of material along the east boundary.

3.4 Site 51/52 Dry Well and Steam Line Area

Figures 10 and 11 present GPR profiles that were acquired during the geophysical survey. Along these GPR profiles, the horizontal axis represents the horizontal distance in feet; while the left vertical axis represents the two-way travel time in ns and the right vertical axis the depth in feet (converted using the assumed velocity of 0.328 ft/ns). A GPR profile is made of individual traces that have peaks and valleys. The peaks of radar signals represent different interfaces in the subsurface encountered by the penetrating signals. Connecting and coloring the peaks and valleys of successive traces creates a GPR profile. As shown in the profiles, the red reflections represent the peaks of individual traces with the highest amplitudes; while the blue reflections are the valleys of individual traces with the lowest amplitudes. The red color is replaced by dark gray of varying degrees for the lower peak amplitudes; and the blue by white for varying degrees of higher valley amplitudes. The red and blue reflections, as discussed in Section 1.0, are created by interfaces with higher dielectric contrasts.

The location of the GPR profiles are shown in Figure 4 and labeled as A-A' and B-B'. On profile A-A' (Figure 10) the first pipe which is at a distance of 5 feet and a depth of 1 foot represents a utility line. The second and third pipes at distances of 16 feet and 24 feet respectively and depths of 1.5 represent the lines entering the first dry well (defined as the western most well). The saturated reflection at the distance of 26-30 feet represents the concrete/steel pad near the second dry well (defined as the eastern most well). The fourth pipe at a distance of 34 feet and depth of 1.5 feet represents a line entering the second dry

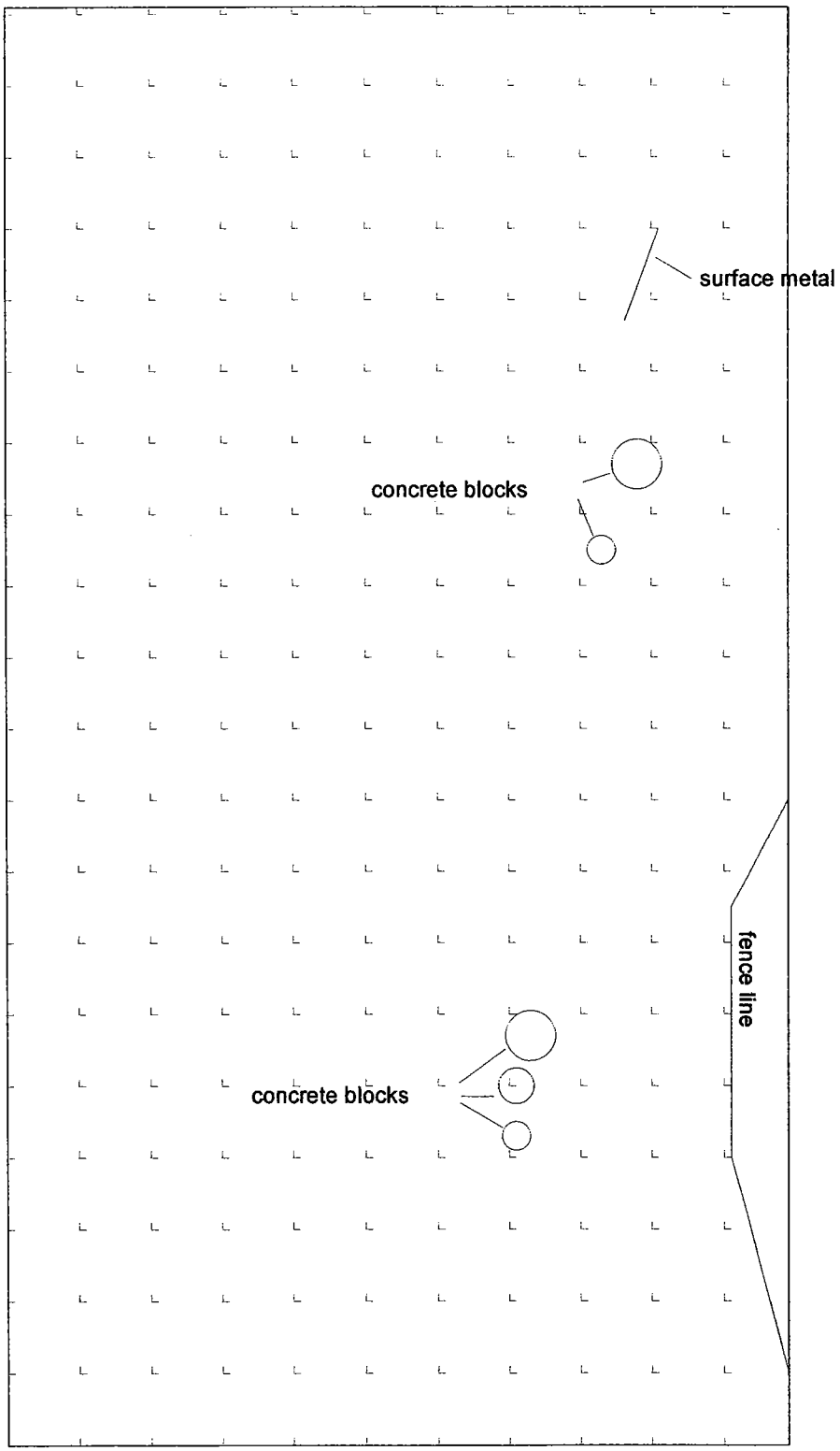
well. On profile B-B' (Figure 11) there are several hyperbolic reflections that represent pipes. The reflection labeled 1 at a distance of 10 feet and a depth of 1.5 feet represents a utility line. The second labeled reflection at a distance of 31 feet and a depth of 2.5 feet represents a utility line. The third labeled line at a distance of 38 feet and a depth of 1.5 feet represents a line entering the first dry well. The fourth labeled reflection at a distance of 42 feet and a depth of 2 feet represents a utility line. The saturated reflection at the distance of 45-47.5 feet represents the steel plates. The reflections at 57 feet to 66 feet represents an area that is generally disturbed. Figure 12 shows the locations of all the pipes (drawn in red) in the area of concern. The lines that are entering the dry wells at the depth of 1.5 feet are probably the steam lines.

4.0 CLOSING

The field procedures and interpretative methodologies used in this project are consistent with standard, recognized practices in similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site. This warranty is in lieu of all other warranties either implied or expressed. **ERT** assumes no responsibility for interpretations made by others based on work performed by, or recommendations made by, **ERT.**

Sincerely,
Earth Resources Technology, Inc.

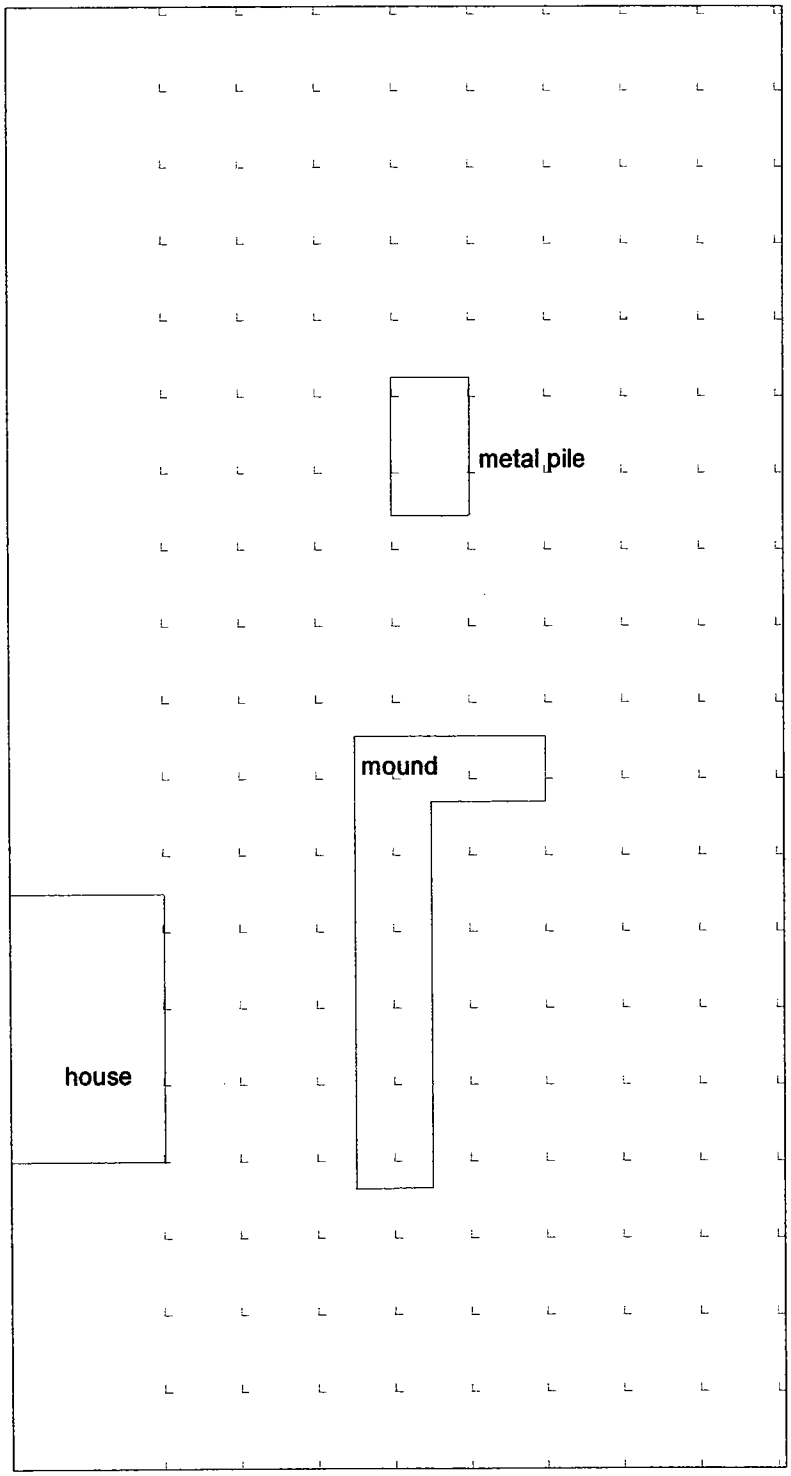
Michael E. Matthews
Staff Geophysicist



GRID LAYOUT MAP OF SITE 33 - SCRAP METAL AREA
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

EARTH RESOURCES TECHNOLOGY

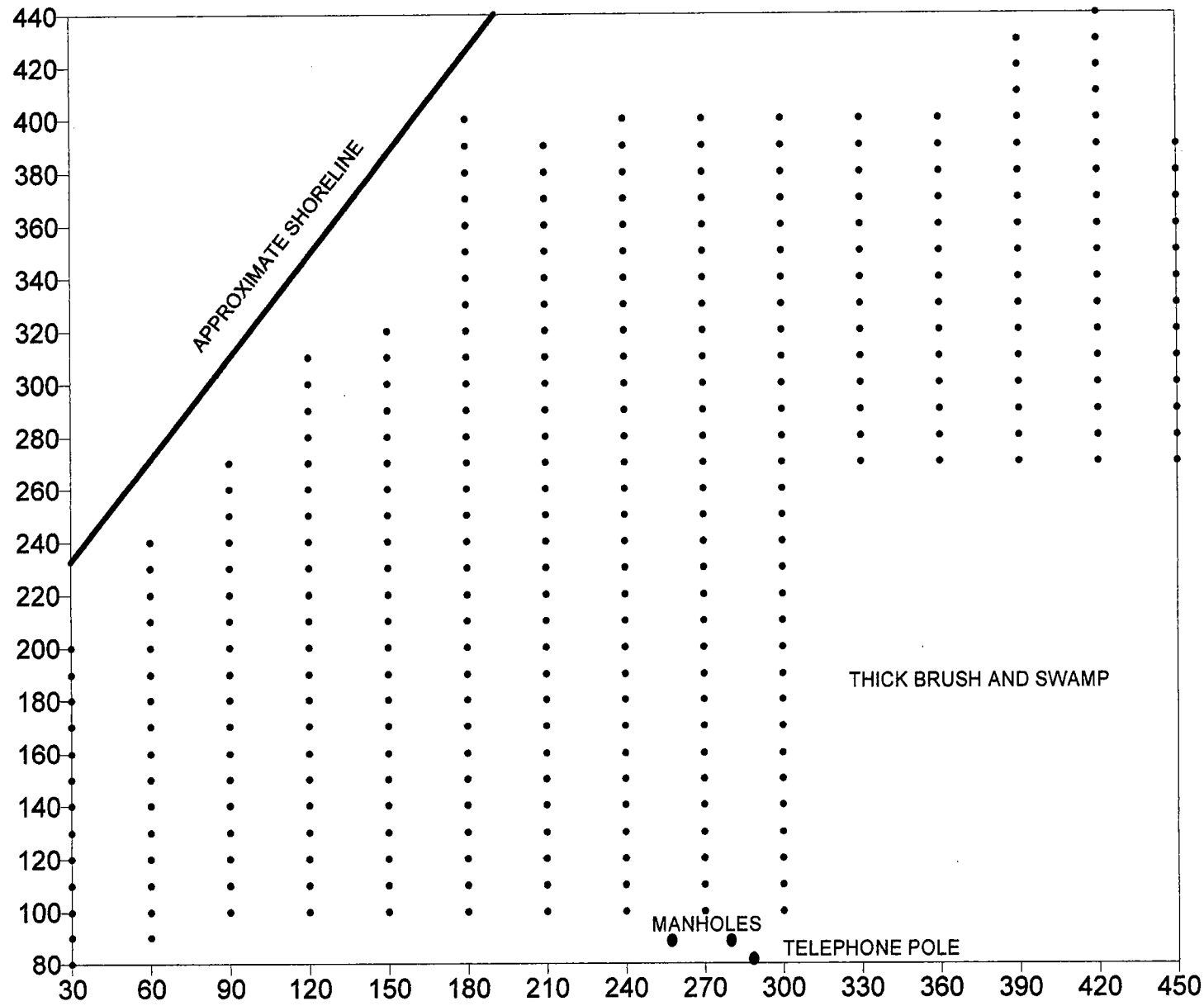
FIGURE 1	SCALE 1" = 25'	FEBRUARY 6, 2002



GRID LAYOUT MAP OF SITE 34 - TOOL AREA
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

EARTH RESOURCES TECHNOLOGY

FIGURE 2	SCALE 1" = 25'	FEBRUARY 6, 2002



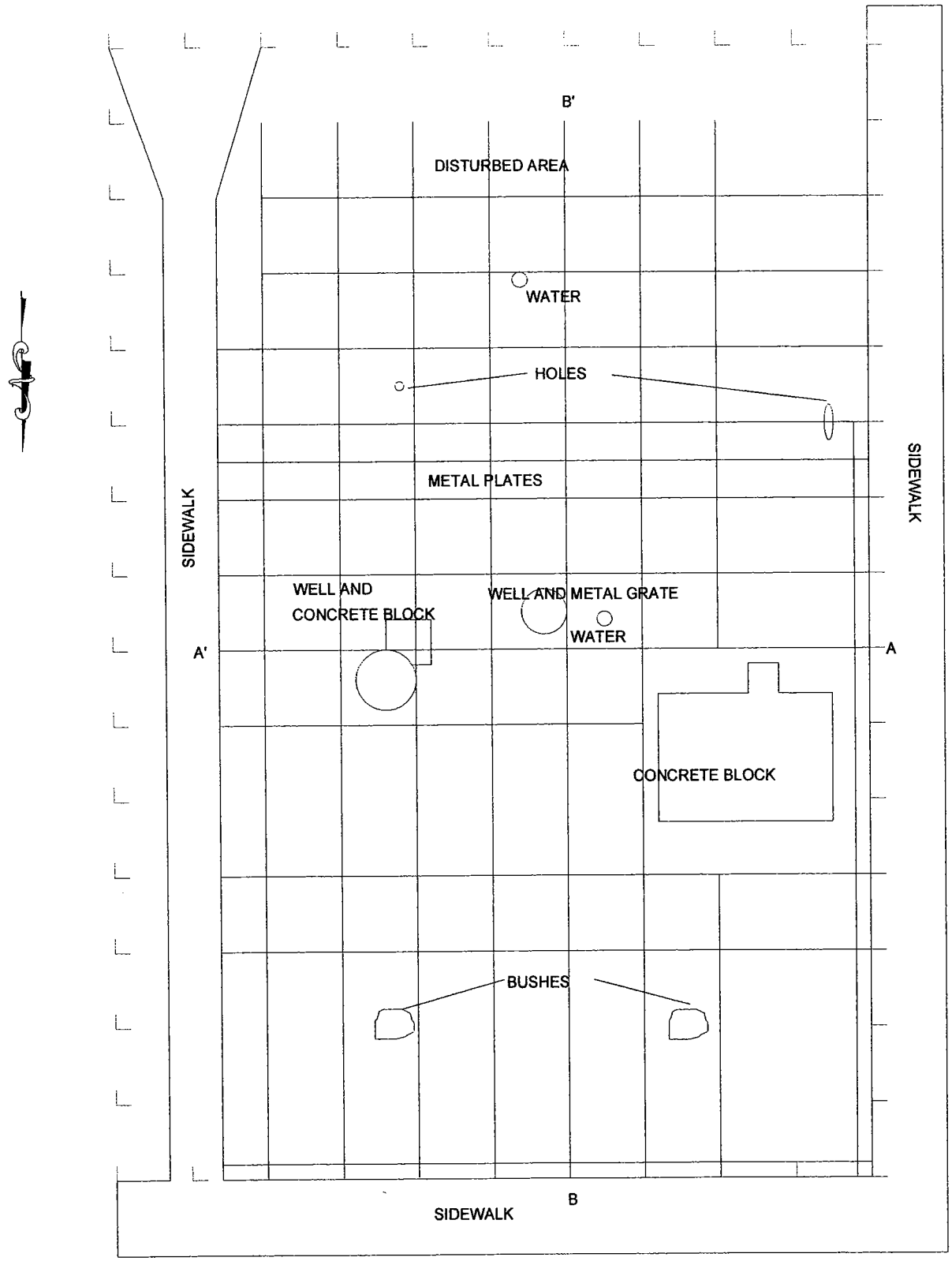
EARTH RESOURCES TECHNOLOGY

GRID LAYOUT MAP OF SITE 36 - LANDFILL
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

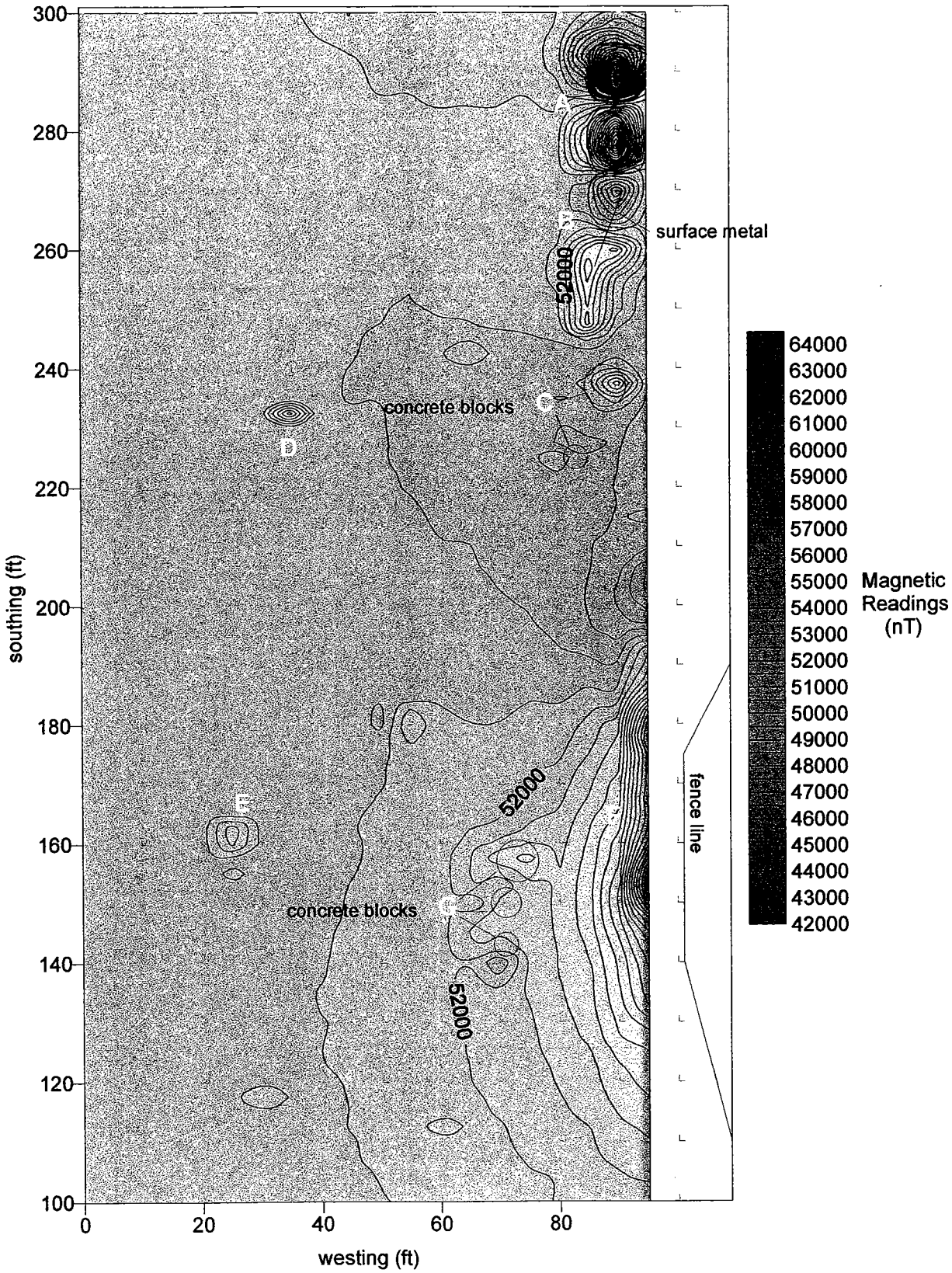
FIGURE 3

SCALE 1" = 60'

FEBRUARY 6, 2002



GPR SITE MAP OF SITE 51/52 - STEAM LINE SURVEY INDIAN HEAD DIVISION - NAVEL SURFACE WARFARE CENTER INDIAN HEAD, MD 20640-5035	EARTH RESOURCES TECHNOLOGY	
FIGURE 4	SCALE 1" = 10'	FEBRUARY 6, 2002



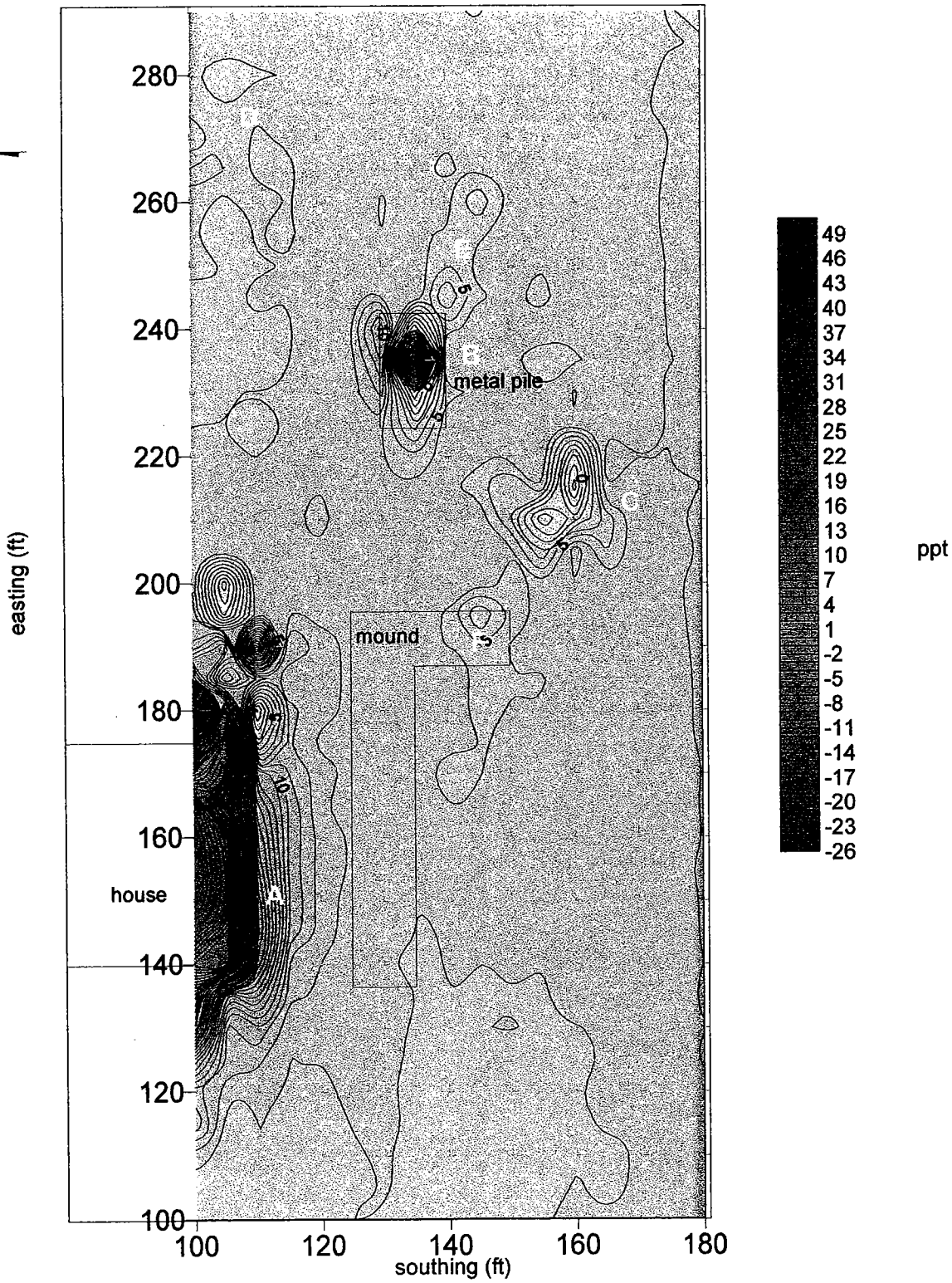
MAGNETIC CONTOUR MAP OF SITE 33 - SCRAP METAL AREA
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

