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Final
Site-Specific Remedial Investigation Work Plan for the Lab Area (Sites 15, 16, 49, 50, 53, 54, and 55) Naval Surface Warfare Center Indian Head Division Indian Head, Maryland

Department of the Navy
Engineering Field Activity, Chesapeake
Naval Facilities Engineering Command

Contract No. N62470-95-D-6007
CTO-0066

March 2001

Prepared by

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Environmental, Inc.

CDM
Federal Programs Corp.

SIGNATURE PAGE

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Naval Surface Warfare Center
Indian Head Division
Indian Head, Maryland

Contract Task Order - 0066
Contract Number N62470-95-D-6007
Navy CLEAN II Program

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Acronyms and Abbreviations

AP	Ammonium Perchlorate
B&RE	Brown and Root Environmental
BGS	Below Ground Surface
BHC	Benzene Hexachloride
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CNO	Chief of Naval Operations
COC	Chain of Custody
COPC	Chemical of Potential Concern
CTO	Contract Task Order
4,4'-DDD	Dichlorodiphenyldichloroethane
4,4'-DDE	Dichlorodiphenyldichloroethylene
4,4'-DDT	Dichlorodiphenyltrichloroethane
DBH	Diameter at Breast Height
DRO	Diesel Range Organics
EDB	Dibromomethane
ERA	Ecological Risk Assessment
FOL	Field Operations Leader
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IDW	Investigation-Derived Wastes
IHDIV-NSWC	Indian Head Division, Naval Surface Warfare Center
IHIRT	Indian Head Installation Restoration Team
IR	Installation Restoration
MCL	Maximum Contaminants Levels
MDE	Maryland Department of the Environment
MEK	Methyl Ethyl Ketone (2-Butanone)
NACIP	Navy Assessment and Control of Installation Pollutants
NEESA	Naval Energy and Environmental Support Activity
NG	Nitroglycerin
NOAA	National Oceanographic and Atmospheric Administration

Acronyms and Abbreviations (Continued)

NOAEL	No Observed Adverse Effect Level
NOS	Naval Ordnance Station
NPL	National Priorities List
NQ	Nitroguanidine
NWI	National Wetlands Inventory
PA	Preliminary Assessment
PCBs	Polychlorinated biphenyls
PETN	Pentaerythritol tetranitrate
QAPP	Quality Assurance Project Plan
RBCs	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RPM	Remedial Project Manager
SVOCs	Semivolatile Organic Compounds
SI	Site Inspection
SOP	Standard Operating Procedure
SSL	Soil Screening Level
SW	Surface Water
TAL	Target Analyte List
TAT	Turn-Around Time
TCL	Target Compound List
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WP	Work Plan

Executive Summary

This Project Specific Remedial Investigation Work Plan (work plan) for the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), Indian Head, Maryland, was prepared in response to Contract Task Orders (CTO) 0066 and 0111, under the Comprehensive Long-term Environmental Action Navy (CLEAN), contract number N62470-95-D-6007. The purpose of this Work Plan is to present site-specific information regarding seven Installation Restoration (IR) sites on the IHDIV-NSWC.

The specific IR Sites covered by this work plan are listed in Table ES-1. The table includes a brief indication of the work planned for each site including the quantities of the various types of samples to be collected.

As a result of similar historic usages, proximity, the sharing of sewer utilities, and overlapping field investigations, it was decided by the Navy, Maryland Department of the Environment (MDE), and the United States Environmental Protection Agency (USEPA) at the May 11, 2000 meeting to simply refer to the area encompassing Sites 15, 16, 49, 50, 53, 54, and 55 as the "lab area." The approximate boundary of the lab area as defined in the meeting is shown in Figure 1-1. Within the lab area, three main areas of investigation were defined for the purpose of the work plan. The first area of investigation is that of the lab area sewers and storm drains that includes Sites 15, 16, and 53. The second area of investigation is the lab area surface soils (Sites 50, 54, and 55). The third area of investigation is Site 49, the chemical disposal pit. Each focus area is addressed separately in a chapter in this work plan.