EARTH RESOURCES TECHNOLOGY

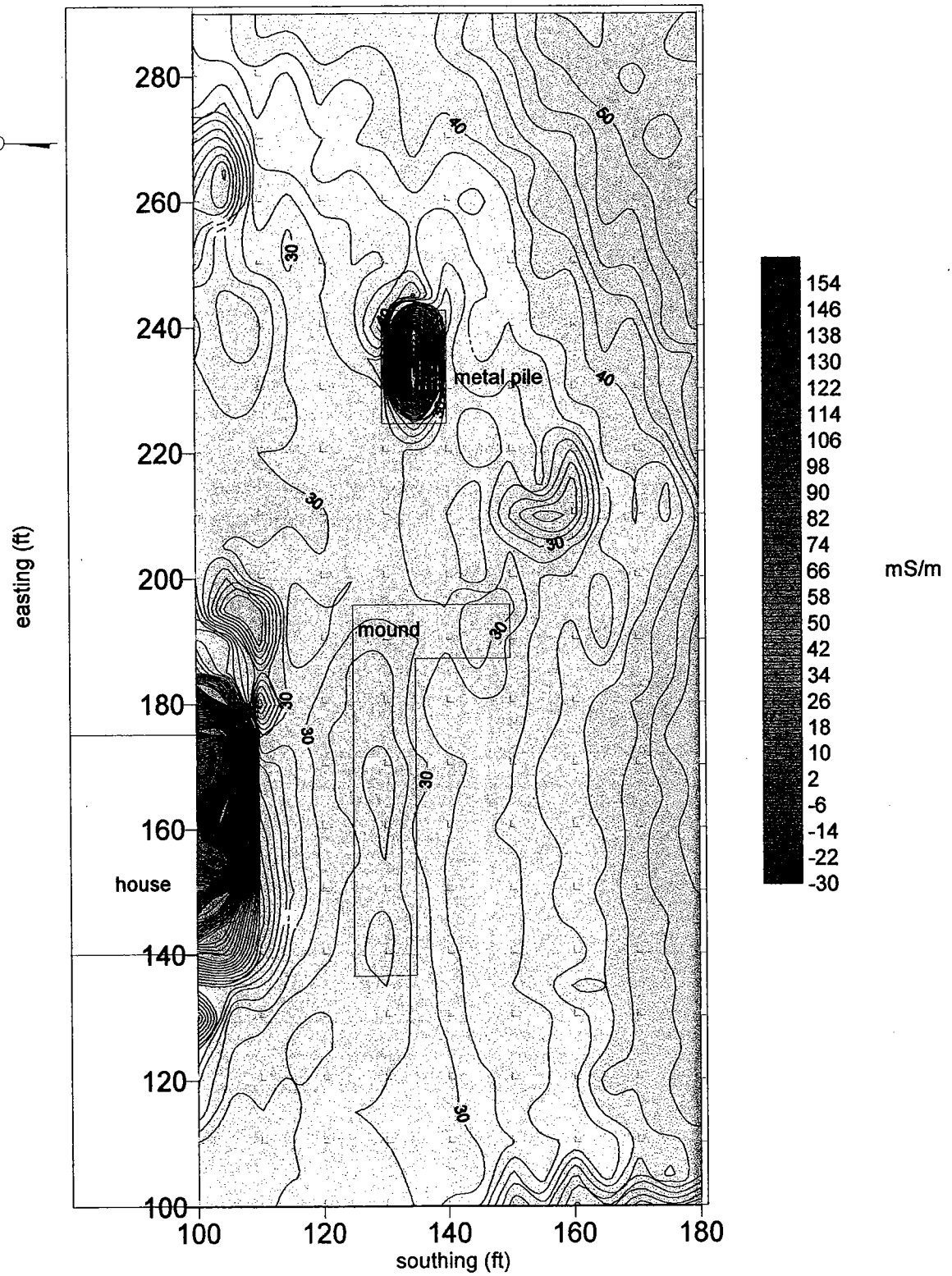
FIGURE 5

SCALE 1" = 25'

FEBRUARY 6, 2002



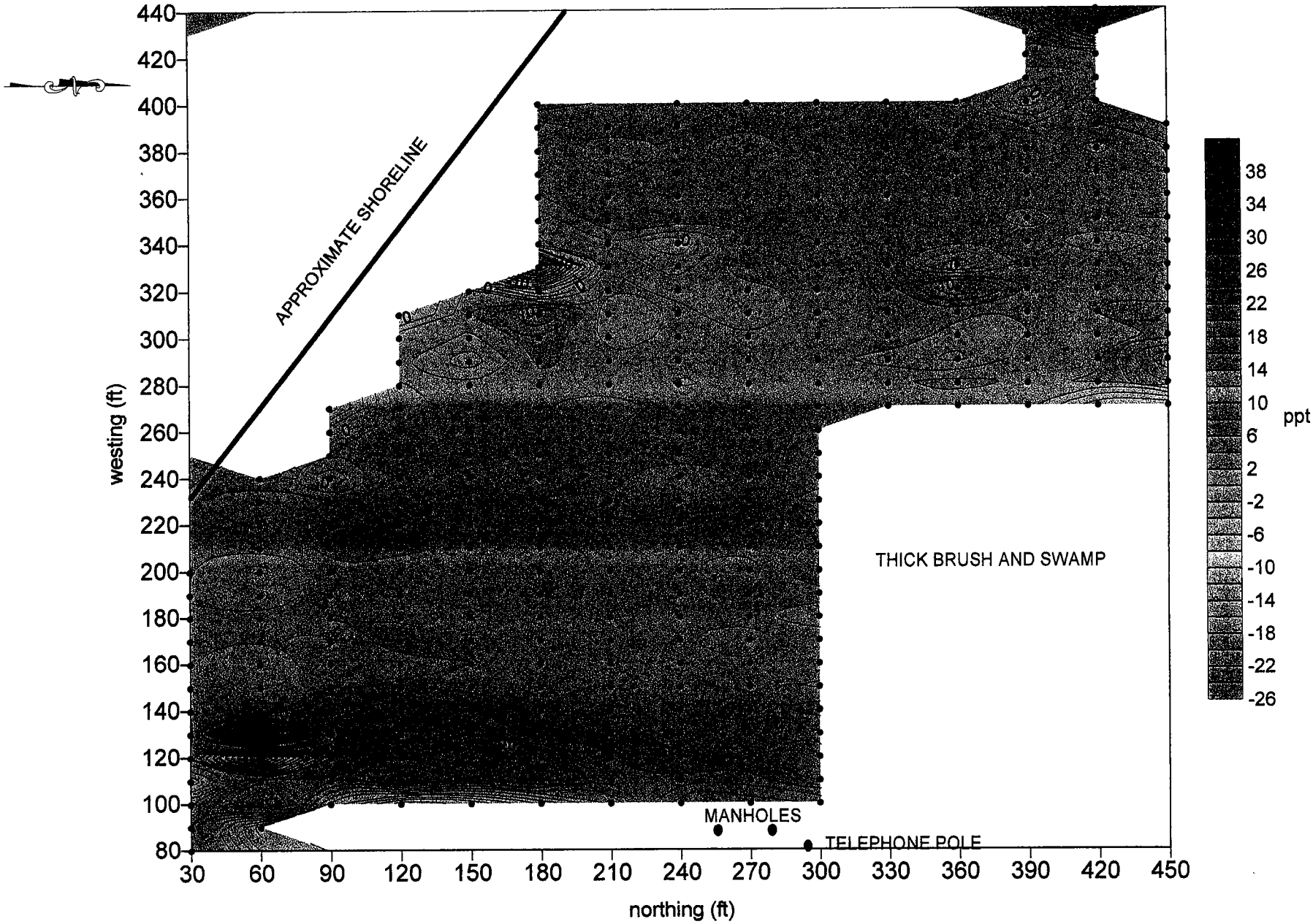
IN-PHASE CONTOUR MAP OF SITE 34 - TOOL AREA INDIAN HEAD DIVISION NAVAL SURFACE WARFARE CENTER INDIAN HEAD, MD 20640-5035	EARTH RESOURCES TECHNOLOGY	
FIGURE 6	SCALE 1" = 25'	FEBRUARY 6, 2002



QUADRATURE CONDUCTIVITY CONTOUR MAP OF SITE 34 - TOOL AREA
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

EARTH RESOURCES TECHNOLOGY

FIGURE 7	SCALE 1" =25'	FEBRUARY 6, 2002



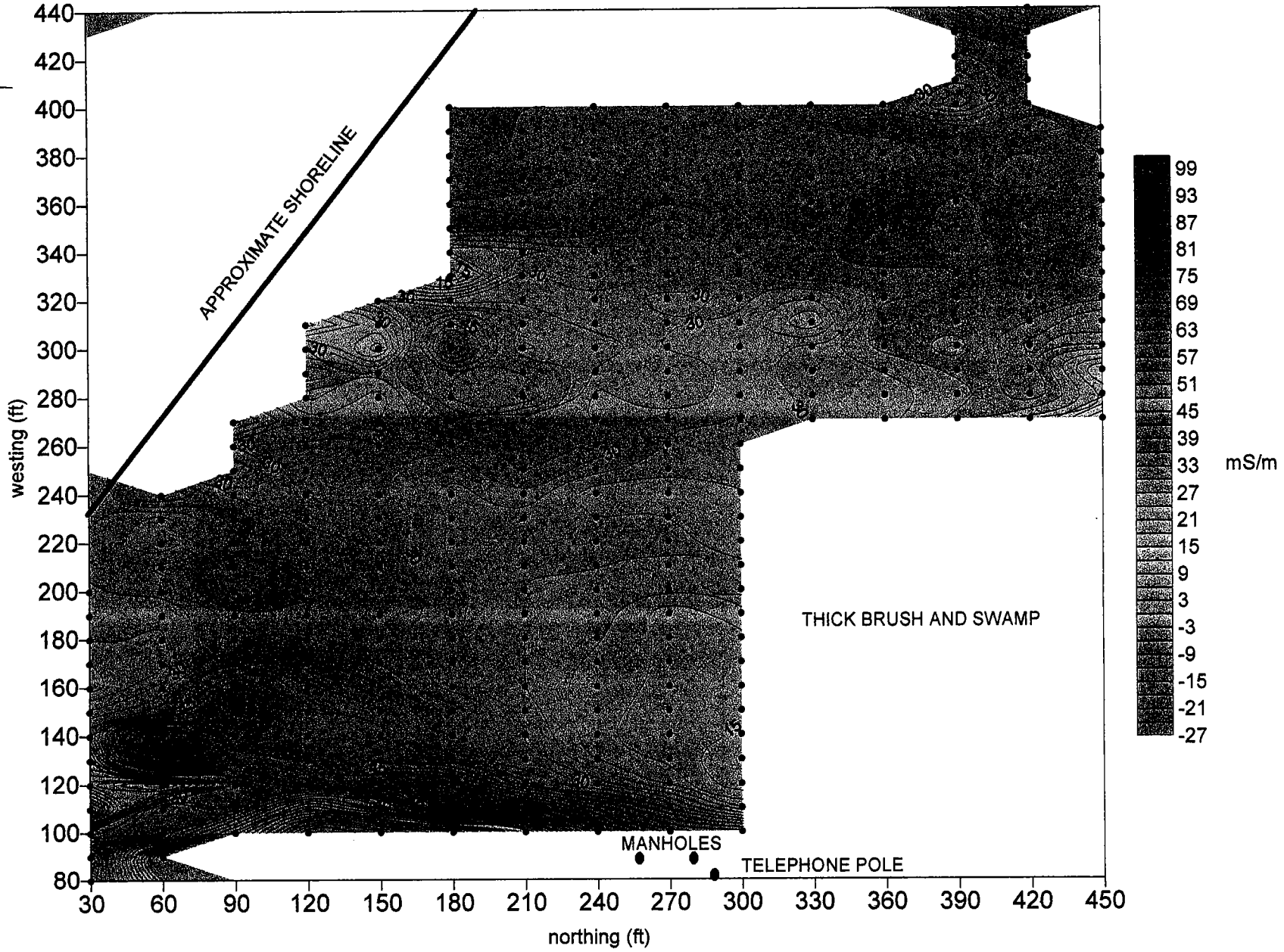
EARTH RESOURCES TECHNOLOGY

IN-PHASE CONTOUR MAP OF SITE 36 - LANDFILL
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

FIGURE 8

SCALE 1" = 60'

FEBRUARY 6, 2002



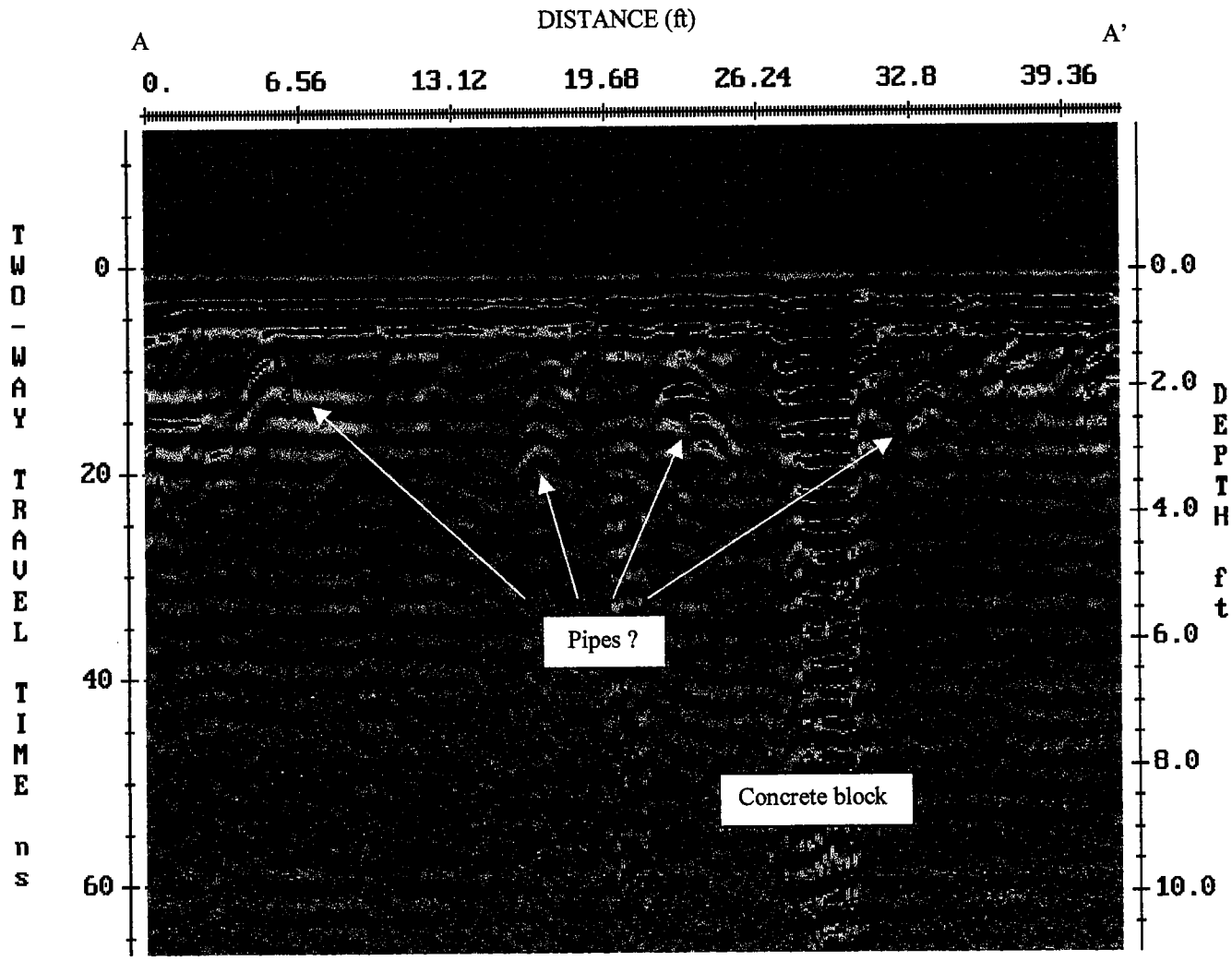
EARTH RESOURCES TECHNOLOGY

QUADRATURE CONDUCTIVITY CONTOUR MAP OF SITE 36 - LANDFILL
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD 20640-5035

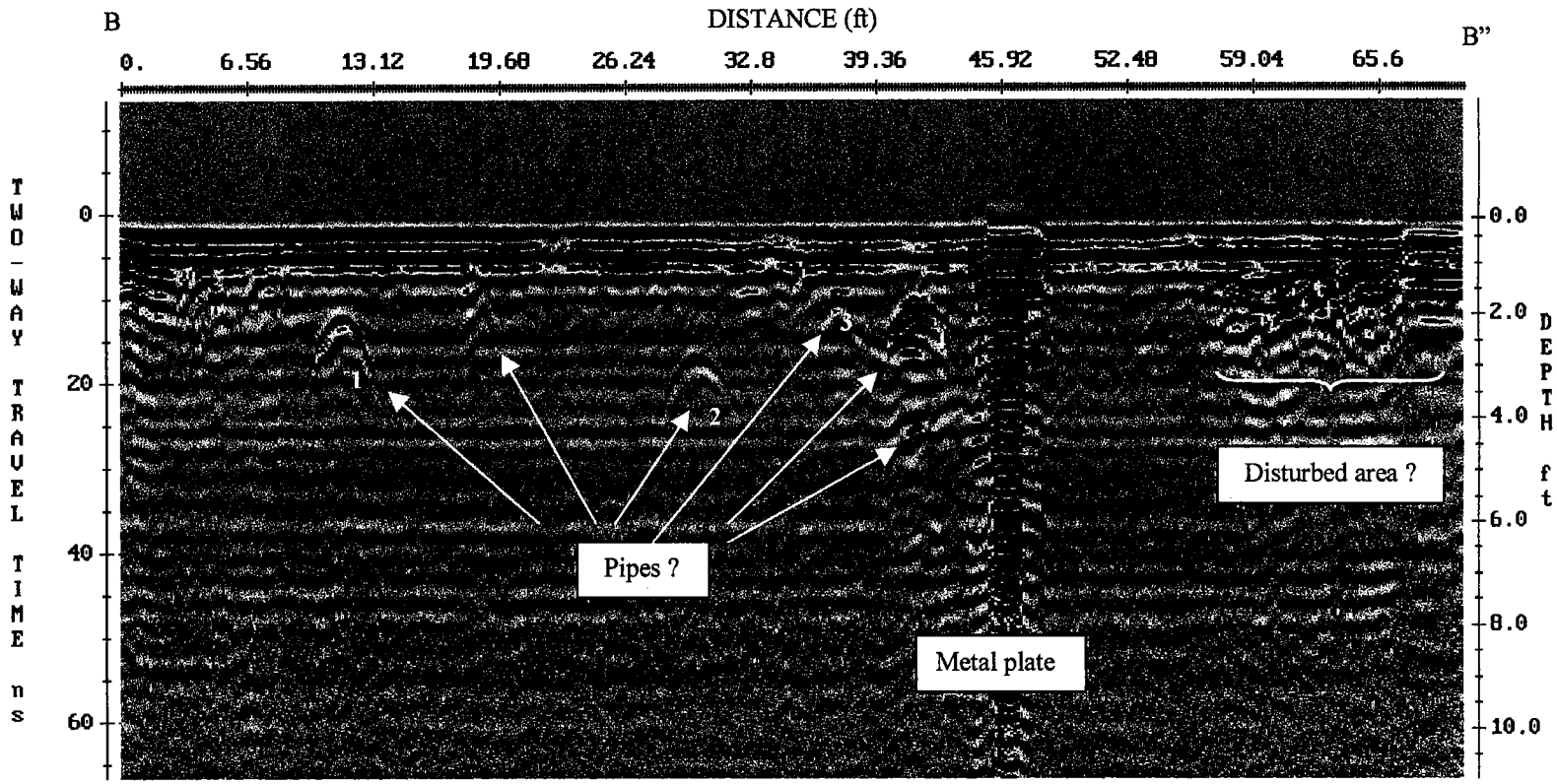
FIGURE 9

SCALE 1" = 60'

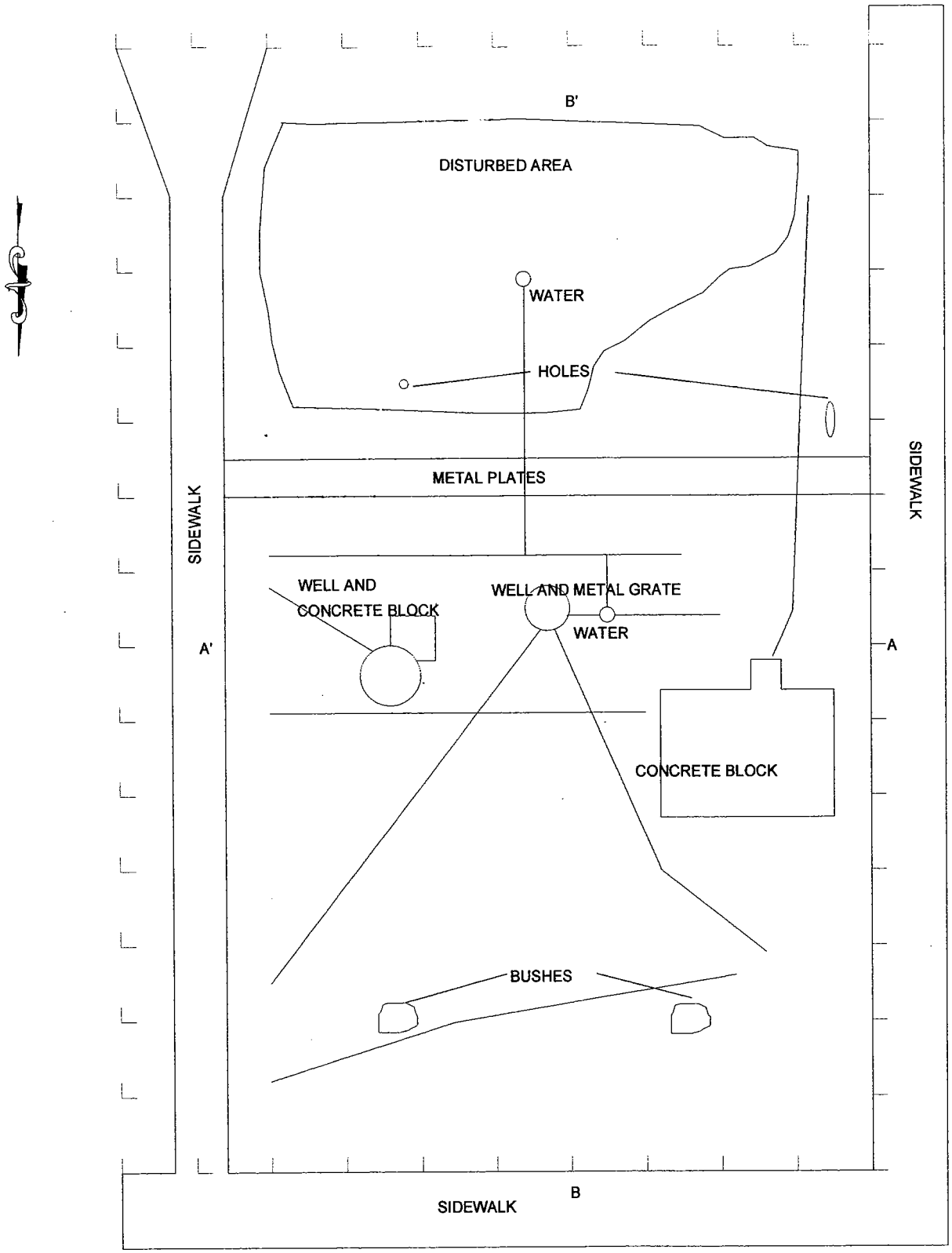
FEBRUARY 6, 2002



EARTH RESOURCES TECHNOLOGY	GPR PROFILE A – A' SITE 51/52 – STEAM LINE SURVEY INDIAN HEAD DIVISION – NAVEL SURFACE WARFARE CENTER INDIAN HEAD, MD 20640-5035	FIGURE 10
SCALE AS SHOWN		February 6, 2002



ERT EARTH RESOURCES TECHNOLOGY	GPR PROFILE B– B' SITE 51/52 – STEAM LINE SURVEY INDIAN HEAD DIVISION – NAVEL SURFACE WARFARE CENTER INDIAN HEAD, MD 20640-5035	FIGURE 11
SCALE AS SHOWN		February 6, 2002



GPR PIPE MAP OF SITE 51/52 - STEAM LINE SURVEY INDIAN HEAD DIVISION - NAVAL SURFACE WARFARE CENTER INDIAN HEAD , MD 20640-5035	EARTH RESOURCES TECHNOLOGY	
FIGURE 12	SCALE 1" = 10'	FEBRUARY 6, 2002

APPENDIX E

GROUNDWATER LEVEL DATA

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: Site Screening **Project No.:** 525
Location: IHDIV Stump Neck **Personnel:** KEITH SIMPSON
Weather Conditions: **Measuring Device:** M-SCOPE
Tidally Influenced: * Yes ✓ No ___ **Remarks:** S33 WELL NOT TIDALLY INFLUE

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
S37TW01	2-12-02	1500	6.89	12.40	6.02	—	0.87	
S37TW02	↓	1503	6.24	12.35	4.99	—	1.25	
S37TW03	2-12-02	1505	6.98	12.25	5.94	—	1.04	
S34TW01	2-12-02	1519	7.20	12.35	7.35	—	-0.15	
S34TW02	↓	1518	5.30	7.50	3.87	—	1.43	
S34TW03	↓	1515	7.40	17.30	8.02	—	-0.62	
S33TW01	2-12-02	1550	82.11	29.40	10.97	—	71.14	
S33TW02	↓	1552	82.82	29.60	10.25	—	72.57	
S33TW03	↓	1545	79.50	30.00	9.25	—	70.25	

* All measurements to the nearest 0.01 foot

APPENDIX F

SURVEY DATA

TEMPOARY WELL SURVEY DATA
SITE SCREENING REPORT
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Well	Northing	Easting	Top of Casing elevation
S33TW001	320265.07	1252092.59	82.11
S33TW002	320293.41	1252107.64	82.82
S33TW003	320285.64	1252062.28	79.50
S34TW001	322639.58	1249271.79	7.20
S34TW002	322602.20	1249337.49	5.30
S34TW003	322676.97	1249318.22	7.40
S37TW001	323264.33	1249892.00	6.89
S37TW002	323217.47	1250053.61	6.24
S3/TW003	323314.95	1250151.60	6.98

Horizontal Datum - 1983 North American Datum
Vertical Datum - 1929 North American Geodetic Vertical Datum

APPENDIX G

DATA VALIDATION MEMORANDA

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**MR. G. LATUILPPE**	**DATE:**	**APRIL 29, 2002**
FROM:	**BERNARD F SPADA III**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION- VOA/SVOA/PEST/PCB**
CTO 325, NSWC INDIAN HEAD
SDG A0172

SAMPLES: 9/Aqueous

FD01310202	S34TB020502-1*	S37RB020502-1
S37SW0010001	S37SW0020001	S37SW0030001
S37TB013102*	S37TW0010001	S37TWDUP001

9/Soils

FD01310201	S37SB0010101	S37SB0010201
S37SB0020101	S37SB0030101	S37SB0030201
S37SD0010001	S37SD0020001	S37SD0030001

Overview

The sample set for CTO 325, NSWC Indian Head, SDG A0172 consists of four (4) environmental aqueous samples, eight (8) environmental soil samples, two (2) trip blanks, and three (3) field duplicates. The trip blanks denoted with an asterisk (*) were analyzed for volatile organic compounds (VOC) only by CLP Method OLC OLC02.1. All remaining samples were analyzed for volatile organic compounds (VOC), semiviolatile organic compounds (SVOC), pesticides (PEST), and polychlorinated biphenyls (PCB) by CLP Methods OLM04.1 (soils) and OLC02.1 (aqueous). Three duplicate pairs were included in this SDG: (FD01310202 / S37SW0010001), (FD01310201 / S37SD0010001), and (S37TWDUP001 / S37TW0010001).

The samples were collected by Tetra Tech NUS on January 31, February 4 and 5, 2002 and analyzed by Mitkem Corporation. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using CLP Methods OLM04.2 and OLC02.1 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters: data completeness, holding times, GCMS tuning, initial/continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike/blank spike duplicate results, internal standard recoveries, chromatographic resolution, compound identification, compound quantitation, field duplicate precision, and detection limits. Areas of concern are listed below.

Major

- Both of the volatile aqueous initial calibrations were below the 0.05 relative response factor (RRF) quality control criteria for acetone. All non-detected results for acetone were rejected (UR).

- All of the volatile aqueous continuing calibrations were below the 0.05 RRF quality control criteria for acetone. All non-detected results for acetone were rejected (UR).

- The volatile aqueous continuing calibration analyzed on February 11 at 01:11 was below the 0.05 RRF quality control criteria for 2-butanone. All associated results for 2-butanone were rejected (UR).

- The volatile aqueous continuing calibration analyzed on February 16 at 12:05 was below the 0.05 RRF quality control criteria for 2-butanone. All associated results for 2-butanone were rejected (UR).

- The volatile aqueous continuing calibration analyzed on February 20 at 09:38 was below the 0.05 RRF quality control criteria for 2-butanone. All associated results for 2-butanone were rejected (UR).

- Both of the semivolatile soil initial calibrations were below the 0.05 RRF quality control criteria for N-nitrosodiphenylamine. All non-detected results for N-nitrosodiphenylamine were rejected (UR).

- All of the semivolatile soil continuing calibrations were below the 0.05 RRF quality control criteria for N-nitrosodiphenylamine. All non-detected results for N-nitrosodiphenylamine were rejected (UR).

Minor

- Sample S37SD0030001 was <30% solids. All results for this sample were qualified as estimated (J, UJ).

The following compounds were detected in the semivolatile solid method blank:

Compound	Maximum Concentration	Blank Action Level
Bis(2-ethylhexyl)phthalate	33 ug/kg	330 ug/kg
Acetophenone	76 ug/kg	380 ug/kg

Sample aliquot, percent solids, and dilution factors were taken into consideration when applying the blank action levels. Positive results for bis(2-ethylhexyl)phthalate and acetophenone below the blank action level were qualified as non-detected (B).

- Internal standards 5 and 6 (chrysene-d12 and perylene-d12) were recovered below the 50% quality control criteria in sample S37SD0030001. All results associated with the aforementioned internal standards were qualified as estimated (UJ).

- Internal standard 6 (perylene-d12) was recovered below the 50% quality control criteria in the re-extraction of sample S37SB0020101. All results associated with the aforementioned internal standard were qualified as estimated (J, UJ).

- The semivolatile surrogate recoveries for 2-fluorobiphenyl and 2,4,6-tribromophenol were below the laboratory's quality control criteria (and <10%) in sample S37SB0020101. The sample was re-extracted outside of holding time and re-analyzed. The surrogate recoveries were compliant in the re-analysis. The re-analysis was qualified as estimated (J, UJ) for all results and used for validation.

Notes

The volatile continuing calibration analyzed on February 11 at 01:11 exceeded the 25 percent difference (%D) quality control criteria (but was < 50%) for acetone, 2-butanone, 4-methyl-2-pentanone, 2-hexanone, 1,2-dibromo-3-chloropropane, and ethyl ether. No action was taken because all associated results were non-detected.

The volatile continuing calibration analyzed on February 16 at 12:05 exceeded the 25 %D quality control criteria (but was < 50%) for acetone, 1,1-dichloroethane, 2-butanone, 1,2-dichloropropane, 4-methyl-2-pentanone, 2-hexanone, and 1,2,4-trichlorobenzene. No action was taken because all associated results were non-detected.

The semivolatile initial calibration analyzed on February 23 exceeded the 30% relative standard deviation (RSD) quality control criteria (but was <50%) for 2,4-dinitrophenol. No action was taken because all results for 2,4-dinitrophenol were non-detected.

The semivolatile continuing calibration analyzed on March 8 at 02:12 exceeded the 25 %D quality control criteria (but was <50%) for 2,4-dimethylphenol, 2,4,5-trichlorophenol, 4-nitrophenol, and pentachlorophenol. No action was taken because all associated results for the aforementioned compounds were non-detected.

The pesticide resolution check analyzed on January 28 at 15:00 was below the 90% resolution quality control criteria for methoxychlor on both columns and for 4,4-DDE on the DB-608 column. No action was taken because the resolution was shown to be acceptable, by analysis of a continuing calibration, before any environmental samples were analyzed.

Executive Summary

Laboratory Performance: Qualifications were made based on calibration non-compliances, internal standard non-compliances, %D between analytical columns for PEST/PCBs, method blank contamination, and surrogate non-compliance.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to U.S. EPA National Functional Guidelines for Data Validation as modified by EPA Region III (9/94) and the NFESC guidelines entitled Navy IRCDQM (Sept. 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Bernard F Spada III

Tetra Tech NUS
Bernard F Spada III
Chemist/Data Validator

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**APRIL 29, 2002**
FROM:	**REBEKAH A. HAYNIE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
CTO 325-NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – A0172

SAMPLES: 4/Sediment/

FD01310201	S37SD0010001	S37SD0020001
S37SD0030001		

5/Soil/

S37SB0010101	S37SB0010201	S37SB0020101
S37SB0030101	S37SB0030201	

9/Aqueous/

FD01310202	S34TW0020001	S34TW0030001
S37RB020502-1	S37SW0010001	S37SW0020001
S37SW0030001	S37TW0010001	S37TWDUP001

Overview

The sample set for CTO 325, NSWC Indian Head, SDG A0172, consists of four (4) sediment, five (5) soil, and eight (8) aqueous environmental samples and one (1) aqueous rinsate blank sample. Three field duplicate pairs, S37TWDUP001 / S37TW0010001, FD01310201 / S37SD0010001, and FD01310202 / S37SW0010001, are included in this SDG.

All sediment and soil samples were analyzed for target analyte list (TAL) metals. Two aqueous samples including S34TW0020001 and S34TW0030001 were analyzed for total and dissolved beryllium and copper only. Two aqueous samples including S37TW0010001 and S37TWDUP001 were analyzed for total and dissolved TAL metals. All other aqueous samples were analyzed for TAL metals only. The samples were collected by TetraTech NUS on February 4 and 5, 2002 and analyzed by Mitkem Corporation under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Analyses were conducted using EPA method ILM04.1.

All analyses, with the exclusion of mercury, were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) methodologies.

Summary

All samples were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory blank results, ICP interference check sample (ICS) results, laboratory control spike (LCS) samples, matrix spike (MS) results, laboratory and field duplicate precision, and ICP serial dilutions.

Problems with respect to data quality are listed below.

Minor Problems

- The following contaminants were detected in the laboratory method / preparation blanks run on instrument identification Optima 1 at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Aluminum	30.9 µg/L	154.5 µg/L 30.9 mg/kg
Barium(1)	4.615 µg/L	23.075 µg/L
Barium	1.8 µg/L	1.8 mg/kg
Chromium(1)	0.636 µg/L	3.18 µg/L
Chromium(2)	0.11 mg/kg	0.55 mg/kg
Cobalt	0.6 µg/L	3.0 µg/L 0.6 mg/kg
Copper(1)	4.541 µg/L	22.705 µg/L
Copper	3.2 µg/L	3.2 mg/kg
Iron(1)	98.944 µg/L	494.72 µg/L
Iron(2)	5.203 mg/kg	26.015 mg/kg
Magnesium	16.9 µg/L	84.5 µg/L
Magnesium(2)	3.701 mg/kg	18.505 mg/kg
Manganese(1)	2.22 µg/L	11.1 µg/L
Manganese(2)	0.549 mg/kg	2.745 mg/kg
Nickel	0.5 µg/L	2.5 µg/L 0.5 mg/kg
Potassium	101.7 µg/L	508.5 µg/L 101.7 mg/kg
Zinc(1)	5.088 µg/L	25.44 µg/L
Zinc(2)	2.077 mg/kg	10.385 mg/kg

Sediment samples affected: S37SD0010001, S37SD0020001, FD01310201
Aqueous samples affected: S37SW0010001, S37SW0020001, FD01310202

(1) Maximum concentration present in an aqueous preparation blank.
(2) Maximum concentration present in a sediment preparation blank.

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids, and dilution factors were taken into consideration when evaluating for blank contamination. Sample results for aluminum, chromium, cobalt, copper, iron, and nickel of the aqueous samples listed above and cobalt, copper, potassium, and zinc of the sediment samples listed above were qualified with a "B", as a result of blank contamination.

- The following contaminants were detected in the laboratory method / preparation blanks run on instrument identification Optima 2 at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Antimony*	5.0 µg/L	25.0 µg/L 5.0 mg/kg
Barium(1)	2.608 µg/L	13.04 µg/L
Barium(2)	0.132 mg/kg	0.66 mg/kg
Chromium(1)	0.481 µg/L	2.405 µg/L
Chromium(2)	0.192 mg/kg	0.96 mg/kg
Cobalt	0.9 µg/L	4.5 µg/L 0.9 mg/kg
Copper	1.1 µg/L	5.5 µg/L 1.1 mg/kg
Magnesium	75.7 µg/L	378.5 µg/L 75.7 mg/kg
Manganese(1)	1.616 µg/L	8.08 µg/L
Manganese(2)	0.24 mg/kg	1.2 mg/kg
Nickel	1.0 µg/L	5.0 µg/L 1.0 mg/kg
Potassium(1)	137.71 µg/L	688.55 µg/L
Potassium(2)	19.582 mg/kg	97.91 mg/kg
Silver(1)	0.511 µg/L	2.555 µg/L
Sodium(1)	600.012 µg/L	3000.06 µg/L
Sodium(2)	109.759 mg/kg	548.795 mg/kg
Zinc	5.4 µg/L	27.0 µg/L 5.4 mg/kg

Solid samples affected: S37SD0030001, S37SB0010101, S37SB0010201, S37SB0030101, S37SB0030201, and S37SB0020101
Aqueous samples affected: S34TW0030001, S34TW0030001-F, S34TW0020001, S34TW0020001-F, S37SW0030001, S37TW0010001, S37TW0010001-F, S37TWDUP001, and S37TWDUP001-F

(1) Maximum concentration present in an aqueous preparation blank.
(2) Maximum concentration present in a sediment preparation blank.
*Antimony blank contamination affects all samples in the SDG

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids, and dilution factors were taken into consideration when evaluating for blank contamination. Sample results for antimony, beryllium, cobalt, nickel, silver, and zinc of the aqueous samples listed above and cobalt, potassium, and sodium of the solid samples listed above were qualified with a "B", as a result of blank contamination.

- Percent solids were < 30% in sediment sample S37SD0030001. All positive sample results were qualified as estimated, "J". Non-detected sample results were qualified as estimated, "UJ".

- Serial dilution non-compliance (percent difference (%D) > 10%) was noted for aluminum, barium, iron, and manganese, affecting the soil matrix. All positive results for these analytes were qualified as estimated, "J".

- Serial dilution non-compliance (%D > 10%) was noted for barium, magnesium, manganese, and potassium, affecting the aqueous matrix. All positive results for these analytes were qualified as estimated, "J". All non-detected results for magnesium, manganese, and potassium were qualified as estimated, "UJ".

- Laboratory duplicate imprecision (relative percent difference (RPD) > 35%) was noted for aluminum and manganese, affecting the soil matrix. All positive results were qualified as estimated, "J".

- LCS sample recovery non-compliance (percent recovery (%R) < 80%) was noted for aluminum, antimony, and iron, affecting the soil and sediment matrices. Positive results for aluminum and iron were qualified as estimated, "J". Due to conflicting non-compliances, a direction of bias could not be determined. Non-detected results reported for antimony were qualified as biased low, "UL", and estimated, "UJ", when a direction of bias could not be determined due to conflicting non-compliances.

- MS recovery non-compliance (%R < 75%) was noted for selenium, affecting the sediment matrix. Non-detected selenium results were qualified as biased low, "UL". In cases where directional bias could not be determined due to conflicting non-compliances, non-detected results were qualified as estimated, "UJ".

- The interfering analyte iron was present in sample S37SD0030001 at a concentration comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium, silver, and thallium. The non-detected results reported for antimony, silver, and thallium were qualified as estimated, "UJ", due to conflicting non-compliances. Positive results reported for arsenic and cadmium were qualified as estimated, "J", due to conflicting non-compliances.

- Contract Required Detection Limit (CRDL) calibration standards non-compliance (%R > 110%) was noted for antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, selenium, silver, thallium, and vanadium, affecting all three sample matrices. Positive results less than two times the CRDL for antimony, arsenic, cadmium, cobalt, nickel, selenium, thallium, and vanadium of the aqueous matrix were qualified as biased high, "K". Positive results less than two times the CRDL for arsenic, beryllium, cadmium, chromium, cobalt, copper, nickel, silver, and vanadium of the soil and sediment matrices were qualified as biased high, "K", or estimated, "J", in cases where directional bias could not be determined due to conflicting non-compliances.

<u>Notes</u>

- LCS non-compliance (%R > 120%) was noted for mercury, affecting the soil and sediment matrices. Because all sample results for mercury were reported as non-detected by the laboratory, qualification was not necessary and sample results were considered acceptable.

- CRDL calibration standards noncompliance (%R > 110%) was noted for lead and zinc. Qualification of the sample results was not necessary, as results were greater than two times the CRDL.

Executive Summary

Laboratory Performance: Contamination of the laboratory method/preparation blanks was noted for all three sample matrices. Laboratory duplicate imprecision was noted for aluminum and manganese, affecting the soil and sediment matrices. CRDL calibration non-compliance was noted for many analytes, affecting all three sample matrices. The LCS sample recovery was low for aluminum, antimony, and iron, affecting the soil and sediment sample matrices.
Other Factors Affecting Data Quality: MS recovery non-compliance was noted for selenium, affecting the soil and sediment matrices. The interfering analyte iron was found in a sediment sample. Serial dilution non-compliance was noted for several analytes, affecting all three sample matrices. Percent solids of sediment sample S37SD0030001 were < 30%, requiring estimation of positive and non-detected sample results of the sample.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", April 1993, as amended for using within USEPA Region 3, and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Rebekah A. Haynie

Tetra Tech NUS
Rebekah A. Haynie
Environmental Scientist

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**MR. G. LATUILPPE**	**DATE:**	**APRIL 29, 2002**
FROM:	**BERNARD F SPADA III**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION- VOA/SVOA/PEST/PCB**
CTO 325, NSWC INDIAN HEAD
SDG A0205

SAMPLES: 3/Aqueous

S37TB020602-1	S37TW0020001*	S37TW0030001*

3/Soils

S51SB0010101	S51SB0010201	S51SBDUP101

Overview

The sample set for CTO 803, NSWC INDIAN HEAD, SDG A0205 consists of two (2) environmental aqueous samples, two (2) environmental soil samples, one (1) trip blank, and one (1) field duplicate. All samples were analyzed for volatile organic compounds (VOC) by CLP Methods OLM04.1 (soils) and OLC02.1 (aqueous). The samples denoted with an asterisk (*) were analyzed for semivolatile organic compounds (SVOC), pesticides (PEST), and polychlorinated biphenyls (PCB) by method CLP OLC02.1. The duplicate pair is S51SBDUP101 and S51SB0010101.

The samples were collected by Tetra Tech NUS on February 6 and 11, 2002 and analyzed by Mitkem Corporation. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using CLP Methods OLM04.2 and OLC02.1 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters: data completeness, holding times, GCMS tuning, initial/continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike/blank spike duplicate results, internal standard recoveries, chromatographic resolution, compound identification, compound quantitation, field duplicate precision, and detection limits. Areas of concern are listed below.

Major

- The volatile aqueous initial calibration was below the 0.05 relative response factor (RRF) quality control criteria for acetone. All associated non-detects were rejected (UR).

- The volatile aqueous continuing calibration performed on February 16 at 12:05 was below the 0.05 relative response factor (RRF) quality control criteria for acetone and 2-butanone. All associated non-detects were rejected (UR).

Minor

- Samples S51SB0010201 and S37TW0020001 had results below the detection limit but above the method detection limit. These results were qualified as estimated (J) due to uncertainty near

detection limit.

The following compounds were detected in the solid method blank:

Compound	Maximum Concentration	Blank Action Level
Acetone	9.0 ug/kg	90 ug/kg
Methylene chloride	4.0 ug/kg	40 ug/kg

Sample aliquot, percent solids, and dilution factors were taken into consideration when applying the blank action levels. Positive results for acetone and methylene chloride below the blank action level were qualified as non-detected (B).

- Sample S37TW0020001 surrogate recoveries were >150%. The sample was re-extracted with similar results. However a difference between the extracts were noticed. Positive results were reported in the original extract and non-detects were reported in the re-extraction for endosulfan I and gamma-BHC. Because the original results were associated with high %Ds, the reviewer used the non-detected re-extraction results for endosulfan I, endrin, and gamma-BHC. These results were quailfied as estimated (UJ), due to extraction holding time exceedance.

Notes

The volatile continuing calibration performed on February 16 at 12:05 exceeded the 25%D (but were <50%) quality control criteria for chloromethane, 1,1-dichloroethane, 1,2-dichloropropane, 4-methyl-2-pentanone, 2-hexanone, and 1,2,4-trichlorobenzene. No action was taken for acetone and 2-butanone because they were already rejected for a more severe surrogate recovery non-compliance. No action was taken for the remaining compounds because all results are non-detected.

The volatile soil initial calibration exceeded the 30% relative standard deviation (RSD) quality control criteria for acetone. No action was taken because acetone was already qualified for method blank contamination.

The volatile soil continuing calibration performed on February 20 at 17:59 exceeded the 25%D (but was <50%) quality control criteria for chloroethane, methylene chloride, 2-butanone, and 2-hexanone. No action was taken for methylene chloride because its results were already qualified for method blank contamination. No action was taken for the remaining compounds because all results are non-detected.

The volatile soil continuing calibration performed on February 20 at 17:59 exceeded the 25%D (and was >50%) quality control criteria for acetone. No action was taken because acetone was already qualified for method blank contamination.

The Form I's and the EDD did not correspond correctly for the semivolatiles fraction. The Form I indicated that samples S37TW0020001 and S33SB0010101 were analyzed and the EDD indicates S37TW0020001 and S37TW0030001. Also, the results for S37TW0020001 on the Form I correspond to sample S37TW0030001 on the EDD and the results for S33SB0010101 on the Form I correspond to sample S37TW0020001 on the EDD. Another discrepancy is that sample S33SB0010101 was not to be analyzed for semivolatiles. Upon informing the laboratory of this inconsistency, it was determined that the results on the EDD were correct. The laboratory reprocessed the data and sent new copies of the CLP forms associated with these samples. The reprocessed data is included at the beginning of the support documentation.

Executive Summary

Laboratory Performance: Qualifications were made based on calibration non-compliances, %D between analytical columns for PEST/PCBs, method blank contamination, and surrogate non-compliance.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to U.S. EPA National Functional Guidelines for Data Validation as modified by EPA Region III (9/94) and the NFESC guidelines entitled Navy IRCDQM (Sept. 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS

Bernard F Spada III
Chemist/Data Validator

Tetra Tech NUS

Joseph A. Samchuck
Quality Assurance Officer

Attachments:

Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO :	**G. LATULIPPE**	**DATE:**	**APRIL 29, 2002**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
CTO 325 NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – A0205

SAMPLES: 7/Soil/

S33SB0010101	S33SB0010201	S33SB0020101
S33SB0020201	S33SB0030101	S33SB0030201
S33SBDUP0101		

7/Aqueous/

S33RB020702-1	S33TW0010001	S33TW0020001
S33TW0030001	S34TW0010001	S37TW0020001
S37TW0030001		

Overview

The sample set for CTO 325, NSWC Indian Head, SDG A0205, consists of seven (7) soil environmental samples, six (6) aqueous environmental samples and one (1) aqueous rinsate blank, S33RB020702-1. One (1) field duplicate pair (S33SBDUP0101 / S33SB0030201) is included within this SDG.

All soil samples were analyzed for target analyte list (TAL) metals. All aqueous samples, with the exception of samples S34TW0010001and S33RB020702-1, were analyzed for total and dissolved TAL metals. Sample S34TW0010001 was analyzed for total and dissolved beryllium and copper and dissolved mercury. Sample S33RB020702-1 was analyzed for total TAL metals only. The samples were collected by Tetra Tech NUS on February 2, 7, 8 and 12, 2001 and analyzed by Mitkem Corporation under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control (QA/QC) criteria. Metals analyses were conducted using the Contract Laboratory Program (CLP) method ILM04.1.

Metals analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) instrumentation. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) instrumentation.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory method/preparation blanks, ICP interference check sample results, matrix spike results, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The Contract Required Detection Limit (CRDL) percent recoveries for antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, selenium, silver, thallium, vanadium and zinc were >110% quality control limit, affecting all samples except S33SB0010001 and S33SB0010201. Positive results less than two times the CRDL reported for antimony, arsenic, beryllium, chromium, cobalt, nickel, thallium, vanadium and zinc were qualified as biased high, "K". Positive results greater than two times the CRDL reported for cadmium, cobalt, manganese, selenium, silver and thallium were qualified as estimated, "J", due to conflicting noncompliances. No validation action was required for lead because the results were either reported by the laboratory as nondetected, qualifies "B" due to laboratory blank contamination or were greater than 2X the CRDL.

- The CRDL percent recovery for copper was >110% quality control limit, affecting all samples except S33TW0030001, S33TW0030001-F, S34TW0010001-F, S33RB020702-1, S33SB0010101 and S33SB0010201. Positive results less than two times the CRDL reported for copper were qualified as biased high, "K" or estimated, "J", due to conflicting noncompliances.

- The CRDL percent recoveries for antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, silver thallium, vanadium and zinc were >110% quality control limit, affecting samples S33SB0010101 and S33SB0010201. The positive results less than two times the CRDL reported for beryllium, copper and nickel were qualified as biased high, "K". The positive results less than two times the CRDL reported for cobalt and manganese were qualified as estimated, "J", due to conflicting noncompliances. No validation action was required for the remaining analytes because the results were either reported by the laboratory as nondetected, qualifies "B" due to laboratory blank contamination or were greater than 2X the CRDL.

- The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations :

Analyte	Maximum Concentration	Action Level
Aluminum	13.8 µg/L	13.8 mg/kg
Antimony	4.8 µg/L	4.8 mg/kg
Barium(1)	0.314 mg/kg	1.57 mg/kg
Calcium	54.6 µg/L	54.6 mg/kg
Chromium(2)	0.087 mg/kg	0.435 mg/kg
Chromium(3)	0.106 mg/kg	0.53 mg/kg
Cobalt	1.2 µg/L	1.2 mg/kg
Copper	2.0 µg/L	2.0 mg/kg
Iron(3)	5.803 mg/kg	29.015 mg/kg
Lead(3)	0.310 mg/kg	1.55 mg/kg
Magnesium	55.6 µg/L	55.6 mg/kg
Manganese(3)	0.432 mg/kg	2.16 mg/kg
Nickel	2.3 µg/L	2.3 mg/kg
Sodium	685.9 µg/L	685.9 mg/kg
Zinc	4.8 µg/L	4.8 mg/kg
Zinc(3)	3.385 mg/kg	16.925 mg/kg

(1) Maximum concentration present in a soil preparation blank, affecting all samples.
(2) Maximum concentration present in a soil preparation blank, affecting all samples except S33SB0010101 and S33SB0010102.

[3] Maximum concentration present in a soil preparation blank, affecting samples S33SB0010101 and S33SB0010102.

Samples Affected: All soil samples

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. The positive results less than the action level reported for calcium, nickel, sodium and zinc were qualified, "B", as a result of blank contamination. No validation action was required for the remaining analytes because the results were either greater than the action level or were nondetected.

Analyte	Maximum Concentration	Action Level
Aluminum	13.8 µg/L	69.0 µg/L
Aluminum[1]	16.85 µg/L	84.25 µg/L
Antimony	4.8 µg/L	24.0 µg/L
Barium	0.40 µg/L	2.0 µg/L
Barium[1]	1.624 µg/L	8.12 µg/L
Calcium	54.6 µg/L	273 µg/L
Calcium[1]	113.906 µg/L	569.53 µg/L
Cobalt	1.2 µg/L	6.0 µg/L
Copper	2.0 µg/L	10.0 µg/L
Copper[1]	3.651 µg/L	18.255 µg/L
Lead	0.70 µg/L	3.5 µg/L
Magnesium	55.6 µg/L	278 µg/L
Manganese[2]	2.809 µg/L	14.045 µg/L
Nickel	2.3 µg/L	11.0 µg/L
Sodium	685.9 µg/L	3429.5 µg/L
Zinc	4.8 µg/L	24.0 µg/L
Zinc[1]	13.067 µg/L	65.33 µg/L

[1] Maximum concentration present in an aqueous preparation blank, affecting the dissolved metals matrix.
[2] Maximum concentration present in an aqueous preparation blank, affecting the total metals matrix.

Samples Affected: All aqueous samples

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. The positive results less than the action level reported for aluminum, antimony, cobalt, copper, lead, nickel, sodium and zinc were qualified, "B", as a result of blank contamination. No validation action was required for the remaining analytes because the results were either greater than the action level or were nondetected.

- The interfering analyte calcium was present in sample S37TW0020001-F at a concentration that was comparable to the level of calcium in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium, copper, selenium, silver and thallium in the affected sample. The positive result reported for cadmium was qualified as estimated, "J"

due to conflicting noncompliances. The nondetected results reported for copper, selenium, silver and thallium were qualified as biased low, "UL".

- The interfering analyte calcium was present in sample S37TW0030001 at a concentration that was comparable to the level of calcium in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium, copper, selenium, silver, thallium and zinc in the affected sample. The positive result reported for silver was qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for cadmium, copper, selenium, thallium and zinc were qualified as biased low, "UL".

- The interfering analyte calcium was present in sample S37TW0020001 at a concentration that was comparable to the level of calcium in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium, copper, selenium, silver, thallium and zinc in the affected sample. The positive result reported for selenium was qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for cadmium, copper, silver, thallium and zinc were qualified as biased low, "UL".

- The interfering analyte calcium was present in sample S37TW0030001-F at a concentration that was comparable to the level of calcium in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for arsenic, cadmium, copper, selenium, silver and thallium in the affected sample. The positive result reported for arsenic was qualified as biased high, "K". The positive result reported for cadmium was qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for copper, selenium, silver and thallium were qualified as biased low, "UL".

- The interfering analyte iron was present in sample S33SB0010201 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium, selenium, silver and thallium in the affected sample. The positive result reported for arsenic was qualified as biased high, "K". The nondetected results reported for antimony, cadmium, selenium, silver and thallium were qualified as biased low, "UL".

- The interfering analyte iron was present in sample S33SB0020201 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium, cobalt, selenium, silver and thallium in the affected sample. The positive result reported for arsenic was qualified as biased high, "K". The positive results reported for cobalt and thallium were qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for antimony, cadmium, selenium and silver were qualified as biased low, "UL".

- The interfering analyte iron was present in sample S33SB0030201 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium, cobalt, copper, lead, selenium, silver and thallium in the affected sample. The positive results reported for arsenic and thallium were qualified as biased high, "K". The positive results reported for cobalt, copper, lead and selenium were qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for antimony, cadmium and silver were qualified as biased low, "UL".

- The interfering analyte iron was present in sample S33SBDUP0101 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, cadmium, cobalt, copper, lead, selenium, silver and thallium in the affected sample. The positive result reported for arsenic was qualified as biased high, "K". The positive results reported for cobalt, copper, lead and thallium were qualified as estimated, "J" due to conflicting noncompliances. The nondetected results reported for antimony, cadmium, selenium and silver were qualified as biased low, "UL".

- The Matrix Spike (MS) percent recovery for antimony was < 75% quality control limit, affecting the soil matrix. Nondetected results reported for antimony were qualified as biased low, "UL".

- Field duplicate imprecision (RPD>50%) was noted for manganese, affecting the soil matrix. Positive results reported for manganese were qualified as estimated, "J".

- The ICP serial dilution percent differences for cobalt, lead and potassium were >10% quality control limit, affecting the soil matrix. Positive results reported for these analytes were qualified as estimated, "J". A direction of bias could not be determined.

- The ICP serial dilution percent difference for barium was >10% quality control limit, affecting the total aqueous matrix. Positive results reported for barium were qualified as estimated, "J". A direction of bias could not be determined.

Notes

The rinsate blank sample was not used to establish blank action levels and was not qualified due to laboratory blank contamination.

The ICS percent recovery for selenium was >120% quality control limit, affecting samples S33TW0030001, S33RB020702-1 and S33TW0030001-F. No validation action was required because all results were reported by the laboratory as nondetected.

The MS percent recovery for selenium was >125% quality control limit, affecting the dissolved aqueous matrix. No validation action was required because all results were reported by the laboratory as nondetected.

Executive Summary

Laboratory Performance: Several analytes were qualified due to calibration noncompliance. Several analytes were present in the laboratory method/preparation blanks.

Other Factors Affecting Data Quality: Antimony was qualified due to MS noncompliance, affecting the soil matrix. Cobalt, lead and potassium were qualified due to ICP serial dilution noncompliance, affecting the soil matrix. Barium was qualified due to ICP serial dilution noncompliance, affecting the total aqueous matrix. Field duplicate imprecision was noted for manganese, affecting the soil matrix. The interfering analytes calcium or iron were present in several samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Chemical Data Quality Manual" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Erin M Faust

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**April 26, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDG 10218**		

SAMPLES: 3 / Aqueous

FD01310202	S37SW0010001	S37SW0020001

3 / Solid

FD01310201	S37SD0010001	S37SD0020001

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 10218 consists of three (3) aqueous environmental samples and three sediment environmental samples. Two pairs of field duplicates were included in the SDG: S37SW0010001 / FD01310202 and S37SD0010001 / FD01310201. The samples were analyzed for explosives (EXP).

The samples were collected by TetraTech NUS on January 31, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 and MCAWW 353.2 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, field duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- The following compound was detected in the soil method blank at the maximum concentration indicated below:

Compound	Concentration (mg/kg)	Action Level (mg/kg)
Nitrocellulose	0.44	2.2

An action level of 5X the maximum contaminant level has been used to evaluate sample data for contamination. Dilution factors and sample aliquots were taken into consideration during the application of all action levels. The affected positive results were qualified (B) as a result of blank contamination for nitrocellulose.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% quality control limit for 4-amino-2,6-dinitrotoluene. No qualification action was taken because the calibration was not associated with any samples in this SDG.

The surrogate recovery was greater than the upper quality control limit of 140% in samples S37SD0020001, S37SD0010001, and FD01310201 for the nitroquanidine analyses. No qualification action was taken because nitroquanidine was not detected in the samples.

The tetryl recovery was less than the quality control limit of 55% for the MS/MSD performed on sample S37SW0020001. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

The nitrocellulose recovery was less than the quality control limit of 53% for the MS/MSD associated with the sediment samples (2042493). However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Nitrocellulose was detected in the solid method blank resulting in qualification of the data.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**APRIL 26, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDG 60111**		

SAMPLES: 4 / Aqueous

S37RB020502-1	S37SW0030001	S37TW0010001	S37TWDUP001

6 / Solid

S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101
S37SB0030201	S37SD0030001		

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 60111 consists of three (3) aqueous environmental samples, six (6) solid environmental samples, and one (1) field quality control sample. The samples were analyzed for explosives (EXP). One pair of field duplicates was included in the SDG: S37TW0010001 and S37TWUP001.

The samples were collected by TetraTech NUS on February 5, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 and MCAWW 353.2 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, field duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- The following compound was detected in the soil method blank at the maximum concentration indicated below:

Compound	Concentration (mg/kg)	Action Level (mg/kg)
Nitrocellulose	0.44	2.2

An action level of 5X the maximum contaminant level has been used to evaluate sample data for contamination. Dilution factors and sample aliquots were taken into consideration during the application of all action levels. The affected positive results were qualified (B) as a result of blank contamination for nitrocellulose.

- The percent solids were less than 30% for sample S37SD0030001. The positive and non-detected results were qualified "J" and "UJ" respectively for this sample.

- Positive results less than the reporting limit (RL) were qualified as estimated "J", due to uncertainty near the detection limit.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% quality control limit for 4-amino-2,6-dinitrotoluene. No action was taken because this calibration was not associated with any samples contained in this SDG.

The continuing calibration analyzed on 2/14/02 @06:07 had a %D that exceeded the 15% quality control limit for RDX. No action was taken because this calibration was not associated with any samples contained in this SDG.

The surrogate recoveries were greater than the upper quality control limit of 140% in samples S37SB0010201, S37SB0030201, S37SB0020101, and S37SD0030001 for the nitroquanidine analyses. No qualification action was taken because nitroquanidine was not detected in any of the samples.

The nitroquanidine recovery was less than the quality control limit of 60% for the MS/MSD performed on sample S37SB0010101. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

The nitrocellulose recovery was less than the quality control limit of 53% for the MS/MSD associated with the solid samples (2042493). However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

Samples S37RB020502-1 and S37SB0030201 were reported with elevated detection limits due to matrix interference for 2,6-dinitrotoluene and nitroquanidine respectively. No qualification action was taken on this basis.

Due to matrix interference, an estimated result below the reporting limit, was not reported for nitroguanidine in sample S37SB0020101.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Nitrocellulose was detected in the solid method blank resulting in qualification of the data.

Other Factors Affecting Data Quality: Sample S37SD0030001had percent solids less than 30%, resulting in qualification of the data.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**April 26, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDG 80106**		

SAMPLES: 4 / Aqueous

S33RB020702-1 S33TW0030001 S37TW0020001 S37TW0030001

2 / Solid

S33SB0010101 S33SB0010201

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 80106 consists of three (3) aqueous environmental samples, two (2) solid environmental samples, and one (1) field quality control sample. The samples were analyzed for explosives (EXP). Samples with S37 designations were also analyzed for nitrocellulose.

The samples were collected by TetraTech NUS on February 6 and 7, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 and MCAWW 353.2 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- Positive results less than the reporting limit (RL) were qualified as estimated "J", due to uncertainty near the detection limit.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% (but <30%) quality control limit for 4-amino-2,6-dinitrotoluene. No action was taken on the 4-amino-2,6-dinitrotoluene result for samples S37TW0030001, S33TW0030001, and S33RB020702-1.

The continuing calibration analyzed on 2/14/02 @06:07 had a %D that exceeded the 15% (but <30%) quality control limit for RDX. No action was taken on the RDX results for samples S33SB0010101 and S33SB0010201.

The surrogate recovery was greater than the upper quality control limit of 133% in sample S37TW0020001 for the nitroquanidine analyses. No qualification action was taken because nitroquanidine was not detected in the sample.

The nitroquanidine recovery was less than the quality control limit of 60% for the MS/MSD associated with the solid samples. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

Samples S33RB020702-1, S37TW0020001, and S37TW0030001 were reported with elevated detection limits due to matrix interference for several compounds. No qualification action was taken on this basis.

Due to matrix interference, estimated results below the reporting limit, were not reported for 2-nitrotoluene and 3-nitrotoluene in sample S33RB020702-1.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Several compounds exceeded the continuing calibration %D criteria, resulting in qualification of the data.

Other Factors Affecting Data Quality: Sample S37SD0030001had percent solids less than 30%, resulting in qualification of the data.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**April 26, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDG 90121**		
SAMPLES:	1 / Aqueous		
	S33TW0010001		
	2 / Solid		
	S33SB0020101 S33SB0020201		

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 90121 consists of one (1) aqueous environmental sample and two (2) solid environmental samples. The samples were analyzed for explosives (EXP).

The samples were collected by TetraTech NUS on February 8, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- None.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% (but <30%) quality control limit for 4-amino-2,6-dinitrotoluene. No action was taken on the 4-amino-2,6-dinitrotoluene result for sample S33TW0030001.

The continuing calibration analyzed on 2/14/02 @06:07 had a %D that exceeded the 15% (but <30%) quality control limit for RDX. No action was taken on the RDX results for samples S33SB0020101 and S33SB0020201.

The surrogate recovery was greater than the upper quality control limit of 133% in sample S37TW0020001 for the nitroquanidine analyses. No qualification action was taken because nitroquanidine was not detected in the sample.

The nitroquanidine recovery was less than the quality control limit of 60% for the MS/MSD associated with the solid samples. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

Sample S33TW0010001 was reported with elevated detection limits due to matrix interference for 1,3,5-trinitrobenzene, 4-nitrotoluene, and 3-nitrotoluene. No qualification action was taken on this basis.

Due to matrix interference, estimated results below the reporting limit, were not reported for 2,4-dinitrotoluene 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and 2,6-dinitrotoluene, in sample S33TW0010001.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Several compounds exceeded the continuing calibration %D criteria, resulting in qualification of the data.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**FEBRUARY 22, 2002**
FROM:	**REBEKAH A. HAYNIE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – BERYLLIUM AND COPPER**
CTO 325-NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – 90144

SAMPLES: 2/Soil/

S34SB0010101 S34SBDUP0101

Overview

The sample set for CTO 325, NSWC Indian Head, SDG 90144, consists of two (2) soil environmental samples. This is a field duplicate pair.

Both samples were analyzed for beryllium and copper. Analyses were conducted using EPA method ILM04.1. The samples were collected by TetraTech NUS on January 30, 2002 and analyzed by Mitkem Corporation under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria.

All analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

Summary

Both samples were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory blank results, ICP interference check sample (ICS) results, laboratory control spike (LCS) samples, field duplicate precision, and ICP serial dilutions. Criteria were met for all parameters investigated with the exception of laboratory blank contamination.

Problems with respect to data quality are listed below.

Minor Problems

- The following contaminant was detected in the laboratory soil method blank at the following maximum concentration:

Analyte	Maximum Concentration	Action Level
Copper	2.20 µg/L	2.20 mg/kg

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. Qualification of the sample results was not necessary, as copper results reported by the laboratory were greater than 5X the contamination level.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994, Region 3 Modifications (April 1993), and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Rebekah A. Haynie

Tetra Tech NUS
Rebekah A. Haynie
Environmental Scientist

_____

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**APRIL 26, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDGs 130111**		
SAMPLES:	1 / Aqueous		
	S33TW0020001		
	3 / Solid		
	S33SB0030101 S33SB0030201 S33SBDUP0101		

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 130111 consists of one (1) aqueous environmental sample and three (3) solid environmental samples. One pair of field duplicates was included in the SDG: S33SB0030201 / S33SBDUP0101. The samples were analyzed for explosives (EXP).

The samples were collected by TetraTech NUS on February 12, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, field duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- The surrogate recoveries were less than 10% for all samples associated with the nitroquanidine aqueous batch extracted on 2/18/02. The sample batch was re-extracted, 14 days after collection, and re-analyzed with acceptable results. The re-extracted results are considered the valid results. The non-detected nitroquanidine result for sample S33TW0020001 was qualified "UJ" as estimated.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% quality control limit for 4-amino-2,6-dinitrotoluene. No qualification action was taken because the calibration was not associated with any samples in this SDG.

The nitroquanidine recovery was less than the quality control limit of 60% for the MS/MSD performed on sample S33SB0030101. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Nitrocellulose was detected in the solid method blank resulting in qualification of the data.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**April 12, 2002**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – EXP CTO 325, NSWC INDIAN HEAD SDG 310181**		
SAMPLES:	2 / Solid		
	S34SB0010101 S34SBDUP0101		

OVERVIEW

The sample set for CTO 325; NSWC Indian Head, SDG 310181 consists of two (2) solid environmental samples. Sample S34SBDUP0101 is the field duplicate of sample S34SB0010101. The samples were analyzed for explosives (EXP).

The samples were collected by TetraTech NUS on January 30, 2002 and analyzed by Severn Trent Laboratories Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Method 8330 and MCAWW 353.2 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike recoveries, blank spike results, matrix spike/matrix spike duplicate results, field duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- None.

Minor Problems

- The following compound was detected in the soil method blank at the maximum concentration indicated below:

Compound	Concentration (mg/kg)	Action Level (mg/kg)
Nitrocellulose	0.44	2.2

An action level of 5X the maximum contaminant level has been used to evaluate sample data for contamination. Dilution factors and sample aliquots were taken into consideration during the application of all action levels. The affected positive results were qualified (B) as a result of blank contamination for nitrocellulose.

Notes

The continuing calibration analyzed on 2/12/02 @05:44 had a %D that exceeded the 15% quality control limit for 4-amino-2,6-dinitrotoluene. No qualification action was taken because the calibration was not associated with any samples in this SDG.

The nitroquanidine recovery was less than the quality control limit of 60% for the MS/MSD performed on sample S34SB0010101. However, the LCS recovery was compliant. Therefore, no qualification action was taken based on this non-compliance.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Nitrocellulose was detected in the solid method blank resulting in qualification of the data.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Edward Sedlmyer
TetraTech NUS

Edward Sedlmyer
Chemist/Data Validator

_____
TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

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APPENDIX H

DATABASE

sb33_res -
full appendix results

order	001	002	003	004	005	006	007	008
location	S33SB001/TW001	S33SB001/TW001	S33SB002/TW002	S33SB002/TW002	S33SB003/S33TP003	S33SB003/S33TP003	S33SB003/S33TP003	S33SB003/S33TP003
matrix	SB	SB	SB	SB	SB	SB	SB	SB
nsample	S33SB0010101	S33SB0010201	S33SB0020101	S33SB0020201	S33SB0030101	S33SB0030201	S33SB0030201-AVG	S33SB0030201-D
sample	S33SB0010101	S33SB0010201	S33SB0020101	S33SB0020201	S33SB0030101	S33SB0030201	S33SBDUP0101	S33SBDUP0101
sample_dat	02/07/02	02/07/02	02/08/02	02/08/02	02/12/02	02/12/02	02/12/02	02/12/02
depth_rang	6 - 8	14 - 16	6 - 8	14 - 16	3 - 5	8 - 10	8 - 10	8 - 10
cto_proj	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**
Explosives (mg/kg)								
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
NITROGLYCERIN	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
NITROGUANIDINE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
RDX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Inorganics (mg/kg)								
ALUMINUM	6520	5870	2760	4880	7660	12500	12750	13000
ANTIMONY	0.19 UL	0.18 UL	0.16 UL	0.21 UL	0.21 UL	0.23 UL	0.23 UL	0.23 UL
ARSENIC	6.1	5.3 K	1.6 K	5.6 K	3.2 K	25 K	21.45 K	17.9 K
BARIUM	29.5	40.3	17.3	29.4	15.9	22.4	21.4	20.4
BERYLLIUM	0.34 K	1.3 K	0.16 K	1.5 K	0.22 K	1.9 K	1.7 K	1.5 K
CADMIUM	0.038 U	0.035 UL	0.032 U	0.043 UL	0.042 U	0.046 UL	0.046 UL	0.046 UL
CALCIUM	551	1170	165	640	8.9 U	14.1 B	22.35 B	30.6 B
CHROMIUM	15.1	18	11.6	21.2	16.6	44.1	45.8	47.5
COBALT	0.97 B	3 J	0.22 B	2 J	1.5 J	2.5 J	2 J	1.5 J
COPPER	3.6 K	7 K	3.3 K	13.2	7.6 K	4.7 J	4.3 J	3.9 J
IRON	12700	17700	7770	32300	15400	50200	45250	40300
LEAD	8.4 J	9.3 J	4.4 J	7.9 J	8 J	10.1 J	8.65 J	7.2 J
MAGNESIUM	625	897	177	641	554	1930	1955	1980
MANGANESE	2.4 J	16.8 J	1.4 J	21.8 J	20.9 J	228 J	167.5 J	107 J
MERCURY	0.047 U	0.055	0.055 U	0.046 U	0.055 U	0.057 U	0.058 U	0.059 U
NICKEL	2.9 K	9.6 K	0.94 B	13 K	3.1 K	9.5 K	8.4 K	7.3 K
POTASSIUM	546 J	981 J	292 J	853 J	543 J	3990 J	4045 J	4100 J
SELENIUM	0.38 U	0.35 UL	0.32 U	0.43 UL	0.42 U	0.61 J	0.42	0.46 UL
SILVER	0.094 U	0.088 UL	0.081 U	0.11 UL	0.11 U	0.11 UL	0.115 UL	0.12 UL
SODIUM	79.7 B	26.7 B	24.3 B	29.3 B	24.8 B	37.4 B	35.6 B	33.8 B
THALLIUM	0.38 U	0.35 UL	0.33 K	0.63 J	0.42 U	1.1 K	1.015 J	0.93 J
VANADIUM	36.2	29.9	14.4 K	36.8	25.1	55.6	52.55	49.5
ZINC	12.1 B	37	5.9 K	36.3	14.6	49.3	44.05	38.8

from sb33_sam.dbf
from sb33_res.dbf
from sb33_res.xls
from q:\sql_server\indian_head

tw33_res -
full appendix results

order	001	002	003	004	005	006
location	S33SB001/TW001	S33SB001/TW001	S33SB002/TW002	S33SB002/TW002	S33SB003/TW003	S33SB003/TW003
matrix	GW	GW	GW	GW	GW	GW
nsample	S33TW0010001	S33TW0010001-F	S33TW0020001	S33TW0020001-F	S33TW0030001	S33TW0030001-F
sample	S33TW0010001	S33TW0010001-F	S33TW0020001	S33TW0020001-F	S33TW0030001	S33TW0030001-F
sample_dat	02/08/02	02/09/02	02/12/02	02/13/02	02/12/02	02/08/02
cto_proj	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**
Explosives (ug/L)						
1,3,5-TRINITROBENZENE	0.23 U		0.2 U		0.2 U	
1,3-DINITROBENZENE	0.2 U		0.2 U		0.2 U	
2,4,6-TRINITROTOLUENE	0.2 U		0.2 U		0.2 U	
2,4-DINITROTOLUENE	0.2 U		0.2 U		0.2 U	
2,6-DINITROTOLUENE	0.2 U		0.11 J		0.13 J	
2-AMINO-4,6-DINITROTOLUENE	0.2 U		0.2 U		0.2 U	
2-NITROTOLUENE	0.2 U		0.2 U		0.2 U	
3-NITROTOLUENE	0.45 U		0.2 U		0.2 U	
4-AMINO-2,6-DINITROTOLUENE	0.2 U		0.2 U		0.2 U	
4-NITROTOLUENE	0.42 U		0.2 U		0.2 U	
HMX	0.5 U		0.5 U		0.5 U	
NITROBENZENE	0.2 U		0.2 U		0.2 U	
NITROGLYCERIN	2.5 U		2.5 U		2.5 U	
NITROGUANIDINE	20 U		20 UJ		20 U	
RDX	0.5 U		0.5 U		0.5 U	
TETRYL	0.2 U		0.2 U		0.2 U	
Inorganics (ug/L)						
ALUMINUM	286		435		15400	
ANTIMONY	1.9 B		1.5 B		1 U	
ARSENIC	2 U		2 U		11.8 K	
BARIUM	25.8 J		21.8 J		117 J	
BERYLLIUM	0.2 U		0.2 U		2.8 K	
CADMIUM	0.2 U		0.2 U		0.2 U	
CALCIUM	3780		2570		5400	
CHROMIUM	1.7 K		1.8 K		56	
COBALT	3.9 B		3.1 B		42.8 K	
COPPER	1.4 B		1.7 B		26.8	
IRON	700		1060		30600	
LEAD	0.4 U		0.77 B		9.8	
MAGNESIUM	1130		905		4210	
MANGANESE	59.3		62.8		191	
MERCURY	0.14 U		0.14 U		0.13 U	
NICKEL	4.6 B		2.8 B		31 K	
POTASSIUM	1380		1470		7290	
SELENIUM	2 U		2 U		2 U	
SILVER	0.5 U		0.5 U		0.5 U	
SODIUM	3110 B		6070		6320	
THALLIUM	2 U		2 U		2 U	
VANADIUM	1.1 K		2 K		76.4 K	
ZINC	16.9 B		18.3 B		129	
Inorganics, Filtered (ug/L)						
ALUMINUM		53.5 B		17.2 B		18.6 B
ANTIMONY		1 U		2.7 B		3.1 B
ARSENIC		2 U		2 U		2 U
BARIUM		25.3		21.8		22.9
BERYLLIUM		0.2 U		0.2 U		0.2 U
CADMIUM		0.2 U		0.2 U		0.2 U
CALCIUM		3800		2790		2760
CHROMIUM		0.75 K		0.4 U		0.64 K
COBALT		3.8 B		4 B		3.3 B
COPPER		1 U		1 U		2.6 B
IRON		223		23 U		23 U
LEAD		0.4 U		0.4 U		0.4 U
MAGNESIUM		1130		969		897
MANGANESE		62.7		61.2		61.5
MERCURY		0.15 U		0.13 U		0.11 U
NICKEL		4.4 B		2.6 B		3.4 B
POTASSIUM		1380		1280		1200
SELENIUM		2 U		2 U		2 U
SILVER		0.5 U		0.5 U		0.5 U
SODIUM		3090 B		2350 B		3070 B
THALLIUM		2 U		2 U		2 U
VANADIUM		0.3 U		0.37 K		0.3 U
ZINC		15 B		10.5 B		14.2 B

from tw33_sam.dbf
from tw33_res.dbf
from tw33_res.xls
from q:\sql_server\indian_head

order	001	002	003
location	S34SB001	S34SB001	S34SB001
matrix	SB	SB	SB
nsample	S34SB0010101	S34SB0010101-AVG	S34SB0010101-D
sample	S34SB0010101	S34SBDUP0101	S34SBDUP0101
sample_dat	01/30/02	01/30/02	01/30/02
depth_rang	4 - 4.5	4 - 4.5	4 - 4.5
cto_proj	325	325	325
sort	**c_001**	**c_002**	**c_003**
Explosives (mg/kg)			
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U
HMX	0.5 U	0.5 U	0.5 U
NITROBENZENE	0.25 U	0.25 U	0.25 U
NITROCELLULOSE	0.73 B	0.6 B	0.47 B
NITROGLYCERIN	2.5 U	2.5 U	2.5 U
NITROGUANIDINE	0.1 U	0.1 U	0.1 U
RDX	0.5 U	0.5 U	0.5 U
TETRYL	0.65 U	0.65 U	0.65 U
Inorganics (mg/kg)			
BERYLLIUM	0.65	0.565	0.48
COPPER	110	85.55	61.1

from sb34_sam.dbf
from sb34_res.dbf
from sb34_res.xls
from q:\sql_server\indian_head

tw34_res
full appendix results

order	001	002	003	004	005	006
location	S34TW001	S34TW001	S34TW002	S34TW002	S34TW003	S34TW003
matrix	GW	GW	GW	GW	GW	GW
nsample	S34TW0010001	S34TW0010001-F	S34TW0020001	S34TW0020001-F	S34TW0030001	S34TW0030001-F
sample	S34TW0010001	S34TW0010001-F	S34TW0020001	S34TW0020001-F	S34TW0030001	S34TW0030001-F
sample_dat	02/08/02	02/08/02	02/04/02	02/04/02	02/04/02	02/04/02
cto_proj	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**
Inorganics (ug/L)						
BERYLLIUM	1.6 K		0.2 U		1.2 K	
COPPER	1 U		1 U		3 K	
Inorganics, Filtered (ug/L)						
BERYLLIUM		1.7 K		0.2 U		1.1 K
COPPER		1 U		1 U		1 U

from tw34_sam.dbf
from tw34_res.dbf
from tw34_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	SB	SB	SB	SB	SB
nsample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02
depth_rang	2 - 4	4 - 6	2 - 4	2 - 4	4 - 6
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
Volatile Organics (ug/kg)					
1,1,1-TRICHLOROETHANE	13 U	11 U	10 U	10 U	10 U
1,1,2,2-TETRACHLOROETHANE	13 U	11 U	10 U	10 U	10 U
1,1,2-TRICHLOROETHANE	13 U	11 U	10 U	10 U	10 U
1,1,2-TRICHLOROTRIFLUOROETHANE	13 U	11 U	10 U	10 U	10 U
1,1-DICHLOROETHANE	13 U	11 U	10 U	10 U	10 U
1,1-DICHLOROETHENE	13 U	11 U	10 U	10 U	10 U
1,2,4-TRICHLOROBENZENE	13 U	11 U	10 U	10 U	10 U
1,2-DIBROMO-3-CHLOROPROPANE	13 U	11 U	10 U	10 U	10 U
1,2-DIBROMOETHANE	13 U	11 U	10 U	10 U	10 U
1,2-DICHLOROBENZENE	13 U	11 U	10 U	10 U	10 U
1,2-DICHLOROETHANE	13 U	11 U	10 U	10 U	10 U
1,2-DICHLOROPROPANE	13 U	11 U	10 U	10 U	10 U
1,3-DICHLOROBENZENE	13 U	11 U	10 U	10 U	10 U
1,4-DICHLOROBENZENE	13 U	11 U	10 U	10 U	10 U
2-BUTANONE	13 U	11 U	10 U	10 U	10 U
2-HEXANONE	13 U	11 U	10 U	10 U	10 U
4-METHYL-2-PENTANONE	13 U	11 U	10 U	10 U	10 U
ACETONE	4 J	18	10 U	2 J	10 U
BENZENE	13 U	11 U	10 U	10 U	10 U
BROMODICHLOROMETHANE	13 U	11 U	10 U	10 U	10 U
BROMOFORM	13 U	11 U	10 U	10 U	10 U
BROMOMETHANE	13 U	11 U	10 U	10 U	10 U
CARBON DISULFIDE	13 U	11 U	10 U	10 U	10 U
CARBON TETRACHLORIDE	13 U	11 U	10 U	10 U	10 U
CHLOROBENZENE	13 U	11 U	10 U	10 U	10 U
CHLORODIBROMOMETHANE	13 U	11 U	10 U	10 U	10 U
CHLOROETHANE	13 U	11 U	10 U	10 U	10 U
CHLOROFORM	13 U	11 U	10 U	10 U	10 U
CHLOROMETHANE	13 U	11 U	10 U	10 U	10 U
CIS-1,2-DICHLOROETHENE	13 U	11 U	10 U	10 U	10 U
CIS-1,3-DICHLOROPROPENE	13 U	11 U	10 U	10 U	10 U
CYCLOHEXANE	13 U	11 U	10 U	10 U	10 U
DICHLORODIFLUOROMETHANE	13 U	11 U	10 U	10 U	10 U
DIETHYL ETHER	13 U	11 U	10 U	10 U	10 U
ETHYLBENZENE	13 U	11 U	10 U	10 U	10 U
ISOPROPYLBENZENE	13 U	11 U	10 U	10 U	10 U
METHYL ACETATE	13 U	11 U	10 U	10 U	10 U
METHYL CYCLOHEXANE	13 U	11 U	10 U	10 U	10 U
METHYL TERT-BUTYL ETHER	13 U	11 U	10 U	10 U	10 U
METHYLENE CHLORIDE	13 U	11 U	10 U	10 U	10 U
STYRENE	13 U	11 U	10 U	10 U	10 U
TETRACHLOROETHENE	13 U	11 U	10 U	10 U	10 U
TOLUENE	13 U	11 U	10 U	10 U	10 U
TOTAL XYLENES	13 U	11 U	10 U	10 U	10 U
TRANS-1,2-DICHLOROETHENE	13 U	11 U	10 U	10 U	10 U
TRANS-1,3-DICHLOROPROPENE	13 U	11 U	10 U	10 U	10 U
TRICHLOROETHENE	13 U	11 U	10 U	10 U	10 U
TRICHLOROFLUOROMETHANE	13 U	11 U	10 U	10 U	10 U
VINYL CHLORIDE	13 U	11 U	10 U	10 U	10 U
Semivolatile Organics (ug/kg)					
1,1-BIPHENYL	340 U	380 U	350 UJ	350 U	370 U
2,2'-OXYBIS(1-CHLOROPROPANE)	340 U	380 U	350 UJ	350 U	370 U
2,4,5-TRICHLOROPHENOL	860 U	960 U	890 UJ	890 U	930 U
2,4,6-TRICHLOROPHENOL	340 U	380 U	350 UJ	350 U	370 U
2,4-DICHLOROPHENOL	340 U	380 U	350 UJ	350 U	370 U
2,4-DIMETHYLPHENOL	340 U	380 U	350 UJ	350 U	370 U
2,4-DINITROPHENOL	860 U	960 U	890 UJ	890 U	930 U
2-CHLORONAPHTHALENE	340 U	380 U	350 UJ	350 U	370 U
2-CHLOROPHENOL	340 U	380 U	350 UJ	350 U	370 U
2-METHYLNAPHTHALENE	78 J	380 U	350 UJ	350 U	97 J
2-METHYLPHENOL	340 U	380 U	350 UJ	350 U	370 U
2-NITROANILINE	860 U	960 U	890 UJ	890 U	930 U
2-NITROPHENOL	340 U	380 U	350 UJ	350 U	370 U
3,3'-DICHLOROBENZIDINE	340 U	380 U	350 UJ	350 U	370 U
3-NITROANILINE	860 U	960 U	890 UJ	890 U	930 U
4,6-DINITRO-2-METHYLPHENOL	860 U	960 U	890 UJ	890 U	930 U
4-BROMOPHENYL PHENYL ETHER	340 U	380 U	350 UJ	350 U	370 U
4-CHLORO-3-METHYLPHENOL	340 U	380 U	350 UJ	350 U	370 U
4-CHLOROANILINE	340 U	380 U	350 UJ	350 U	370 U

from sb37_sam.dbf
from sb37_res.dbf
from sb37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	SB	SB	SB	SB	SB
nsample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02
depth_rang	2 - 4	4 - 6	2 - 4	2 - 4	4 - 6
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
4-CHLOROPHENYL PHENYL ETHER	340 U	380 U	350 UJ	350 U	370 U
4-METHYLPHENOL	340 U	380 U	350 UJ	350 U	370 U
4-NITROANILINE	860 U	960 U	890 UJ	890 U	930 U
4-NITROPHENOL	860 U	960 U	890 UJ	890 U	930 U
ACENAPHTHENE	340 U	380 U	350 UJ	350 U	370 U
ACENAPHTHYLENE	340 U	380 U	350 UJ	350 U	370 U
ACETOPHENONE	340 U	380 U	70 B	350 U	370 U
ANTHRACENE	340 U	380 U	350 UJ	350 U	370 U
ATRAZINE	340 U	380 U	350 UJ	350 U	370 U
BENZALDEHYDE	340 U	380 U	350 UJ	350 U	370 U
BENZO(A)ANTHRACENE	340 U	380 U	41 J	350 U	370 U
BENZO(A)PYRENE	340 U	380 U	350 UJ	350 U	370 U
BENZO(B)FLUORANTHENE	340 U	380 U	110 J	350 U	370 U
BENZO(G,H,I)PERYLENE	340 U	380 U	350 UJ	350 U	370 U
BENZO(K)FLUORANTHENE	340 U	380 U	44 J	350 U	370 U
BIS(2-CHLOROETHOXY)METHANE	340 U	380 U	350 UJ	350 U	370 U
BIS(2-CHLOROETHYL)ETHER	340 U	380 U	350 UJ	350 U	370 U
BIS(2-ETHYLHEXYL)PHTHALATE	68 B	94 B	64 B	48 B	51 B
BUTYL BENZYL PHTHALATE	340 U	380 U	350 UJ	350 U	370 U
CAPROLACTAM	340 U	380 U	350 UJ	350 U	370 U
CARBAZOLE	340 U	380 U	350 UJ	350 U	370 U
CHRYSENE	340 U	380 U	70 J	350 U	370 U
DI-N-BUTYL PHTHALATE	340 U	380 U	350 UJ	350 U	370 U
DI-N-OCTYL PHTHALATE	340 U	380 U	350 UJ	350 U	370 U
DIBENZO(A,H)ANTHRACENE	340 U	380 U	350 UJ	350 U	370 U
DIBENZOFURAN	340 U	380 U	350 UJ	350 U	370 U
DIETHYL PHTHALATE	340 U	380 U	350 UJ	350 U	370 U
DIMETHYL PHTHALATE	340 U	380 U	350 UJ	350 U	370 U
FLUORANTHENE	340 U	380 U	87 J	350 U	86 J
FLUORENE	340 U	380 U	350 UJ	350 U	370 U
HEXACHLOROBENZENE	340 U	380 U	350 UJ	350 U	370 U
HEXACHLOROBUTADIENE	340 U	380 U	350 UJ	350 U	370 U
HEXACHLOROCYCLOPENTADIENE	340 U	380 U	350 UJ	350 U	370 U
HEXACHLOROETHANE	340 U	380 U	350 UJ	350 U	370 U
INDENO(1,2,3-CD)PYRENE	340 U	380 U	350 UJ	350 U	370 U
ISOPHORONE	340 U	380 U	350 UJ	350 U	370 U
N-NITROSO-DI-N-PROPYLAMINE	340 UR	380 U	350 UJ	350 U	370 U
N-NITROSODIPHENYLAMINE	340 U	380 UR	350 UR	350 UR	370 UR
NAPHTHALENE	340 U	380 U	350 UJ	350 U	370 U
PENTACHLOROPHENOL	860 U	960 U	890 UJ	890 U	930 U
PHENANTHRENE	340 U	380 U	41 J	350 U	370 U
PHENOL	340 U	380 U	350 UJ	350 U	370 U
PYRENE	340 U	380 U	99 J	350 U	86 J
Pesticides/PCBs (ug/kg)					
4,4'-DDD	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
4,4'-DDE	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
4,4'-DDT	3.4 U	3.9	4.7	3.6 U	3.7 U
ALDRIN	1.8 U	2 U	1.8 U	1.8 U	1.9 U
ALPHA-BHC	1.8 U	2 U	1.8 U	1.8 U	1.9 U
ALPHA-CHLORDANE	1.8 U	2 U	1.8 U	1.8 U	1.9 U
AROCLOR-1016	34 U	38 U	35 U	36 U	37 U
AROCLOR-1221	69 U	77 U	72 U	73 U	75 U
AROCLOR-1232	34 U	38 U	35 U	36 U	37 U
AROCLOR-1242	34 U	38 U	35 U	36 U	37 U
AROCLOR-1248	34 U	38 U	35 U	36 U	37 U
AROCLOR-1254	34 U	38 U	35 U	36 U	37 U
AROCLOR-1260	34 U	38 U	35 U	36 U	37 U
BETA-BHC	1.8 U	2 U	1.8 U	1.8 U	1.9 U
DELTA-BHC	1.8 U	2 U	1.8 U	1.8 U	1.9 U
DIELDRIN	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
ENDOSULFAN I	1.8 U	2 U	1.8 U	1.8 U	1.9 U
ENDOSULFAN II	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
ENDOSULFAN SULFATE	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
ENDRIN	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
ENDRIN ALDEHYDE	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
ENDRIN KETONE	3.4 U	3.8 U	3.5 U	3.6 U	3.7 U
GAMMA-BHC (LINDANE)	1.8 U	2 U	1.8 U	1.8 U	1.9 U
GAMMA-CHLORDANE	1.8 U	2 U	1.8 U	1.8 U	1.9 U
HEPTACHLOR	1.8 U	2 U	1.8 U	1.8 U	1.9 U
HEPTACHLOR EPOXIDE	1.8 U	2 U	1.8 U	1.8 U	1.9 U

from sb37_sam.dbf
from sb37_res.dbf
from sb37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	SB	SB	SB	SB	SB
nsample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample	S37SB0010101	S37SB0010201	S37SB0020101	S37SB0030101	S37SB0030201
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02
depth_rang	2 - 4	4 - 6	2 - 4	2 - 4	4 - 6
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
METHOXYCHLOR	18 U	20 U	18 U	18 U	19 U
TOXAPHENE	180 U	200 U	180 U	180 U	190 U
Explosives (mg/kg)					
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
NITROCELLULOSE	0.59 B	0.63 B	0.6 B	0.47 B	0.64 B
NITROGLYCERIN	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
NITROGUANIDINE	0.1 U	0.1 U	0.1 U	0.1 U	0.19 U
RDX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Inorganics (mg/kg)					
ALUMINUM	382 J	554 J	3410 J	3900 J	1010 J
ANTIMONY	0.17 UL	0.16 UL	0.19 UL	0.2 UL	0.15 UL
ARSENIC	0.8 K	0.87 K	2.6 K	4.3 K	1.1 K
BARIUM	5.5	5.9	8.6	13.4	6.1
BERYLLIUM	0.095 K	0.093 K	0.12 K	0.13 K	0.084 K
CADMIUM	0.1 K	0.031 U	0.038 U	0.039 U	0.031 U
CALCIUM	78.5	571	2040	25.7	148
CHROMIUM	2.8 K	4.1	15	9.2	3.4 K
COBALT	0.79 B	0.7 B	3.7 K	4.7 K	1.1 K
COPPER	1.8 K	2.4 K	14.7	5.6 K	3.6 K
IRON	2600 J	3030 J	8970 J	11200 J	3550 J
LEAD	15.5	8.2	22.9	13.5	7.2
MAGNESIUM	56.5 B	112	2530	133	95.3
MANGANESE	60.4	28.8	76.6	108	53.2
MERCURY	0.025 U	0.024 U	0.023 U	0.027 U	0.027 U
NICKEL	3.8 K	3.8 K	16.1	3.1 K	4 K
POTASSIUM	61.6 B	82.5 B	186	182	70.9 B
SELENIUM	0.34 U	0.31 U	0.38 U	0.39 U	0.31 U
SILVER	0.084 U	0.079 U	0.096 U	0.098 U	0.077 U
SODIUM	52.3 B	58.3 B	821	47.9 B	34.5 B
THALLIUM	0.34 U	0.31 U	0.38 U	0.39 U	0.31 U
VANADIUM	4 K	4.1 K	17.5 K	15 K	4.9 K
ZINC	9.1	8.2	14.7	9.6	8.6

from sb37_sam.dbf
from sb37_res.dbf
from sb37_res.xls
from q:\sql_server\indian_head

tw37_res -
full appendix results

order	001	002	003	004	005	006	007	008	009	010
location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
nsample	S37TW0010001	S37TW0010001-AVG	S37TW0010001-D	S37TW0010001-F	S37TW0010001-F-AVG	S37TW0010001-F-D	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample	S37TW0010001	S37TWDUP001	S37TWDUP001	S37TW0010001-F	S37TWDUP001-F	S37TWDUP001-F	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/06/02	02/08/02	02/06/02	02/08/02
cto_proj	325	325	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
Volatile Organics (ug/L)										
1,1,1-TRICHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
1,1,2-TRICHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
1,1-DICHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
1,1-DICHLOROETHENE	1 U	1 U	1 U				1 U		1 U	
1,2,4-TRICHLOROBENZENE	1 U	1 U	1 U				1 U		1 U	
1,2-DIBROMO-3-CHLOROPROPANE	1 U	1 U	1 U				1 U		1 U	
1,2-DIBROMOETHANE	1 U	1 U	1 U				1 U		1 U	
1,2-DICHLOROBENZENE	1 U	1 U	1 U				1 U		1 U	
1,2-DICHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
1,2-DICHLOROPROPANE	1 U	1 U	1 U				1 U		1 U	
1,3-DICHLOROBENZENE	1 U	1 U	1 U				1 U		1 U	
1,4-DICHLOROBENZENE	1 U	1 U	1 U				1 U		1 U	
2-BUTANONE	5 UR	5 UR	5 UR				5 UR		5 UR	
2-HEXANONE	5 U	5 U	5 U				5 U		5 U	
4-METHYL-2-PENTANONE	5 U	5 U	5 U				5 U		5 U	
ACETONE	5 UR	5 UR	5 UR				5 UR		5 UR	
BENZENE	1 U	1 U	1 U				1 U		1 U	
BROMOCHLOROMETHANE	1 U	1 U	1 U				1 U		1 U	
BROMODICHLOROMETHANE	1 U	1 U	1 U				1 U		1 U	
BROMOFORM	1 U	1 U	1 U				1 U		1 U	
BROMOMETHANE	1 U	1 U	1 U				1 U		1 U	
CARBON DISULFIDE	1 U	1 U	1 U				1 U		1 U	
CARBON TETRACHLORIDE	1 U	1 U	1 U				1 U		1 U	
CHLOROBENZENE	1 U	1 U	1 U				1 U		1 U	
CHLORODIBROMOMETHANE	1 U	1 U	1 U				1 U		1 U	
CHLOROETHANE	1 U	1 U	1 U				1 U		1 U	
CHLOROFORM	1 U	1 U	1 U				1 U		1 U	
CHLOROMETHANE	1 U	1 U	1 U				1 U		1 U	
CIS-1,2-DICHLOROETHENE	1 U	1 U	1 U				1 U		1 U	
CIS-1,3-DICHLOROPROPENE	1 U	1 U	1 U				1 U		1 U	
DIETHYL ETHER	1 U	1 U	1 U				1 U		1 U	
ETHYLBENZENE	1 U	1 U	1 U				1 U		1 U	
METHYLENE CHLORIDE	2 U	2 U	2 U				2 U		2 U	
STYRENE	1 U	1 U	1 U				1 U		1 U	
TETRACHLOROETHENE	1 U	1 U	1 U				1 U		1 U	
TOLUENE	1 U	1 U	1 U				1 U		1 U	
TOTAL XYLENES	1 U	1 U	1 U				2		1 U	
TRANS-1,2-DICHLOROETHENE	1 U	1 U	1 U				1 U		1 U	
TRANS-1,3-DICHLOROPROPENE	1 U	1 U	1 U				1 U		1 U	
TRICHLOROETHENE	1 U	1 U	1 U				1 U		1 U	
VINYL CHLORIDE	1 U	1 U	1 U				1 U		1 U	
Semivolatile Organics (ug/L)										
2,2'-OXYBIS(1-CHLOROPROPANE)	5 U	5 U	5 U				5 U		5 U	
2,4,5-TRICHLOROPHENOL	20 U	20 U	20 U				20 U		20 U	
2,4,6-TRICHLOROPHENOL	5 U	5 U	5 U				5 U		5 U	

from tw37_sam.dbf
from tw37_res.dbf
from tw37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005	006	007	008	009	010
location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
nsample	S37TW0010001	S37TW0010001-AVG	S37TW0010001-D	S37TW0010001-F	S37TW0010001-F-AVG	S37TW0010001-F-D	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample	S37TW0010001	S37TWDUP001	S37TWDUP001	S37TW0010001-F	S37TWDUP001-F	S37TWDUP001-F	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/06/02	02/08/02	02/06/02	02/08/02
cto_proj	325	325	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
2,4-DICHLOROPHENOL	5 U	5 U	5 U				5 U		5 U	
2,4-DIMETHYLPHENOL	5 U	5 U	5 U				5 U		5 U	
2,4-DINITROPHENOL	20 U	20 U	20 U				20 U		20 U	
2,4-DINITROTOLUENE							5 U		5 U	
2,6-DINITROTOLUENE							5 U		5 U	
2-CHLORONAPHTHALENE	5 U	5 U	5 U				5 U		5 U	
2-CHLOROPHENOL	5 U	5 U	5 U				5 U		5 U	
2-METHYLNAPHTHALENE	5 U	5 U	5 U				6		5 U	
2-METHYLPHENOL	5 U	5 U	5 U				5 U		5 U	
2-NITROANILINE	20 U	20 U	20 U				20 U		20 U	
2-NITROPHENOL	5 U	5 U	5 U				5 U		5 U	
3,3'-DICHLOROBENZIDINE	5 U	5 U	5 U				5 U		5 U	
3-NITROANILINE	20 U	20 U	20 U				20 U		20 U	
4,6-DINITRO-2-METHYLPHENOL	20 U	20 U	20 U				20 U		20 U	
4-BROMOPHENYL PHENYL ETHER	5 U	5 U	5 U				5 U		5 U	
4-CHLORO-3-METHYLPHENOL	5 U	5 U	5 U				5 U		5 U	
4-CHLOROANILINE	5 U	5 U	5 U				5 U		5 U	
4-CHLOROPHENYL PHENYL ETHER	5 U	5 U	5 U				5 U		5 U	
4-METHYLPHENOL	5 U	5 U	5 U				5 U		5 U	
4-NITROANILINE	20 U	20 U	20 U				20 U		20 U	
4-NITROPHENOL	20 U	20 U	20 U				20 U		20 U	
ACENAPHTHENE	5 U	5 U	5 U				2 J		5 U	
ACENAPHTHYLENE	5 U	5 U	5 U				5 U		5 U	
ANTHRACENE	5 U	5 U	5 U				5 U		5 U	
BENZO(A)ANTHRACENE	5 U	5 U	5 U				5 U		5 U	
BENZO(A)PYRENE	5 U	5 U	5 U				5 U		5 U	
BENZO(B)FLUORANTHENE	5 U	5 U	5 U				5 U		5 U	
BENZO(G,H,I)PERYLENE	5 U	5 U	5 U				5 U		5 U	
BENZO(K)FLUORANTHENE	5 U	5 U	5 U				5 U		5 U	
BIS(2-CHLOROETHOXY)METHANE	5 U	5 U	5 U				5 U		5 U	
BIS(2-CHLOROETHYL)ETHER	5 U	5 U	5 U				5 U		5 U	
BIS(2-ETHYLHEXYL)PHTHALATE	5 U	2 J	2 J				5 U		5 U	
BUTYL BENZYL PHTHALATE	5 U	5 U	5 U				5 U		5 U	
CHRYSENE	5 U	5 U	5 U				5 U		5 U	
DI-N-BUTYL PHTHALATE	5 U	5 U	5 U				5 U		5 U	
DI-N-OCTYL PHTHALATE	5 U	5 U	5 U				5 U		5 U	
DIBENZO(A,H)ANTHRACENE	5 U	5 U	5 U				5 U		5 U	
DIBENZOFURAN	5 U	5 U	5 U				5 U		5 U	
DIETHYL PHTHALATE	5 U	5 U	5 U				5 U		5 U	
DIMETHYL PHTHALATE	5 U	5 U	5 U				5 U		5 U	
FLUORANTHENE	5 U	5 U	5 U				5 U		5 U	
FLUORENE	5 U	5 U	5 U				3 J		5 U	
HEXACHLOROBENZENE	5 U	5 U	5 U				5 U		5 U	
HEXACHLOROBUTADIENE	5 U	5 U	5 U				5 U		5 U	
HEXACHLOROCYCLOPENTADIENE	5 U	5 U	5 U				5 U		5 U	
HEXACHLOROETHANE	5 U	5 U	5 U				5 U		5 U	
INDENO(1,2,3-CD)PYRENE	5 U	5 U	5 U				5 U		5 U	

from tw37_sam.dbf
from tw37_res.dbf
from tw37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005	006	007	008	009	010
location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
nsample	S37TW0010001	S37TW0010001-AVG	S37TW0010001-D	S37TW0010001-F	S37TW0010001-F-AVG	S37TW0010001-F-D	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample	S37TW0010001	S37TWDUP001	S37TWDUP001	S37TW0010001-F	S37TWDUP001-F	S37TWDUP001-F	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/06/02	02/08/02	02/06/02	02/08/02
cto_proj	325	325	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
ISOPHORONE	5 U	5 U	5 U				5 U		5 U	
N-NITROSO-DI-N-PROPYLAMINE	5 U	5 U	5 U				5 U		5 U	
N-NITROSODIPHENYLAMINE	5 U	5 U	5 U				5 U		5 U	
NAPHTHALENE	5 U	5 U	5 U				10		5 U	
NITROBENZENE							5 U		5 U	
PENTACHLOROPHENOL	20 U	20 U	20 U				20 U		20 U	
PHENANTHRENE	5 U	5 U	5 U				4 J		5 U	
PHENOL	5 U	5 U	5 U				5 U		5 U	
PYRENE	5 U	5 U	5 U				5 U		5 U	
Pesticides/PCBs (ug/L)										
4,4'-DDD	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
4,4'-DDE	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
4,4'-DDT	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
ALDRIN	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
ALPHA-BHC	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
ALPHA-CHLORDANE	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
AROCLOR-1016	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
AROCLOR-1221	0.4 U	0.4 U	0.4 U				0.4 U		0.4 U	
AROCLOR-1232	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
AROCLOR-1242	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
AROCLOR-1248	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
AROCLOR-1254	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
AROCLOR-1260	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
BETA-BHC	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
DELTA-BHC	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
DIELDRIN	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
ENDOSULFAN I	0.01 U	0.01 U	0.01 U				0.01 UJ		0.01 U	
ENDOSULFAN II	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
ENDOSULFAN SULFATE	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
ENDRIN	0.02 U	0.02 U	0.02 U				0.02 UJ		0.02 U	
ENDRIN ALDEHYDE	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
ENDRIN KETONE	0.02 U	0.02 U	0.02 U				0.02 U		0.02 U	
GAMMA-BHC (LINDANE)	0.01 U	0.01 U	0.01 U				0.01 UJ		0.01 U	
GAMMA-CHLORDANE	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
HEPTACHLOR	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
HEPTACHLOR EPOXIDE	0.01 U	0.01 U	0.01 U				0.01 U		0.01 U	
METHOXYCHLOR	0.1 U	0.1 U	0.1 U				0.1 U		0.1 U	
TOXAPHENE	1 U	1 U	1 U				1 U		1 U	
Explosives (ug/L)										
1,3,5-TRINITROBENZENE	0.2 U	0.2 U	0.2 U				1.4 U		0.2 U	
1,3-DINITROBENZENE	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
2,4,6-TRINITROTOLUENE	0.2 U	0.2 U	0.2 U				0.39 U		0.2 U	
2,4-DINITROTOLUENE	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
2,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
2-AMINO-4,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U				1.8 U		0.2 U	
2-NITROTOLUENE	0.2 U	0.2 U	0.2 U				1.1 U		0.2 U	
3-NITROTOLUENE	0.2 U	0.2 U	0.2 U				2.1 U		1.1 U	

from tw37_sam.dbf
from tw37_res.dbf
from tw37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005	006	007	008	009	010
location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
nsample	S37TW0010001	S37TW0010001-AVG	S37TW0010001-D	S37TW0010001-F	S37TW0010001-F-AVG	S37TW0010001-F-D	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample	S37TW0010001	S37TWDUP001	S37TWDUP001	S37TW0010001-F	S37TWDUP001-F	S37TWDUP001-F	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/06/02	02/08/02	02/06/02	02/08/02
cto_proj	325	325	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
4-AMINO-2,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U				0.41 U		0.2 U	
4-NITROTOLUENE	0.2 U	0.2 U	0.2 U				0.92 U		0.2 U	
HMX	0.5 U	0.5 U	0.5 U				0.5 U		0.5 U	
NITROBENZENE	0.2 U	0.2 U	0.2 U				0.2 U		0.087 J	
NITROCELLULOSE	500 U	500 U	500 U				500 U		500 U	
NITROGLYCERIN	2.5 U	2.5 U	2.5 U				2.5 U		2.5 U	
NITROGUANIDINE	20 U	20 U	20 U				20 U		20 U	
RDX	0.5 U	0.5 U	0.5 U				1.2		0.5 U	
TETRYL	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
Inorganics (ug/L)										
ALUMINUM	214	153.25	92.5				14.9 B		11.5 B	
ANTIMONY	1.6 B	1.5 B	1.4 B				1.6 B		4.5 B	
ARSENIC	6.1 K	5.95 K	5.8 K				2 U		2 U	
BARIUM	149 J	153 J	157 J				299		92.1 J	
BERYLLIUM	0.2 U	0.2 U	0.2 U				0.2 U		0.2 U	
CADMIUM	0.41 K	0.435 K	0.46 K				0.2 UL		0.2 UL	
CALCIUM	94600	97250	99900				231000		131000	
CHROMIUM	1 B	0.885 B	0.77 B				0.4 U		0.4 U	
COBALT	4.7 K	4.7 K	4.7 K				0.43 B		1.2 B	
COPPER	1 U	1 U	1 U				1 UL		1 UL	
IRON	10500	10750	11000				444		194	
LEAD	0.4 U	0.4 U	0.4 U				0.4 U		0.4 U	
MAGNESIUM	24900 J	25500 J	26100 J				13900		47400	
MANGANESE	2840 J	2910 J	2980 J				183		56.7	
MERCURY	0.07 U	0.0695 U	0.069 U				0.14 U		0.14 U	
NICKEL	4.7 B	4.6 B	4.5 B				2.1 B		10.8 B	
POTASSIUM	6660 J	6720 J	6780 J				4400		7640	
SELENIUM	2.5 K	2.95 K	3.4 K				3.1 J		2 UL	
SILVER	0.5 U	0.5 U	0.5 U				0.5 UL		0.86 J	
SODIUM	155000	156500	158000				72900		216000	
THALLIUM	2 U	2 U	2 U				2 UL		2 UL	
VANADIUM	0.3 U	0.3 U	0.3 U				0.3 U		0.3 K	
ZINC	5.7 B	4.4 B	3.1 B				2 UL		2 UL	
Inorganics, Filtered (ug/L)										
ALUMINUM				18.9	21.15	23.4		55.5 B		31.8 B
ANTIMONY				2.9 B	2.2 B	1.5 B		3.5 B		1.2 B
ARSENIC				2 U	2 U	2 U		2 U		3.2 K
BARIUM				127 J	129 J	131 J		134		229
BERYLLIUM				0.2 U	0.2 U	0.2 U		0.2 U		0.2 U
CADMIUM				0.2 U	0.2 U	0.2 U		0.98 J		0.76 J
CALCIUM				91700	92150	92600		171000		149000
CHROMIUM				0.86 B	0.815 B	0.77 B		0.66 K		0.4 U
COBALT				4.3 B	4.2 B	4.1 B		11.4 K		2.5 B
COPPER				1 U	1 U	1 U		1 UL		1 UL
IRON				3260	2775	2290		15100		12700
LEAD				0.4 U	0.4 U	0.4 U		0.4 U		0.4 U
MAGNESIUM				23800 J	24050 J	24300 J		34900		26500

from tw37_sam.dbf
from tw37_res.dbf
from tw37_res.xls
from q:\sql_server\indian_head

tw37_res -
full appendix results

order	001	002	003	004	005	006	007	008	009	010
location	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB001/TW001	S37SB002/TW002	S37SB002/TW002	S37SB003/TW003	S37SB003/TW003
matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
nsample	S37TW0010001	S37TW0010001-AVG	S37TW0010001-D	S37TW0010001-F	S37TW0010001-F-AVG	S37TW0010001-F-D	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample	S37TW0010001	S37TWDUP001	S37TWDUP001	S37TW0010001-F	S37TWDUP001-F	S37TWDUP001-F	S37TW0020001	S37TW0020001-F	S37TW0030001	S37TW0030001-F
sample_dat	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/05/02	02/06/02	02/08/02	02/06/02	02/08/02
cto_proj	325	325	325	325	325	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
MANGANESE				2660 J	2700 J	2740 J		3310		2050
MERCURY				0.072 U	0.071 U	0.07 U		0.14 U		0.11 U
NICKEL				4.5 B	4.25 B	4 B		14.9 K		5.6 B
POTASSIUM				6470 J	6550 J	6630 J		4570		6470
SELENIUM				2 U	2 U	2 U		2 UL		2 UL
SILVER				0.71 B	0.81 B	0.91 B		0.5 UL		0.5 UL
SODIUM				153000	153000	153000		321000		717000
THALLIUM				2 U	2 U	2 U		2 UL		2 UL
VANADIUM				0.3 U	0.3 U	0.3 U		0.3 U		0.3 U
ZINC				2 U	2 U	2 U		29.4 B		9.8 B

from tw37_sam.dbf
from tw37_res.dbf
from tw37_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
matrix	SW	SW	SW	SW	SW
nsample	S37SW0010001	S37SW0010001-AVG	S37SW0010001-D	S37SW0020001	S37SW0030001
sample	S37SW0010001	FD01310202	FD01310202	S37SW0020001	S37SW0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
Volatile Organics (ug/L)					
1,1,1-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	1 U	1 U	1 U	1 U	1 U
1,1,2-TRICHLOROETHANE	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHANE	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROETHENE	1 U	1 U	1 U	1 U	1 U
1,2,4-TRICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMO-3-CHLOROPROPANE	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMOETHANE	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROPROPANE	1 U	1 U	1 U	1 U	1 U
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U
2-BUTANONE	5 U	5 U	5 U	5 U	5 UR
2-HEXANONE	5 U	5 U	5 U	5 U	5 U
4-METHYL-2-PENTANONE	5 U	5 U	5 U	5 U	5 U
ACETONE	5 UR	5 UR	5 UR	5 UR	5 UR
BENZENE	1 U	1 U	1 U	1 U	1 U
BROMOCHLOROMETHANE	1 U	1 U	1 U	1 U	1 U
BROMODICHLOROMETHANE	1 U	1 U	1 U	1 U	1 U
BROMOFORM	1 U	1 U	1 U	1 U	1 U
BROMOMETHANE	1 U	1 U	1 U	1 U	1 U
CARBON DISULFIDE	1 U	1 U	1 U	1 U	1 U
CARBON TETRACHLORIDE	1 U	1 U	1 U	1 U	1 U
CHLOROBENZENE	1 U	1 U	1 U	1 U	1 U
CHLORODIBROMOMETHANE	1 U	1 U	1 U	1 U	1 U
CHLOROETHANE	1 U	1 U	1 U	1 U	1 U
CHLOROFORM	1 U	1 U	1 U	1 U	1 U
CHLOROMETHANE	1 U	1 U	1 U	1 U	1 U
CIS-1,2-DICHLOROETHENE	1 U	1 U	1 U	1 U	1 U
CIS-1,3-DICHLOROPROPENE	1 U	1 U	1 U	1 U	1 U
DIETHYL ETHER	1 U	1 U	1 U	1 U	1 U
ETHYLBENZENE	1 U	1 U	1 U	1 U	1 U
METHYLENE CHLORIDE	2 U	2 U	2 U	2 U	2 U
STYRENE	1 U	1 U	1 U	1 U	1 U
TETRACHLOROETHENE	1 U	1 U	1 U	1 U	1 U
TOLUENE	1 U	1 U	1 U	1 U	1 U
TOTAL XYLENES	1 U	1 U	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE	1 U	1 U	1 U	1 U	1 U
TRANS-1,3-DICHLOROPROPENE	1 U	1 U	1 U	1 U	1 U
TRICHLOROETHENE	1 U	1 U	1 U	1 U	1 U
VINYL CHLORIDE	1 U	1 U	1 U	1 U	1 U
Semivolatile Organics (ug/L)					
2,2'-OXYBIS(1-CHLOROPROPANE)	5 U	5 U	5 U	5 U	5 U
2,4,5-TRICHLOROPHENOL	20 U	20 U	20 U	20 U	20 U
2,4,6-TRICHLOROPHENOL	5 U	5 U	5 U	5 U	5 U
2,4-DICHLOROPHENOL	5 U	5 U	5 U	5 U	5 U
2,4-DIMETHYLPHENOL	5 U	5 U	5 U	5 U	5 U
2,4-DINITROPHENOL	20 U	20 U	20 U	20 U	20 U
2-CHLORONAPHTHALENE	5 U	5 U	5 U	5 U	5 U
2-CHLOROPHENOL	5 U	5 U	5 U	5 U	5 U
2-METHYLNAPHTHALENE	2 J	2 J	5 U	5 U	5 U
2-METHYLPHENOL	5 U	5 U	5 U	5 U	5 U
2-NITROANILINE	20 U	20 U	20 U	20 U	20 U
2-NITROPHENOL	5 U	5 U	5 U	5 U	5 U
3,3'-DICHLOROBENZIDINE	5 U	5 U	5 U	5 U	5 U
3-NITROANILINE	20 U	20 U	20 U	20 U	20 U
4,6-DINITRO-2-METHYLPHENOL	20 U	20 U	20 U	20 U	20 U
4-BROMOPHENYL PHENYL ETHER	5 U	5 U	5 U	5 U	5 U
4-CHLORO-3-METHYLPHENOL	5 U	5 U	5 U	5 U	5 U
4-CHLOROANILINE	5 U	5 U	5 U	5 U	5 U
4-CHLOROPHENYL PHENYL ETHER	5 U	5 U	5 U	5 U	5 U
4-METHYLPHENOL	5 U	5 U	5 U	5 U	3 J
4-NITROANILINE	20 U	20 U	20 U	20 U	20 U
4-NITROPHENOL	20 U	20 U	20 U	20 U	20 U
ACENAPHTHENE	5 U	5 U	5 U	5 U	5 U
ACENAPHTHYLENE	5 U	5 U	5 U	5 U	5 U
ANTHRACENE	5 U	5 U	5 U	5 U	5 U
BENZO(A)ANTHRACENE	5 U	5 U	5 U	5 U	5 U
BENZO(A)PYRENE	5 U	5 U	5 U	5 U	5 U

from sw_sam.dbf
from sw_res.dbf
from sw_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
matrix	SW	SW	SW	SW	SW
nsample	S37SW0010001	S37SW0010001-AVG	S37SW0010001-D	S37SW0020001	S37SW0030001
sample	S37SW0010001	FD01310202	FD01310202	S37SW0020001	S37SW0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
BENZO(B)FLUORANTHENE	5 U	5 U	5 U	5 U	5 U
BENZO(G,H,I)PERYLENE	5 U	5 U	5 U	5 U	5 U
BENZO(K)FLUORANTHENE	5 U	5 U	5 U	5 U	5 U
BIS(2-CHLOROETHOXY)METHANE	5 U	5 U	5 U	5 U	5 U
BIS(2-CHLOROETHYL)ETHER	5 U	5 U	5 U	5 U	5 U
BIS(2-ETHYLHEXYL)PHTHALATE	5 U	5 U	5 U	5 U	5 U
BUTYL BENZYL PHTHALATE	5 U	5 U	5 U	5 U	5 U
CHRYSENE	5 U	5 U	5 U	5 U	5 U
DI-N-BUTYL PHTHALATE	5 U	5 U	5 U	5 U	5 U
DI-N-OCTYL PHTHALATE	5 U	5 U	5 U	5 U	5 U
DIBENZO(A,H)ANTHRACENE	5 U	5 U	5 U	5 U	5 U
DIBENZOFURAN	5 U	5 U	5 U	5 U	5 U
DIETHYL PHTHALATE	5 U	5 U	5 U	5 U	5 U
DIMETHYL PHTHALATE	5 U	5 U	5 U	5 U	5 U
FLUORANTHENE	5 U	5 U	5 U	5 U	5 U
FLUORENE	5 U	5 U	5 U	5 U	5 U
HEXACHLOROBENZENE	5 U	5 U	5 U	5 U	5 U
HEXACHLOROBUTADIENE	5 U	5 U	5 U	5 U	5 U
HEXACHLOROCYCLOPENTADIENE	5 U	5 U	5 U	5 U	5 U
HEXACHLOROETHANE	5 U	5 U	5 U	5 U	5 U
INDENO(1,2,3-CD)PYRENE	5 U	5 U	5 U	5 U	5 U
ISOPHORONE	5 U	5 U	5 U	5 U	5 U
N-NITROSO-DI-N-PROPYLAMINE	5 U	5 U	5 U	5 U	5 U
N-NITROSODIPHENYLAMINE	5 U	5 U	5 U	5 U	5 U
NAPHTHALENE	5	5	5 U	5 U	5 U
PENTACHLOROPHENOL	20 U	20 U	20 U	20 U	20 U
PHENANTHRENE	5 U	5 U	5 U	5 U	5 U
PHENOL	5 U	2 J	2 J	5 U	5 U
PYRENE	5 U	5 U	5 U	5 U	5 U
Pesticides/PCBs (ug/L)					
4,4'-DDD	0.02 U	0.02 U	0.02 U	0.02 U	0.032
4,4'-DDE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDT	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ALDRIN	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ALPHA-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ALPHA-CHLORDANE	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
AROCLOR-1016	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
AROCLOR-1221	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
AROCLOR-1232	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
AROCLOR-1242	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
AROCLOR-1248	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
AROCLOR-1254	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
AROCLOR-1260	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BETA-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DELTA-BHC	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
DIELDRIN	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDOSULFAN I	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
ENDOSULFAN II	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDOSULFAN SULFATE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDRIN	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDRIN ALDEHYDE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
ENDRIN KETONE	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
GAMMA-BHC (LINDANE)	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
GAMMA-CHLORDANE	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
HEPTACHLOR EPOXIDE	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
METHOXYCHLOR	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
TOXAPHENE	1 U	1 U	1 U	1 U	1 U
Explosives (ug/L)					
1,3,5-TRINITROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-DINITROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4,6-TRINITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,4-DINITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-AMINO-4,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-NITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
3-NITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-AMINO-2,6-DINITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
4-NITROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
HMX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
NITROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

from sw_sam.dbf
from sw_res.dbf
from sw_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
matrix	SW	SW	SW	SW	SW
nsample	S37SW0010001	S37SW0010001-AVG	S37SW0010001-D	S37SW0020001	S37SW0030001
sample	S37SW0010001	FD01310202	FD01310202	S37SW0020001	S37SW0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
cto_proj	325	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
NITROCELLULOSE	500 U	500 U	500 U	500 U	500 U
NITROGLYCERIN	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
NITROGUANIDINE	20 U	20 U	20 U	20 U	20 U
RDX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TETRYL	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Inorganics (ug/L)					
ALUMINUM	91.9 B	95.7 B	99.5 B	134 B	1350
ANTIMONY	3.4 B	2.35 B	1.3 B	3.5 B	1 U
ARSENIC	2 U	2 U	2 U	2 U	2 U
BARIUM	74.4 J	74.3 J	74.2 J	73.7 J	124 J
BERYLLIUM	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CADMIUM	0.21 K	0.225 K	0.24 K	0.27 K	0.41 K
CALCIUM	72200	71900	71600	70600	17300
CHROMIUM	0.5 U	0.85 B	1.2 B	0.5 U	1.9 B
COBALT	1.1 B	1.1 B	1.1 B	0.99 B	29.6 K
COPPER	4.8 B	4.8 B	4.8 B	6.1 B	1 U
IRON	124 B	139.5 B	155 B	140 B	9080
LEAD	0.4 U	0.4 U	0.4 U	0.4 U	9.1
MAGNESIUM	127000 J	126500 J	126000 J	124000 J	12900 J
MANGANESE	61 J	62.45 J	63.9 J	61.5 J	2430 J
MERCURY	0.067 U	0.0665 U	0.066 U	0.07 U	0.071 U
NICKEL	2.4 B	2.25 B	2.1 B	2.3 B	10.3 K
POTASSIUM	54400 J	54500 J	54600 J	50400 J	3340 J
SELENIUM	2.1 K	1.55	2 U	2 U	2 U
SILVER	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
SODIUM	980000	984000	988000	978000	112000
THALLIUM	5 K	6.35 K	7.7 K	6.2 K	2 U
VANADIUM	8.4 K	8.25 K	8.1 K	8.2 K	1.9 K
ZINC	2 U	2 U	2 U	2 U	42.7

from sw_sam.dbf
from sw_res.dbf
from sw_res.xls
from q:\sql_server\indian_head

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
nsample	S37SD0010001	S37SD0010001-AVG	S37SD0010001-D	S37SD0020001	S37SD0030001
sample	S37SD0010001	FD01310201	FD01310201	S37SD0020001	S37SD0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
sacode	ORIG	AVG	DUP	NORMAL	NORMAL
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
Volatile Organics (ug/kg)					
1,1,1-TRICHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,1,2,2-TETRACHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,1,2-TRICHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,1,2-TRICHLOROTRIFLUOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,1-DICHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,1-DICHLOROETHENE	12 U	11.5 U	11 U	12 U	110 UJ
1,2,4-TRICHLOROBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
1,2-DIBROMO-3-CHLOROPROPANE	12 U	11.5 U	11 U	12 U	110 UJ
1,2-DIBROMOETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,2-DICHLOROBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
1,2-DICHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
1,2-DICHLOROPROPANE	12 U	11.5 U	11 U	12 U	110 UJ
1,3-DICHLOROBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
1,4-DICHLOROBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
2-BUTANONE	12 U	11.5 U	11 U	12 U	110 UJ
2-HEXANONE	12 U	11.5 U	11 U	12 U	110 UJ
4-METHYL-2-PENTANONE	12 U	11.5 U	11 U	12 U	110 UJ
ACETONE	12 U	11.5 U	11 U	12 U	85 J
BENZENE	12 U	11.5 U	11 U	12 U	110 UJ
BROMODICHLOROMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
BROMOFORM	12 U	11.5 U	11 U	12 U	110 UJ
BROMOMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
CARBON DISULFIDE	12 U	11.5 U	11 U	12 U	110 UJ
CARBON TETRACHLORIDE	12 U	11.5 U	11 U	12 U	110 UJ
CHLOROBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
CHLORODIBROMOMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
CHLOROETHANE	12 U	11.5 U	11 U	12 U	110 UJ
CHLOROFORM	12 U	11.5 U	11 U	12 U	110 UJ
CHLOROMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
CIS-1,2-DICHLOROETHENE	12 U	11.5 U	11 U	12 U	110 UJ
CIS-1,3-DICHLOROPROPENE	12 U	11.5 U	11 U	12 U	110 UJ
CYCLOHEXANE	12 U	11.5 U	11 U	12 U	110 UJ
DICHLORODIFLUOROMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
DIETHYL ETHER	12 U	11.5 U	11 U	12 U	110 UJ
ETHYLBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
ISOPROPYLBENZENE	12 U	11.5 U	11 U	12 U	110 UJ
METHYL ACETATE	12 U	11.5 U	11 U	12 U	110 UJ
METHYL CYCLOHEXANE	12 U	11.5 U	11 U	12 U	110 UJ
METHYL TERT-BUTYL ETHER	12 U	11.5 U	11 U	12 U	110 UJ
METHYLENE CHLORIDE	12 U	11.5 U	11 U	12 U	110 UJ
STYRENE	12 U	11.5 U	11 U	12 U	110 UJ
TETRACHLOROETHENE	12 U	11.5 U	11 U	12 U	110 UJ
TOLUENE	12 U	11.5 U	11 U	12 U	110 UJ
TOTAL XYLENES	12 U	11.5 U	11 U	12 U	110 UJ
TRANS-1,2-DICHLOROETHENE	12 U	11.5 U	11 U	12 U	110 UJ
TRANS-1,3-DICHLOROPROPENE	12 U	11.5 U	11 U	12 U	110 UJ
TRICHLOROETHENE	12 U	11.5 U	11 U	12 U	110 UJ
TRICHLOROFLUOROMETHANE	12 U	11.5 U	11 U	12 U	110 UJ
VINYL CHLORIDE	12 U	11.5 U	11 U	12 U	110 UJ
Semivolatile Organics (ug/kg)					
1,1-BIPHENYL	360 U	365 U	370 U	400 U	2300 UJ
2,2'-OXYBIS(1-CHLOROPROPANE)	360 U	365 U	370 U	400 U	2300 UJ
2,4,5-TRICHLOROPHENOL	920 U	930 U	940 U	1000 U	5800 UJ
2,4,6-TRICHLOROPHENOL	360 U	365 U	370 U	400 U	2300 UJ
2,4-DICHLOROPHENOL	360 U	365 U	370 U	400 U	2300 UJ
2,4-DIMETHYLPHENOL	360 U	365 U	370 U	400 U	2300 UJ
2,4-DINITROPHENOL	920 U	930 U	940 U	1000 U	5800 UJ
2-CHLORONAPHTHALENE	360 U	365 U	370 U	400 U	2300 UJ
2-CHLOROPHENOL	360 U	365 U	370 U	400 U	2300 UJ
2-METHYLNAPHTHALENE	390	287.5	370 U	400 U	2000 J
2-METHYLPHENOL	360 U	365 U	370 U	400 U	2300 UJ
2-NITROANILINE	920 U	930 U	940 U	1000 U	5800 UJ
2-NITROPHENOL	360 U	365 U	370 U	400 U	2300 UJ
3,3'-DICHLOROBENZIDINE	360 U	365 U	370 U	400 U	2300 UJ
3-NITROANILINE	920 U	930 U	940 U	1000 U	5800 UJ
4,6-DINITRO-2-METHYLPHENOL	920 U	930 U	940 U	1000 U	5800 UJ
4-BROMOPHENYL PHENYL ETHER	360 U	365 U	370 U	400 U	2300 UJ
4-CHLORO-3-METHYLPHENOL	360 U	365 U	370 U	400 U	2300 UJ
4-CHLOROANILINE	360 U	365 U	370 U	400 U	2300 UJ
4-CHLOROPHENYL PHENYL ETHER	360 U	365 U	370 U	400 U	2300 UJ

from sd_sam.dbf
from sd_res.dbf
from sd_res.xls
from q:\sql_server\indian_head\

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
nsample	S37SD0010001	S37SD0010001-AVG	S37SD0010001-D	S37SD0020001	S37SD0030001
sample	S37SD0010001	FD01310201	FD01310201	S37SD0020001	S37SD0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
sacode	ORIG	AVG	DUP	NORMAL	NORMAL
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
4-METHYLPHENOL	360 U	365 U	370 U	400 U	2300 UJ
4-NITROANILINE	920 U	930 U	940 U	1000 U	5800 UJ
4-NITROPHENOL	920 U	930 U	940 U	1000 U	5800 UJ
ACENAPHTHENE	360 U	365 U	370 U	400 U	2300 UJ
ACENAPHTHYLENE	61 J	61 J	370 U	400 U	2300 UJ
ACETOPHENONE	360 U	365 U	370 U	400 U	2300 UJ
ANTHRACENE	360 U	365 U	370 U	400 U	2300 UJ
ATRAZINE	360 U	365 U	370 U	400 U	2300 UJ
BENZALDEHYDE	360 U	365 U	370 U	400 U	700 J
BENZO(A)ANTHRACENE	360 U	445	710	400 U	2300 UJ
BENZO(A)PYRENE	360 U	405	630	400 U	2300 UJ
BENZO(B)FLUORANTHENE	360 U	320 J	320 J	400 U	2300 UJ
BENZO(G,H,I)PERYLENE	360 U	150 J	150 J	400 U	2300 UJ
BENZO(K)FLUORANTHENE	360 U	83 J	83 J	400 U	2300 UJ
BIS(2-CHLOROETHOXY)METHANE	360 U	365 U	370 U	400 U	2300 UJ
BIS(2-CHLOROETHYL)ETHER	360 U	365 U	370 U	400 U	2300 UJ
BIS(2-ETHYLHEXYL)PHTHALATE	60 B	215 U	370 U	41 B	610 B
BUTYL BENZYL PHTHALATE	360 U	365 U	370 U	400 U	2300 UJ
CAPROLACTAM	360 U	365 U	370 U	400 U	2300 UJ
CARBAZOLE	360 U	365 U	370 U	400 U	2300 UJ
CHRYSENE	360 U	640	1100	400 U	2300 UJ
DI-N-BUTYL PHTHALATE	360 U	365 U	370 U	400 U	2300 UJ
DI-N-OCTYL PHTHALATE	360 U	365 U	370 U	400 U	2300 UJ
DIBENZO(A,H)ANTHRACENE	360 U	57 J	57 J	400 U	2300 UJ
DIBENZOFURAN	360 U	365 U	370 U	400 U	2300 UJ
DIETHYL PHTHALATE	360 U	365 U	370 U	400 U	2300 UJ
DIMETHYL PHTHALATE	360 U	365 U	370 U	400 U	2300 UJ
FLUORANTHENE	360 U	170 J	170 J	400 U	2300 UJ
FLUORENE	360 U	365 U	370 U	400 U	2300 UJ
HEXACHLOROBENZENE	360 U	365 U	370 U	400 U	2300 UJ
HEXACHLOROBUTADIENE	360 U	365 U	370 U	400 U	2300 UJ
HEXACHLOROCYCLOPENTADIENE	360 U	365 U	370 U	400 U	2300 UJ
HEXACHLOROETHANE	360 U	365 U	370 U	400 U	2300 UJ
INDENO(1,2,3-CD)PYRENE	360 U	79 J	79 J	400 U	2300 UJ
ISOPHORONE	360 U	365 U	370 U	400 U	2300 UJ
N-NITROSO-DI-N-PROPYLAMINE	360 U	365 U	370 U	400 U	2300 UJ
N-NITROSODIPHENYLAMINE	360 UR	365 UR	370 UR	400 UR	2300 UR
NAPHTHALENE	360 U	365 U	370 U	400 U	640 J
PENTACHLOROPHENOL	920 U	930 U	940 U	1000 U	5800 UJ
PHENANTHRENE	360 U	260 J	260 J	400 U	2300 UJ
PHENOL	360 U	365 U	370 U	400 U	2300 UJ
PYRENE	360 U	640	1100	400 U	520 J
Pesticides/PCBs (ug/kg)					
4,4'-DDD	3.6 U	3.65 U	3.7 U	4 U	180 J
4,4'-DDE	3.6 U	3.65 U	3.7 U	4 U	73 J
4,4'-DDT	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ALDRIN	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
ALPHA-BHC	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
ALPHA-CHLORDANE	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
AROCLOR-1016	36 U	36.5 U	37 U	40 U	230 UJ
AROCLOR-1221	73 U	74.5 U	76 U	81 U	470 UJ
AROCLOR-1232	36 U	36.5 U	37 U	40 U	230 UJ
AROCLOR-1242	36 U	36.5 U	37 U	40 U	230 UJ
AROCLOR-1248	36 U	36.5 U	37 U	40 U	230 UJ
AROCLOR-1254	36 U	36.5 U	37 U	40 U	230 UJ
AROCLOR-1260	36 U	36.5 U	37 U	40 U	230 UJ
BETA-BHC	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
DELTA-BHC	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
DIELDRIN	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ENDOSULFAN I	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
ENDOSULFAN II	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ENDOSULFAN SULFATE	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ENDRIN	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ENDRIN ALDEHYDE	3.6 U	3.65 U	3.7 U	4 U	23 UJ
ENDRIN KETONE	3.6 U	3.65 U	3.7 U	4 U	23 UJ
GAMMA-BHC (LINDANE)	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
GAMMA-CHLORDANE	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
HEPTACHLOR	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
HEPTACHLOR EPOXIDE	1.9 U	1.9 U	1.9 U	2.1 U	12 UJ
METHOXYCHLOR	19 U	19 U	19 U	21 U	120 UJ
TOXAPHENE	190 U	190 U	190 U	210 U	1200 UJ

from sd_sam.dbf
from sd_res.dbf
from sd_res.xls
from q:\sql_server\indian_head\

order	001	002	003	004	005
location	S37SD001/SW001	S37SD001/SW001	S37SD001/SW001	S37SD002/SW002	S37SD003/SW003
nsample	S37SD0010001	S37SD0010001-AVG	S37SD0010001-D	S37SD0020001	S37SD0030001
sample	S37SD0010001	FD01310201	FD01310201	S37SD0020001	S37SD0030001
sample_dat	01/31/02	01/31/02	01/31/02	01/31/02	02/05/02
sacode	ORIG	AVG	DUP	NORMAL	NORMAL
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
Explosives (mg/kg)					
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
HMX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 UJ
NITROCELLULOSE	0.49 B	0.59 B	0.69 B	0.69 B	4.5 J
NITROGLYCERIN	2.5 U	2.5 U	2.5 U	2.5 U	2.5 UJ
NITROGUANIDINE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UJ
RDX	0.5 U	0.5 U	0.5 U	0.5 U	0.5 UJ
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 UJ
Inorganic (mg/kg)					
ALUMINUM	356 J	356 J	356 J	208 J	10200 J
ANTIMONY	0.21 UL	0.215 UL	0.22 UL	0.24 UL	1.4 UJ
ARSENIC	0.69 K	1.645 K	2.6 K	0.64 K	11.5 J
BARIUM	4.2 J	4.15 J	4.1 J	3 J	140 J
BERYLLIUM	0.17 K	0.155 K	0.14 K	0.071 K	2 J
CADMIUM	0.076 K	0.067 K	0.058 K	0.16 K	1.5 J
CALCIUM	129	100.85	72.7	82.7	4550 J
CHROMIUM	4 K	3.65 K	3.3 K	2.3 K	18 J
COBALT	0.95 K	0.95 K	0.95 K	0.56 B	34.2 J
COPPER	0.55 B	1.425 B	2.3 B	1.2 B	100 J
IRON	5970 J	5500 J	5030 J	1620 J	25800 J
LEAD	6.8	6.25	5.7	8.5	456 J
MAGNESIUM	101	102.5	104	70.1	2550 J
MANGANESE	73.6 J	67.75 J	61.9 J	34.2 J	435 J
MERCURY	0.023 U	0.0255 U	0.028 U	0.027 U	0.18 UJ
NICKEL	1.5 K	1.6 K	1.7 K	0.78 K	51.9 J
POTASSIUM	101 B	89.3 B	77.6 B	75.2 B	1590 J
SELENIUM	0.42 UL	0.43 UL	0.44 UL	0.48 UL	2.8 UJ
SILVER	0.7 K	0.64 K	0.58 K	0.22 K	0.69 UJ
SODIUM	101	85.9	70.8	112	1530 B
THALLIUM	0.62 U	0.64 U	0.66 U	0.72 U	2.8 UJ
VANADIUM	5.3 K	6.85 K	8.4 K	3.1 K	43.5 J
ZINC	11.6	12.55	13.5	10.5 B	141 J

from sd_sam.dbf
from sd_res.dbf
from sd_res.xls
from q:\sql_server\indian_head\

sb51_res -
full appendix results

order	001	002	003	004
location	S51SB001/50SB001	S51SB001/50SB001	S51SB001/50SB001	S51SB001/50SB001
matrix	SB	SB	SB	SB
nsample	S51SB0010101	S51SB0010101-AVG	S51SB0010101-D	S51SB0010201
sample	S51SB0010101	S51SBDUP0101	S51SBDUP0101	S51SB0010201
sample_dat	02/11/02	02/11/02	02/11/02	02/11/02
depth_rang	1.5 - 2	1.5 - 2	1.5 - 2	2 - 3
cto_proj	325	325	325	325
sort	**c_001**	**c_002**	**c_003**	**c_004**
Volatile Organics (ug/kg)				
1,1,1-TRICHLOROETHANE	11 U	11 U	11 U	13 U
1,1,2,2-TETRACHLOROETHANE	11 U	11 U	11 U	13 U
1,1,2-TRICHLOROETHANE	11 U	11 U	11 U	13 U
1,1,2-TRICHLOROTRIFLUOROETHANE	11 U	11 U	11 U	13 U
1,1-DICHLOROETHANE	11 U	11 U	11 U	13 U
1,1-DICHLOROETHENE	11 U	11 U	11 U	13 U
1,2,4-TRICHLOROBENZENE	11 U	11 U	11 U	13 U
1,2-DIBROMO-3-CHLOROPROPANE	11 U	11 U	11 U	13 U
1,2-DIBROMOETHANE	11 U	11 U	11 U	13 U
1,2-DICHLOROBENZENE	11 U	11 U	11 U	13 U
1,2-DICHLOROETHANE	11 U	11 U	11 U	13 U
1,2-DICHLOROPROPANE	11 U	11 U	11 U	13 U
1,3-DICHLOROBENZENE	11 U	11 U	11 U	13 U
1,4-DICHLOROBENZENE	11 U	11 U	11 U	13 U
2-BUTANONE	11 U	11 U	11 U	13 U
2-HEXANONE	11 U	11 U	11 U	13 U
4-METHYL-2-PENTANONE	11 U	11 U	11 U	13 U
ACETONE	11 U	11 U	11 U	13 U
BENZENE	11 U	11 U	11 U	3 J
BROMODICHLOROMETHANE	11 U	11 U	11 U	13 U
BROMOFORM	11 U	11 U	11 U	13 U
BROMOMETHANE	11 U	11 U	11 U	13 U
CARBON DISULFIDE	11 U	11 U	11 U	13 U
CARBON TETRACHLORIDE	11 U	11 U	11 U	13 U
CHLOROBENZENE	11 U	11 U	11 U	13 U
CHLORODIBROMOMETHANE	11 U	11 U	11 U	13 U
CHLOROETHANE	11 U	11 U	11 U	13 U
CHLOROFORM	11 U	11 U	11 U	13 U
CHLOROMETHANE	11 U	11 U	11 U	13 U
CIS-1,2-DICHLOROETHENE	11 U	11 U	11 U	13 U
CIS-1,3-DICHLOROPROPENE	11 U	11 U	11 U	13 U
CYCLOHEXANE	11 U	11 U	11 U	13 U
DICHLORODIFLUOROMETHANE	11 U	11 U	11 U	13 U
DIETHYL ETHER	11 U	11 U	11 U	13 U
ETHYLBENZENE	11 U	11 U	11 U	13 U
ISOPROPYLBENZENE	11 U	11 U	11 U	13 U
METHYL ACETATE	11 U	11 U	11 U	13 U
METHYL CYCLOHEXANE	11 U	11 U	11 U	13 U
METHYL TERT-BUTYL ETHER	11 U	11 U	11 U	13 U
METHYLENE CHLORIDE	5 B	5 B	5 B	4 B
STYRENE	11 U	11 U	11 U	13 U
TETRACHLOROETHENE	11 U	11 U	11 U	13 U
TOLUENE	11 U	11 U	11 U	2 J
TOTAL XYLENES	11 U	11 U	11 U	13 U
TRANS-1,2-DICHLOROETHENE	11 U	11 U	11 U	13 U
TRANS-1,3-DICHLOROPROPENE	11 U	11 U	11 U	13 U
TRICHLOROETHENE	11 U	11 U	11 U	13 U
TRICHLOROFLUOROMETHANE	11 U	11 U	11 U	13 U
VINYL CHLORIDE	11 U	11 U	11 U	13 U

from sb51_sam.dbf
from sb51_res.dbf
from sb51_res.xls
from q:\sql_server\indian_head

APPENDIX I

HUMAN HEALTH RISK SCREENING CALCULATIONS

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

1.0 Introduction

This Appendix presents the methodology that was used to prepare the human health risk screening for the SSP sites at IHDIV-NSWC.

1.1 Estimation of Exposure

For purposes of this risk screening analysis, maximum detected site concentrations and exposure assumptions used to derive the U.S. EPA Region 3 RBCs (for soil and tap water ingestion under residential land use) were used to assess potential exposure to environmental media at the SSP sites. The RBCs consider the following exposure pathways under residential land use:

- Soil ingestion
- Tap water ingestion
- Inhalation of vapors from tap water exposure

The equations and exposure factors used by U.S. EPA Region 3 to calculate the RBCs are provided in the remainder of this section and are based on residential land use. Potential exposures for likely receptors at IHDIV-NSWC are expected to be less intense than those anticipated for a resident. In addition, it is not likely that a receptor would be exposed to the maximum site concentrations over the entire exposure duration. Consequently, the use of the maximum site concentration and the equations and exposure factors used to calculate RBCs are considered to be a conservative approach to estimating exposure (and risk). This conservative approach assures that the SSP sites will not be inappropriately dismissed as "no further action" sites during the SSP evaluation.

<u>Calculation of Residential Soil RBCs for Carcinogenic Health Effects</u>

According to Region III guidance, residential soil RBCs for carcinogens are based on ingestion of soil by child and adult residents according to the following equation:

$$RBC = \frac{TR \times ATc}{EFr \times CSFo \times \left(\frac{IFSadj}{CF}\right)}$$

where:

RBC = Risk-based concentration (mg/kg)

TR	=	Target cancer risk = 1×10^{-6}
CSFo	=	Chemical-specific oral cancer slope factor (risk per mg/kg-day)
IFSadj	=	Age-adjusted soil ingestion factor = 114.29 mg-year/kg-day
ATc	=	Averaging time for carcinogens (days) = 70 years x 365 days/year = 25,550 days
EFr	=	Exposure frequency = 350 days/year
CF	=	Conversion factor (1×10^{6} mg/kg)

Calculation of Residential Tap Water RBCs for Carcinogenic Health Effects

Residential tap water RBCs for carcinogens are based on ingestion of water and inhalation of vapors emitted from water for child and adult residents by the following equation:

$$RBC = \frac{TR \times ATc \times CF}{EFr \times ([K \times IFAadj \times CSFi] + [IFWadj \times CSFo])}$$

where:

RBC	=	Risk-based concentration (µg/L)
TR	=	Target cancer risk = 1×10^{-6}
CSFo	=	Chemical-specific oral cancer slope factor (risk per mg/kg/day)
CSFi	=	Chemical-specific inhalation cancer slope factor (mg/kg-day)
IFAadj	=	Age-adjusted inhalation factor = 11.66 m^3-year/kg-day
IFWadj	=	Age-adjusted water ingestion factor = 1.09 L-year/kg-day
EFr	=	Exposure frequency = 350 days/year
K	=	Volatilization factor = 0.5 L/m^3
ATc	=	Averaging time for carcinogens (days) = 70 years x 365 days/year = 25,550 days
CF	=	Conversion factor (1,000 µg/mg)

Calculation of Residential Soil RBCs for Noncarcinogenic Health Effects

According to Region 3 guidance, residential soil RBCs for noncarcinogens are based on ingestion of soil by a child resident using the following equation:

$$RBC = \frac{THQ \times RfDo \times BWc \times ATn}{EFr \times EDc \times \left(\frac{IRSc}{CF}\right)}$$

where:

RBC	=	Risk-based concentration (mg/kg)

THQ	=	Target hazard quotient = 1
RfDo	=	Chemical-specific oral reference dose (mg/kg-day)
BWc	=	Body weight of a child, age 1 to 6 years = 15 kg
ATn	=	Averaging time for noncarcinogens (days)
	=	EDc x 365 days/year = 2,190 days
EFr	=	Exposure frequency = 350 days/year
EDc	=	Exposure duration, age 1 to 6 years = 6 years
IRSc	=	Soil ingestion rate for a child, age 1 to 6 years = 200 mg/day
CF	=	Conversion factor (1×10^6 mg/kg)

Calculation of Residential Tap Water RBCs for Noncarcinogenic Health Effects

Residential tap water RBCs for noncarcinogens are based on ingestion of water and inhalation of vapors emitted from water for an adult resident using the following equation:

$$RBC = \frac{THQ \times BWa \times ATn \times CF}{EFr \times EDtot \times \left(\frac{K \times IRAa}{RfDi} + \frac{IRWa}{RfDo}\right)}$$

where:

RBC	=	Risk-based concentration (µg/L)
THQ	=	Target hazard quotient = 1
RfDo	=	Chemical-specific oral reference dose (mg/kg-day)
RfDi	=	Chemical-specific inhalation reference dose (mg/kg-day)
BWa	=	Body weight of an adult = 70 kg
ATn	=	Averaging time for noncarcinogens (days)
	=	EDtot x 365 days/year = 10,950 days
EFr	=	Exposure frequency = 350 days/year
EDtot	=	Exposure duration = 30 years
K	=	Volatilization factor = 0.5 L/m^3
IRAa	=	Adult inhalation rate = 20 m^3/day
IRWa	=	Adult tap water ingestion rate = 2 L/day
CF	=	Conversion factor (1,000 µg/mg)

Exposure to Lead

The methodologies presented in this section cannot be used to evaluate exposure to lead because of the absence of published dose-response parameters for this chemical. Exposure to lead is conservatively

addressed using the U.S. EPA Integrated Exposure Uptake Biokinetic Model (IEUBK) for lead (U.S. EPA, 2001) for exposure to small children (ages 0 to 7 years). This model may be used to evaluate exposure to lead in water and soil and is designed to estimate blood lead levels based on either default or site-specific input values.

Studies indicate that infants and young children are extremely susceptible to adverse effects from exposure to lead. Considerable behavioral and developmental impairments have been noted in small children with elevated blood lead levels. The threshold for toxic effects from this chemical is believed to be in the range of 10 µg/dL to 15 µg/dL. Blood lead levels greater than 10 µg/dL are considered to be a "concern."

According to U.S. EPA guidance for the IEUBK Model (U.S. EPA, 2001), the average concentration is to be used for the lead exposure point concentration. The guidance recommends "using a simple average or arithmetic mean of soil lead concentrations from a representative area in the child's yard, and an average of dust lead concentrations from representative areas frequented by children inside the house." This rationale is appropriate for areas that are sufficiently small so that any part of the area may be accessible to a typical child living at a random residence located within the area. The Guidance also states that "The Model is intended to describe a single residential-level exposure setting" with the "implicit assumption that the input parameters characterize long-term residential exposures scenarios in such settings." As can be seen from U.S. EPA's discussion, U.S. EPA considers the use of the average concentration appropriate and applicable for conservative residential situations. Therefore, the average concentration is used as the exposure point concentration for evaluating exposure to lead in this SSP report.

1.2 Toxicity Assessment

The toxicity assessment is an important component of the risk screening analysis because it focuses on the relationship between the dose of a compound (amount to which an individual or population is exposed) and the potential for adverse health effects resulting from exposure to that dose. The carcinogenic potency of a compound is often expressed in terms of a cancer slope factor (CSF). The potential of a compound to produce noncarcinogenic effects is often expressed in terms of a reference dose (RfD). In many respects, the toxicity assessment for this risk screening analysis is addressed during the development of the RBCs by incorporating the most recent CSFs and RfDs for carcinogenic and noncarcinogenic compounds, respectively.

CSFs and RfDs are obtained from the following references, listed in order of preference: 1) U.S. EPA's Integrated Risk Information System (IRIS), 2) U.S. EPA's Health Effects Assessment Summary Table (HEAST), 3) U.S. EPA's HEAST Alternative Methods, 4) U.S. EPA's National Center for Environmental Assessment Office (NCEA), 5) withdrawn values from IRIS, 6) withdrawn values from HEAST, and 7)

other applicable U.S. EPA documents. The U.S. EPA Region 3 RBC table, which is updated semi-annually, lists the toxicity criteria (CSFs/RfDs) and sources used to develop the RBCs presented in the U.S. EPA Region 3 RBC table (U.S. EPA, Region 3, 2002).

1.3 Risk Characterization

Risk characterization evaluates the potential for adverse effects from exposure to COPCs at the SSP sites by integrating information developed during the toxicity and exposure assessment. The U.S. EPA Region 3 RBCs for soil and tap water ingestion are the basis for the risk characterization conducted for the SSP. Risk characterization for the SSP risk screening analysis consists of calculating a ratio between the maximum detected concentration of a chemical in an environmental media at an SSP site and the corresponding RBC. Carcinogenic and noncarcinogenic effects are evaluated separately for exposure to environmental media.

Some chemicals exhibit both noncarcinogenic and carcinogenic health effects. For those chemicals that U.S. EPA has developed both CSFs and RfDs, the RBCs presented in the U.S. EPA Region 3 guidance (2002) are based on the toxicity criteria that will result in the most conservative screening criteria. The RBCs for arsenic and RDX are based on carcinogenic effects. However, U.S. EPA has also developed RfDs for these compounds based on their noncarcinogenic health effects. Consequently, it is necessary to evaluate noncarcinogenic risks for these constituents, as well as carcinogenic risks. Therefore, residential soil and tap water RBCs based on the noncarcinogenic health effects of these constituents were calculated using the methodology and exposure parameters presented in Section I.1.

The algorithms used to calculate the human health risk estimated for the risk screening analysis are presented in the remainder of this Appendix.

The human health risk estimates produced for the SSP sites are not considered to be reflective of actual current or anticipated future conditions because the current and anticipated land use at the sites is limited (military/industrial). However, the risk characterization is based on RBCs and exposure assumptions that reflect a residential land use scenario, which is conservative and assures that sites will not be inappropriately dismissed as "no further action" sites.

1.3.1 Human Health Effects – Carcinogens

For the purposes of this SSP report, incremental lifetime cancer risk (ILCR) estimates are those hypothetically incurred by a receptor exposed to COPCs in an environmental media according to the assumptions established Section I.1). Although the estimated ILCRs are not reflective of current or

anticipated future conditions at the SSP sites, the following equation is used to conservatively evaluate the cancer risks for chemicals that have potential or known carcinogenic effects:

$$ILCR = \sum (Cmax/RBC) \times 1 \times 10^{-6}$$

where:

ILCR	=	Incremental Lifetime Cancer Risk (unitless)
Cmax	=	Maximum detected site concentration (mg/kg or µg/L)
RBC	=	Risk-based concentration (mg/kg or µg/L)
1×10^{-6}	=	Risk assessment point of departure for carcinogenic effects (unitless)

Multiplying the C_{max}/RBC ratio by U.S. EPA's point of departure risk level, 1.0E-06, produces a risk estimate for the detected chemical. The ILCRs for all COPCs are summed to account for potential carcinogenic effects associated with multiple chemical exposures. The total ILCR is then compared to U.S. EPA's target cancer risk range of 1×10^{-4} to 1×10^{-6}, which is used to determine whether remediation is necessary at a site. According to U.S. EPA, for known or suspected carcinogens, "acceptable" exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk of between 1×10^{-4} to 1×10^{-6} or less than 1×10^{-6}. A 1×10^{-4} ILCR estimate corresponds to the potential for the occurrence of one additional incidence of cancer in an exposed population of 10,000 individuals. Generally, an estimated ILCR greater than 1×10^{-4} is regarded as "unacceptable."

1.3.2 Human Health Effects – Noncarcinogens

Estimated hazard quotients (HQs) and hazard indices (HIs) for the SSP sites are those hypothetically incurred by a receptor exposed to COPCs in an environmental media according to the assumptions established in Section I.1. Although the estimated HQs and HIs are not reflective of current or anticipated future conditions at the SSP sites, the following equations are used to conservatively evaluate the potential for adverse noncarcinogenic health effects:

$$HQ = (Cmax/RBC) \times 1.0$$
$$HI = \sum HQs$$

where:

HQ	=	Hazard quotient (unitless)
C_{max}	=	Maximum detected site concentration (mg/kg or µg/L)
RBC	=	Risk-based concentration (mg/kg or µg/L)

HI	=	Hazard Index (unitless)
1.0	=	Risk assessment point of departure for noncarcinogenic effects (unitless)

Multiplying the C_{max}/RBC ratio by U.S. EPA's point of departure risk level, 1.0, produces a risk estimate for the detected chemical. The HQs for all COPCs are summed to account for potential noncarcinogenic effects associated with multiple chemical exposures. The total HI is then compared to U.S. EPA's target level of 1.0. "Acceptable" exposure levels are generally concentration levels that represent an HI less than or equal to 1.0. However, because all chemicals do not exhibit the same mechanism of action or impact the same target organ, the exceedance of this value does necessarily constitute an "unacceptable" noncarcinogenic risk. If the estimated HI is greater than 1.0, noncarcinogenic effects are segregated according to the affected target organs and target organ HIs are presented, which represent the sum of those chemicals that impact similar target organs or exhibit similar mechanisms of action. Generally, estimated HIs greater than 1.0 for the target organs are considered to be "unacceptable."

1.4 Uncertainty Analysis

The general uncertainties associated with the human health risk screening analysis are presented in this section. Uncertainties for each site-specific risk screening analysis, including a discussion of how the uncertainty may affect the estimated risks, are provided in the site-specific sections.

Various uncertainties are associated with each step of the risk screening process. Uncertainty in the selection of COPCs is related to the current status of the predictive databases, the grouping of samples, and the procedures used to include or exclude constituents as COPCs. Uncertainty associated with the exposure assessment includes the values used as input variables for a given intake route/scenario, the assumptions made to determine exposure point concentrations, and the predictions regarding future land use and population characteristics. Uncertainty in the toxicity assessment includes the quality of the existing toxicity data needed to support dose-response relationships and the weight-of-evidence used for determining the carcinogenicity of COPCs. Uncertainty in risk characterization includes that associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier steps of the risk assessment process.

Whereas various sources of uncertainty exist as described earlier, the direction of uncertainty can be influenced by the assumptions made throughout the risk screening analysis, including selection of COPCs and selection of values for dose-response relationships. In general, assumptions, which consider safety factors, are made so that the risk estimates are overestimated, rather than underestimated.

Generally, risk evaluations carry two types of uncertainty: 1) measurement and 2) informational uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements. For example, this type of uncertainty is associated with analytical data collected for each site. The resultant risk screening analysis reflects the accumulated variances of the individual values used.

Informational uncertainty stems from inadequate availability of information needed to complete the toxicity and exposure assessments. Often, this gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical, on the biological mechanism of action of a chemical, or the behavior of a chemical in soil.

Once the risk screening analysis is complete, the results must be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Reliance on results from the risk screening analysis without consideration of uncertainties, limitations, and assumptions inherent in the process can be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates must be made to ensure that the particular assumptions made are protective of sensitive subpopulations or the maximum exposed individuals. If a number of conservative assumptions are combined in an exposure model, the resulting calculations can propagate the uncertainties associated with those assumptions, thereby producing a much larger uncertainty for the final results. This uncertainty is biased toward overpredicting both carcinogenic and noncarcinogenic risks. Thus, both the results of the risk screening analysis and the uncertainties associated with those results must be considered when making risk management decisions.

This interpretation is especially relevant when the risk estimates exceed the point-of-departure for defining "acceptable" risk. For example, when risks calculated using a high degree of uncertainty are less than an acceptable" risk level (i.e., 1×10^{-6}), the interpretation of no significant risk is typically straightforward. However, when risks calculated using a high degree of uncertainty exceed an "acceptable" risk level (i.e., 1×10^{-6}), a conclusion can be difficult unless uncertainty is considered.

1.4.1 Uncertainty in Selection of COPCs

Some uncertainty is associated with the selection of COPCs that may affect the numerical risk estimates presented in the site-specific risk screening analyses. The following issues may contribute to uncertainty in COPC selection for the SSP sites: the existing database, the inclusion of chemicals potentially attributable to background, the risk screening levels used, and the absence of risk screening levels for a few chemicals detected in the site media. A brief discussion of each of these issues is provided in the remainder of this section.

Existing Database

All data used for the SSP evaluation were validated according to U.S. EPA Region 3 data validation guidelines. Therefore, uncertainties associated with the quality of the data are considered to be minimal because data considered to be unreliable based on laboratory noncompliances have been qualified as such during data validation and were not used in the risk screening analysis.

Limited analytical data are available for some SSP sites. At some sites, only a few samples or one sample only were collected in a given media. The use of small data sets may result in additional uncertainty both in the COPC selection and in the calculated risks. However, the estimated risks associated with the SSP sites are calculated based on maximum site concentrations and the locations sampled were biased toward known contaminant sources. Therefore, the uncertainty associated with small data sets is reduced.

Chemicals Potentially Attributable to Background

COPCs were selected using available background/anthropogenic concentrations for soil. The 95 percent UTL of the mean background concentration was selected as the representative background/anthropogenic concentration and was used to conservatively screen detected site concentrations of inorganics. This method of screening inorganic compounds may result in retaining inorganic compounds as COPCs that would have been omitted as COPCs based on a more rigorous background evaluation, such as statistical testing. Therefore, overall site-related risks from soil may be overestimated by the background screening process.

COPC Screening Levels

The risk screening values used to select COPCs correspond to an ILCR of 1×10^{-6} and an HI of 0.1. The use of these values ensures that significant contributors to risk are evaluated for a site. The elimination of chemicals present at concentrations equal to or less than an ILCR of 1×10^{-6} and an HI less than 0.1 should not affect the final conclusions of the risk screening analysis because these chemicals are not expected to cause a potential health concern at the concentrations detected.

The use of the risk screening levels tend to result in a conservative estimate of COPCs for the site, as identified below.

- The risk screening values used to select COPCs are based on residential land use scenarios (i.e., residential land use for soil and tap water). The SSP sites are not likely to be developed for residential land use and soil and groundwater exposure to likely receptors (trespassers and military

personnel) are expected to be less than residential receptors (i.e., infrequent). Under current land use, exposure to groundwater is limited because shallow groundwater is not used as a potential drinking water source at IHDIV-NSWC.

- Because of the absence of available criteria, risk screening levels for soil were used to select COPCs for sediment. This approach may be relevant for sediment samples collected from drainage areas at the SSP sites, where standing water is not typically present at the location. However, this approach results in a conservative list of COPCs for sediment samples collected from water bodies where standing water is present because human exposure to these sediments would be expected to be less than exposure to soil.

- The risk screening levels for tap water were used to select COPCs for surface water because limited surface water criteria are available to evaluate exposure. This approach is considered to result in a conservative list of COPCs because surface water samples collected from the SSP sites were obtained from small creeks or drainage areas, where standing water was present. Exposure to surface water at these locations is expected to be less than direct exposure to water (tap water) used as a drinking water source.

Absence of COPC Screening Levels

Phenanthrene does not have published health criteria, and, therefore, no risk-based COPC screening levels have been developed by U.S. EPA. During the COPC screening for this SSP report, pyrene (the RBC for a structurally similar compound) was used as the surrogate for phenanthrene. Applying the RBC/toxicity value of one compound to another compound adds to the uncertainty in the risk screening analysis in regards to the selection of COPCs.

1.4.2 Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arises because of the methods used to calculate exposure point concentrations, the determination of land use conditions, the selection of receptors and scenarios, and the selection of exposure parameters. Each of these is discussed below.

Land Use

The current land use patterns at IHDIV-NSWC and the SSP sites are well established. The SSP sites are currently inactive and are not used for specific military purposes. Current land use is not expected to change in the foreseeable future. For this SSP report, exposure to site media was evaluated assuming

that the site was used for residential purposes. Therefore, exposure is overestimated in regard to current land use patterns.

Exposure Point Concentrations

The maximum concentration of each COPC was used as the exposure point concentration (EPC) to quantify potential risks. As a result of using the maximum concentration, the potential risks are likely to be overestimated because it is unlikely that potential receptors would be exposed to the maximum concentration over the entire site for the assumed exposure period.

Exposure Parameters

The exposure factors, e.g., exposure frequency and duration, used to calculate the RBCs are based on reasonable maximum exposure (RME) assumptions for residential land use. Generally, exposure factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid underestimation of potential risks, U.S. EPA used RME exposure factor values to calculate the RBCs, which are used to estimate potential risks in this SSP. Therefore, the selected values used in the development of the RBCs represent the upper bound of the observed or expected habits of the majority of the population.

1.4.3 Uncertainty in the Toxicological Evaluation

Uncertainties associated with the toxicity assessment (determination of RfDs and CSFs from which RBCs are calculated and use of available criteria) are presented in this section.

Derivation of Toxicity Criteria

Uncertainty associated with the toxicity assessment is associated with hazard assessment and dose-response evaluations for the COPCs. The hazard assessment deals with characterizing the nature and strength of the evidence of causation, or the likelihood that a chemical that induces adverse effects in animals will also induce adverse effects in humans. Hazard assessment of carcinogenicity is evaluated as a weight-of-evidence determination, using U.S. EPA methods. Positive animal cancer test data suggest that humans contain tissue(s), which may manifest a carcinogenic response; however, the animal data cannot necessarily be used to predict the target tissue in humans. In the hazard assessment of noncancer effects, however, positive animal data often suggest the nature of the effects (i.e., the target tissues and type of effects) anticipated in humans.

Uncertainty in hazard assessment arises from the nature and quality of the animal and human data. Uncertainty is reduced when similar effects are observed across species, strain, sex, and exposure route; when the magnitude of the response is clearly dose-related; when pharmacokinetic data indicate a similar fate in humans and animals; when postulated mechanisms of toxicity are similar for humans and animals; and when the chemical of concern is structurally similar to other chemicals for which the toxicity is more completely characterized.

Uncertainty in the dose-response evaluation includes the determination of a CSF for the carcinogenic assessment and derivation of an RfD or reference concentration (RfC) for the noncarcinogenic assessment. Uncertainty is introduced from interspecies (animal to human) extrapolation, which, in the absence of quantitative pharmacokinetic or mechanistic data, is usually based on consideration of interspecies differences in basal metabolic rate. Uncertainty also results from intraspecies variation. Most toxicity experiments are performed with animals that are very similar in age and genotype, so that intragroup biological variation is minimal, but the human population of concern may reflect a great deal of heterogeneity including unusual sensitivity or tolerance to the COPC. Even toxicity data from human occupational exposure reflect a bias because only those individuals sufficiently healthy to attend work regularly (the "healthy worker effect") and those not unusually sensitive to the chemical are likely to be occupationally exposed. Finally, uncertainty arises from the quality of the key study from which the quantitative estimate is derived and the database. For cancer effects, the uncertainty associated with dose-response factors is mitigated by assuming the 95% upper bound for the slope factor. Another source of uncertainty in carcinogenic assessment is the method by which data from high doses in animal studies are extrapolated to the dose range expected for environmentally exposed humans. The linearized multistage model, which is used in nearly all quantitative estimations of human risk from animal data, is based on a nonthreshold assumption of carcinogenesis. Evidence suggests, however, that epigenetic carcinogens, as well as many genotoxic carcinogens, have a threshold below which they are noncarcinogenic (Williams and Weisburger, 1991); therefore, the use of the linearized multistage model is conservative for chemicals that exhibit a threshold for carcinogenicity.

For noncancer effects, additional uncertainty factors may be applied in the derivation of the RfD or RfC to mitigate poor quality of the key study or gaps in the database. Additional uncertainty for noncancer effects arises from the use of an effect level in the estimation of an RfD or RfC because this estimation is predicated on the assumption of a threshold less than which adverse effects are not expected. Therefore, an uncertainty factor is usually applied to estimate a no-effect level. Additional uncertainty arises in estimation of an RfD or RfC for chronic exposure from subchronic data. Unless empirical data indicate that effects do not worsen with increasing duration of exposure, an additional uncertainty factor is applied to the no-effect level in the subchronic study. Uncertainty in the derivation of RfDs is mitigated by

the use of uncertainty and modifying factors that normally range between 3 and 10. The resulting combination of uncertainty and modifying factors may reach 1,000 or more.

The derivation of dermal RfDs and CSFs from oral values may cause uncertainty. This is particularly the case when no gastrointestinal absorption rates are available in the literature or when only qualitative statements regarding absorption are available.

Uncertainty Associated with Evaluation of Arsenic

Although the more restrictive basis for evaluating risk associated with exposure to arsenic is to assume this chemical is a carcinogen, carcinogenic effects are not the primary health effects expected to be manifested with exposure to arsenic. Scientific information indicates that humans are capable of metabolizing arsenic to expedite its elimination from the body. The elimination of arsenic from the body obviously mitigates the possibility for this chemical to manifest carcinogenic effects. Therefore, evaluating arsenic as a noncarcinogen would be more appropriate. However, arsenic was conservatively evaluated as a carcinogen, as well as a noncarcinogen in this risk screening analysis. Consequently, the carcinogenic risks for this chemical are probably overestimated to some degree.

Use of Chromium Toxicity Criteria

Some uncertainty is associated with the evaluation of total chromium analytical results. Chromium was assumed to be present in its hexavalent state. Because hexavalent chromium is considered to be more toxic than trivalent chromium, which essentially is a more prevalent form of chromium, risks for this chemical are probably overestimated to some degree.

Use of Aluminum, Copper, and Iron Toxicity Criteria

Potential risks from exposure to aluminum, copper, and iron were evaluated using NCEA provisional RfDs. The provisional RfDs for these chemicals are based on daily allowable intakes rather than adverse effect levels. Therefore, cumulative noncarcinogenic risks may be overestimated by quantifying risks from exposure to aluminum, copper, and iron.

1.4.4 Uncertainty in the Risk Characterization

Uncertainty in risk characterization results primarily from assumptions made regarding additivity of effects from exposure to multiple COPCs from various exposure routes. High uncertainty exists when summing cancer risks for several substances across different exposure pathways. This assumes that each substance has a similar effect and/or mode of action. Often compounds affect different organs, have

different mechanisms of action, and differ in their fate in the body, so additivity may not be an appropriate assumption. However, the assumption of additivity is made to provide a conservative estimate of risk.

Finally, the risk characterization does not consider antagonistic or synergistic effects. Little or no information is available to determine the potential for antagonism or synergism for the COPCs. Therefore, the impact of this uncertainty on the risk screening analysis cannot be determined because the uncertainty may result in either an underestimation or overestimation of potential human health risks.

REFERENCES

U.S. EPA (United States Environmental Protection Agency). 2001. User's Guide for the Biokinetic Model for Lead in Children (IEUBK) Windows version. EPA 9285.7-42. Office of Emergency and Remedial Response, Washington, D.C., May.

U.S. EPA, Region 3, 2002. Risk-Based Concentrations Table. Hazardous Waste Management Division, Philadelphia, Pennsylvania. April.

Williams, G.M. and J.H. Weisburger, 1991. "Chemical Carcinogenesis." Cassarett and Doull's Toxicology, the Basic Science of Poisons. 4th Edition, Pergamon Press, New York, New York.

LEAD MODELING RESULTS

==========
Location: IHDIV-HSWC, Indian Head
Site Name: Sediment
Date: 5/16/2002
Run Mode: Site Risk Assessment

Soil/Dust Data
Average lead concentration in sediment = 157 mg/kg
==========
The time step used in this model run: 1 - Every 4 Hours (6 times a day).

******Air******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc ug Pb/m^3
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

******Diet******

Age	Diet Intake(ug/day)
.5-1	5.530
1-2	5.780
2-3	6.490
3-4	6.240
4-5	6.010
5-6	6.340
6-7	7.000

******Drinking Water******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 4.000 ug Pb/L

==========
Location: IHDIV-HSWC, Indian Head (Page 2 of 3)
Site Name: Sediment
Date: 5/16/2002
Run Mode: Site Risk Assessment

******Soil& Dust******

Multiple Source Analysis Used
Average multiple source concentration: 119.900 ug/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
.5-1	157.000	119.900
1-2	157.000	119.900
2-3	157.000	119.900
3-4	157.000	119.900
4-5	157.000	119.900
5-6	157.000	119.900
6-7	157.000	119.900

******Alternate Intake******

Age	Alternate (ug Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

******Maternal Contribution: Infant Model******

Maternal Blood Concentration: 2.500 ug Pb/dL

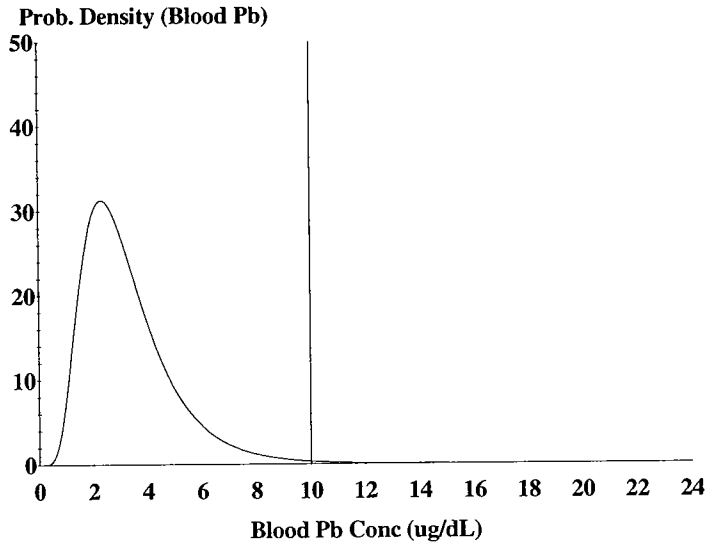
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:

****

Year	Air (ug/dL)	Diet (ug/day)	Alternate (ug/day)	Water (ug/day)
5-1	0.021	2.576	0.000	0.373
1-2	0.034	2.677	0.000	0.926
2-3	0.062	3.030	0.000	0.971
3-4	0.067	2.943	0.000	1.000
4-5	0.067	2.878	0.000	1.054
5-6	0.093	3.053	0.000	1.117
6-7	0.093	3.379	0.000	1.139

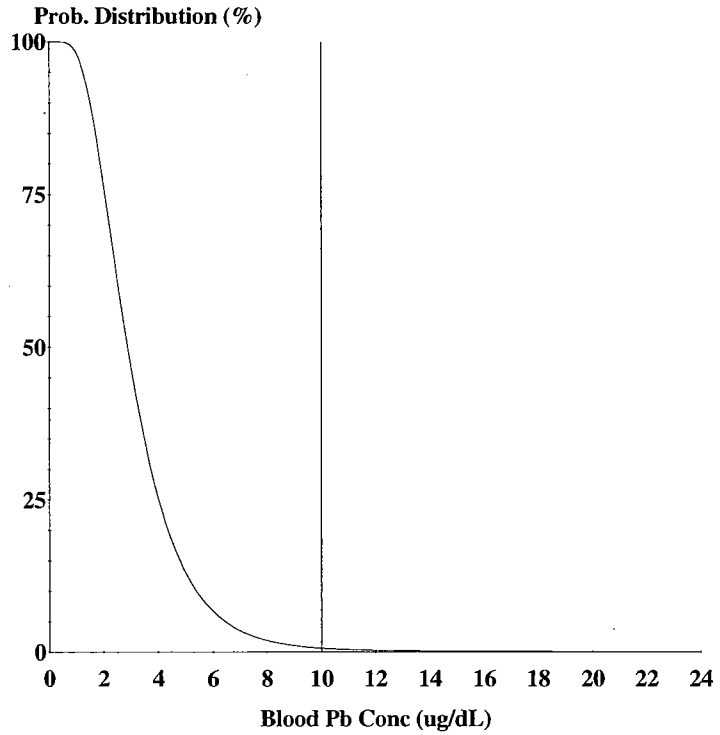
Year	Soil+Dust (ug/day)	Total (ug/day)	Blood (ug/dL)
.5-1	3.245	6.216	3.4
1-2	5.124	8.761	3.7
2-3	5.166	9.230	3.4
3-4	5.219	9.229	3.2
4-5	3.925	7.924	2.8
5-6	3.552	7.817	2.5
6-7	3.363	7.975	2.3

==========
Location: IHDIV-HSWC, Indian Head (Page 3 of 3)
Site Name: Sediment
Date: 5/16/2002
Run Mode: Site Risk Assessment



Cutoff = 10.000 ug/dl
Geo Mean = 3.027
% Above = 0.515
% Below = 99.485

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Site 37 - Sediment



Cutoff = 10.000 ug/dl
Geo Mean = 3.027
% Above = 0.515

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = Site 37 - Sediment

TABLE I-1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL - SITE 33 - INDUSTRIAL EXPOSURES
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil
Exposure Point: Site 33

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Industrial (5)	COPC Flag	Rationale for Contaminant Deletion or Selection(6)
Inorganics															
7429-90-5	Aluminum	2760		13000		mg/kg	S33SB0030201-D	6/6	NA	6740	13000	35400	200000 N	No	BSL, BKG
7440-38-2	Arsenic	1.6	K	25	K	mg/kg	S33SB0030201	6/6	NA	7.21	25	18.9	3.8 C	Yes	ASL
7440-39-3	Barium	15.9		40.3		mg/kg	S33SB0010201	6/6	NA	25.6	40.3	134	14000 N	No	BSL, BKG
7440-41-7	Beryllium	0.16	K	1.9	K	mg/kg	S33SB0030201	6/6	NA	0.870	1.9	3.3	410 N	No	BSL, BKG
7440-70-2	Calcium	165		1170		mg/kg	S33SB0010201	4/6	8.9 - 30.6	424	1170	2590	NA	No	NUT, BKG
7440-47-3	Chromium	11.6		47.5		mg/kg	S33SB0030201-D	6/6	NA	21.4	47.5	60.1	610 (7) N	No	BSL, BKG
7440-48-4	Cobalt	1.5	J	3	J	mg/kg	S33SB0010201	4/6	0.22 - 0.97	1.52	3	133	4100 N	No	BSL, BKG
7440-50-8	Copper	3.3	K	13.2		mg/kg	S33SB0020201	6/6	NA	6.50	13.2	48.6	8200 N	No	BSL, BKG
7439-89-6	Iron	7770		50200		mg/kg	S33SB0030201	6/6	NA	21853	50200	83100	61000 N	No	BSL, BKG
7439-92-1	Lead	4.4	J	10.1	J	mg/kg	S33SB0030201	6/6	NA	7.78	10.1	40.5	750 (8)	No	BSL, BKG
7439-95-4	Magnesium	177		1980		mg/kg	S33SB0030201-D	6/6	NA	808	1980	2640	NA	No	NUT, BKG
7439-96-5	Manganese	1.4	J	228	J	mg/kg	S33SB0030201	6/6	NA	38.5	228	4130	4100 N	No	BSL, BKG
7439-97-6	Mercury	0.055		0.055		mg/kg	S33SB0010201	1/6	0.046 - 0.059	0.031	0.055	0.18	61 (9) N	No	BSL, BKG
7440-02-0	Nickel	2.9	K	13	K	mg/kg	S33SB0020201	5/6	0.94	6.25	13	18.2	4100 N	No	BSL, BKG
7440-09-7	Potassium	292	J	4100	J	mg/kg	S33SB0030201-D	6/6	NA	1210	4100	2610	NA	No	NUT
7782-49-2	Selenium	0.61	J	0.61	J	mg/kg	S33SB0030201	1/6	0.32 - 0.46	0.228	0.61	13.3	1000 N	No	BSL, BKG
7440-28-0	Thallium	0.33	K	1.1	K	mg/kg	S33SB0030201	3/6	0.35 - 0.42	0.425	1.1	21.8	14 N	No	BSL, BKG
7440-62-2	Vanadium	14.4	K	55.6		mg/kg	S33SB0030201	6/6	NA	32.5	55.6	194	1400 N	No	BSL, BKG
7440-66-6	Zinc	5.9	K	49.3		mg/kg	S33SB0030201	5/6	12.1	24.0	49.3	70.4	61000 N	No	BSL, BKG

Notes:
(1) - Sample and duplicate are counted as two separate samples when determining the minimum and maximum detected concentrations.
(2) - Values presented are sample-specific quantitation limits.
(3) - The maximum detected concentration is used for screening purposes.
(4) - Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
(5) - U.S. EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
(7) - Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Value (BKG)
(8) - Value is for hexavalent chromium.
(9) - Frequently Asked Questions (FAQs) on the Adult Lead Model, U.S. EPA, April 1999.
(10) - Value is for mercuric chloride.
Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
C = Carcinogenic.
N = Noncarcinogenic.

Associated Samples:
S33SB0010101 S33SB0030101
S33SB0010201 S33SB0030201
S33SB0020101 S33SB0030201-D
S33SB0020201

TABLE I-2

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SUBSURFACE SOIL - SITE 33 - INDUSTRIAL EXPOSURES

INDIAN HEAD DIVISION NSWC

INDIAN HEAD, MARYLAND

	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
Chemical	Concentration (maximum) (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary Target Organs	RBC[1] (mg/kg)	Estimated HQ
Arsenic	25	3.8	6.6E-06	Skin, Vascular	613	0.04
		Total Carcinogenic Risk	**6.6E-06**		Total HI	**0.04**

Target Organ HIs

Total Vascular HI =	0.04
Total Skin HI =	0.04

1 Risk-Based Concentration (RBC) Table (USEPA Region III, 2002). Industrial RBCs. The noncarcinogenic RBC is not presented in the USEPA Region III Risk Based Concentration Table and was calculated as per the methodology detail in Appendix I.

TABLE I-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT - SITE 37 - INDUSTRIAL EXPOSURES
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Site 37

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Nondetects(2)	Average Concentration	Concentration Used for Screening(3)	Background Value(4)	U.S. EPA Region 3 RBC-Industrial (5)	COPC Flag	Rationale for Contaminant Deletion or Selection(6)
Volatile Organic Compounds															
67-64-1	Acetone	85	J	85	J	ug/kg	S37SD0030001	1/3	11 - 12	32.3	85	NA	20000000 N	No	BSL
Semivolatile Organic Compounds															
91-57-6	2-Methylnaphthalene	390		2000	J	ug/kg	S37SD0030001	2/3	370 - 400	829	2000	NA	4100000 N	No	BSL
208-96-8	Acenaphthylene	61	J	61	J	ug/kg	S37SD0010001	1/3	370 - 2300	470	61	NA	12000000 (7) N	No	BSL
100-52-7	Benzaldehyde	700	J	700	J	ug/kg	S37SD0030001	1/3	360 - 400	361	700	NA	20000000 N	No	BSL
56-55-3	Benzo(a)anthracene	710		710		ug/kg	S37SD0010001-D	1/3	360 - 2300	598	710	NA	7800 C	No	BSL
50-32-8	Benzo(a)pyrene	630		630		ug/kg	S37SD0010001-D	1/3	360 - 2300	585	630	NA	780 C	No	ASL
205-99-2	Benzo(b)fluoranthene	320	J	320	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	557	320	NA	7800 C	No	BSL
191-24-2	Benzo(g,h,i)perylene	150	J	150	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	500	150	NA	6100000 (8) N	No	BSL
207-08-9	Benzo(k)fluoranthene	83	J	83	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	478	83	NA	78000 C	No	BSL
218-01-9	Chrysene	1100		1100		ug/kg	S37SD0010001-D	1/3	360 - 2300	663	1100	NA	780000 C	No	BSL
53-70-3	Dibenzo(a,h)anthracene	57	J	57	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	469	57	NA	780 C	No	BSL
206-44-0	Fluoranthene	170	J	170	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	507	170	NA	8200000 N	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	79	J	79	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	476	79	NA	7800 C	No	BSL
91-20-3	Naphthalene	640	J	640	J	ug/kg	S37SD0030001	1/3	360 - 400	341	640	NA	4100000 N	No	BSL
85-01-8	Phenanthrene	260	J	260	J	ug/kg	S37SD0010001-D	1/3	360 - 2300	537	260	NA	6100000 (8) N	No	BSL
129-00-0	Pyrene	520	J	1100		ug/kg	S37SD0010001-D	2/3	360 - 400	453	1100	NA	6100000 N	No	BSL
Pesticides/PCBs															
72-54-8	4,4'-DDD	180	J	180	J	ug/kg	S37SD0030001	1/3	3.6 - 4	61.3	180	NA	24000 C	No	BSL
72-55-9	4,4'-DDE	73	J	73	J	ug/kg	S37SD0030001	1/3	3.6 - 4	25.6	73	NA	17000 C	No	BSL
Explosives															
9004-70-0	Nitrocellulose	4.5	J	4.5	J	mg/kg	S37SD0030001	1/3	0.49 - 0.69	1.71	4.5	NA	NA	No	NTX
Inorganics															
7429-90-5	Aluminum	208	J	10200	J	mg/kg	S37SD0030001	3/3	NA	3588	10200	52362	200000 N	No	BSL
7440-38-2	Arsenic	0.64	K	11.5	J	mg/kg	S37SD0030001	3/3	NA	4.60	11.5	63	3.8 C	Yes	ASL
7440-39-3	Barium	3	J	140	J	mg/kg	S37SD0030001	3/3	NA	49.1	140	577	14000 N	No	BSL
7440-41-7	Beryllium	0.071	K	2	J	mg/kg	S37SD0030001	3/3	NA	0.742	2	10.9	410 N	No	BSL
7440-43-9	Cadmium	0.058	K	1.5	J	mg/kg	S37SD0030001	3/3	NA	0.576	1.5	1.85	100 N	No	BSL
7440-70-2	Calcium	72.7		4550	J	mg/kg	S37SD0030001	3/3	NA	1578	4550	88137	NA	No	NUT
7440-47-3	Chromium	2.3	K	18	J	mg/kg	S37SD0030001	3/3	NA	7.98	18	79.2	610 (9) N	No	BSL
7440-48-4	Cobalt	0.95	K	34.2	J	mg/kg	S37SD0030001	2/3	0.56	11.8	34.2	118	4100 N	No	BSL
7440-50-8	Copper	100	J	100	J	mg/kg	S37SD0030001	1/3	0.55 - 2.3	33.8	100	297	8200 N	No	BSL
7439-89-6	Iron	1620	J	25800	J	mg/kg	S37SD0030001	3/3	NA	10973	25800	193218	61000 N	No	BSL
7439-92-1	Lead	5.7		456	J	mg/kg	S37SD0030001	3/3	NA	157	456	476	750 (10)	No	BSL
7439-95-4	Magnesium	70.1		2550	J	mg/kg	S37SD0030001	3/3	NA	908	2550	19043	NA	No	NUT
7439-96-5	Manganese	34.2	J	435	J	mg/kg	S37SD0030001	3/3	NA	179	435	2561	4100 N	No	BSL
7440-02-0	Nickel	0.78	K	51.9	J	mg/kg	S37SD0030001	3/3	NA	18.1	51.9	382	4100 N	No	BSL
7440-09-7	Potassium	1590	J	1590	J	mg/kg	S37SD0030001	1/3	75.2 - 101	557	1590	5061	NA	No	NUT
7440-22-4	Silver	0.22	K	0.7	K	mg/kg	S37SD0010001	2/3	0.69	0.402	0.7	0.92	1000 N	No	BSL
7440-23-5	Sodium	70.8		112		mg/kg	S37SD0020001	2/3	1530	321	112	472	NA	No	NUT
7440-62-2	Vanadium	3.1	K	43.5	J	mg/kg	S37SD0030001	3/3	NA	17.8	43.5	196	1400 N	No	BSL
7440-66-6	Zinc	11.6		141	J	mg/kg	S37SD0030001	2/3	10.5	52.9	141	1660	61000 N	No	BSL

TABLE I-3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT - SITE 37 - INDUSTRIAL EXPOSURES
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

Notes:
(1) - Minimum and maximum detected concentrations.
(2) - Values presented are sample-specific quantitation limits.
(3) - The maximum detected concentration is used for screening purposes.
(4) - Background Soil Investigation Report for Indian Head Stump Neck Annex, Indian Head and Stump Neck Annex, TtNUS, February 2002 (Draft).
Sedminent background values are presented for informational purposes only. Sediment is not screened against background, see text.
(5) - U.S. EPA Region 3 Risk-Based Concentration Table, April 2, 2002. (RBCs for noncarcinogenic compounds are divided by 10).
(6) - Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Essential Nutrient (NUT)
(7) - Value is for acenaphthene. Below Screening Level (BSL)
(8) - Value is for pyrene. Below Background Value (BKG)
(9) - Value is for hexavalent chromium. No Toxicity Information (NTX)
(10) - Frequently Asked Questions (FAQs) on the Adult Lead Model, U.S. EPA, April 1999.
Shaded cells indicate that the specified criterion has been exceeded or that the chemical has been selected as a COPC.

Associated Samples:
S37SD0010001
S37SD0010001-D
S37SD0020001
S37SD0030001

Definitions:
NA = Not Applicable.
SQL = Sample Quantitation Limit.
COPC = Chemical of Potential Concern.
J = Estimated Value.
C = Carcinogenic.
N = Noncarcinogenic.
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

TABLE I-4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - SEDIMENT - SITE 37 - INDUSTRIAL EXPOSURES
INDIAN HEAD DIVISION NSWC
INDIAN HEAD, MARYLAND

	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
Chemical	Concentration (maximum) (mg/kg)	RBC[1] (mg/kg)	Estimated ILCR	Primary Target Organs	RBC[1] (mg/kg)	Estimated HQ
Arsenic	11.5	3.8	3.0E-06	Skin, Vascular	613	0.02
		Total Carcinogenic Risk	**3.0E-06**		Total HI	**0.02**

Target Organ HIs

Total Skin HI =	0.02
Total Vascular HI =	0.02

1 Risk-Based Concentration (RBC) Table (USEPA Region III, 2002). Industrial RBCs. The noncarcinogenic RBC is not presented in the USEPA Region III Risk Based Concentration Table and was calculated as per the methodology detail in Appendix I.