Overall, the planned field investigations include the collection of 24 subsurface soil samples and 13 manhole sediment samples from the lab area sewers and storm drains, 78 surface soil samples from the lab area, 6 sediment samples and 3 surface water samples from the wetlands from within the lab area. Additionally, 2 surface soil samples, 1 manhole sediment sample (contingent on routing of chemical pit outfall), 3 subsurface soil samples, and 1 concrete rubble sample will be collected from Site 49.

TABLE ES-1

EXECUTIVE SUMMARY
INDIAN HEAD, MARYLANC

Site Name	Work Plan Summary	Surface Soil Samples	Subsurface Soil Boring Samples	Ground Water Samples	Surface Water Samples	Sediment Samples	Other Samples*	Smoke Testing	Ecological Risk Assessment	Human Health Risk Assessment
Lab Area Sewers and Storm Drains (Includes Sites 15, 16, and 53)	Determine extent of contamination; additional sediment and soil boring sampling, ecological sampling in downstream creek.	N/A	24	N/A	0	13	N/A	N/A	YES	YES
Lab Area Surface Soils (Includes Sites 50, 54, and 55)	Determine extent of surface soil contamination in lab area, and sediment and surface water contamination in the wetlands area.	78	N/A	N/A	3	6	N/A	N/A	YES	YES
Site 49 - Chemical Disposal Pit	Additional soil samples proposed to evaluate extent of contamination.	2	3	N/A	N/A	0-1*	1**	N/A	YES	YES

* Number of samples contingent on location of chemical pit outfall
** Concrete rubble sample
N/A - No samples taken

1.0 Introduction

This Project Specific Remedial Investigation Work Plan (work plan) for the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), Indian Head, Maryland, was prepared in response to Contract Task Orders (CTO) 0066 0111, under the Comprehensive Long-term Environmental Action Navy (CLEAN), contract number N62470-95-D-6007. The purpose of this work plan is to present site-specific information regarding seven Installation Restoration (IR) sites on the IHDIV-NSWC.

The specific sites covered by this work plan are Sites 15, 16, 49, 50, 53, 54, and 55. As a result of similar historic usages, proximity, the sharing of sewer utilities, and overlapping field investigations, it was decided by the Navy, Maryland Department of the Environment (MDE), and the United States Environmental Protection Agency (USEPA) at the May 11, 2000 meeting to simply refer to the area encompassing Sites 15, 16, 49, 50, 53, 54, and 55 as the "lab area." The approximate boundary of the lab area as defined in the meeting is shown in Figure 1-1. Within the lab area, three main areas of investigation were defined for the purpose of the work plan. The first area of investigation is that of the lab area sewers and storm drains that includes Sites 15, 16, and 53. The second area of investigation is the lab area surface soils (Sites 50, 54, and 55). The third area of investigation is Site 49, the chemical disposal pit. Each focus area is addressed separately in a chapter in this work plan.

This work plan is a supplement to the following master planning documents:

- Master Work Plan (Master WP), prepared by Brown & Root Environmental (B&RE), April 1997.
- Standard Operating Procedures (SOPs), prepared by B&RE, April 1997.
- Master Quality Assurance Project Plan (Master QAPP), prepared by B&RE, April 1997.
- Health and Safety Guidance Document, prepared by B&RE, April 1997.
- Addendum to B&RE Master Work Plans (Addendum), prepared by CH2M HILL, March 2000.

The master planning documents provide the methods and procedures that will be used to perform environmental investigation work proposed at the three areas covered in this work plan. The objective of this work plan is to present historical information regarding each site, evaluate that information, determine the need for further investigation, and propose a plan for further investigation where needed. The specific objective for an individual site is dependent on the work previously conducted at that site. Depending on the results of previous investigations, the site-specific objective in this document may be limited to verifying the presence or absence of contamination, or it may be to define the extent of contamination and evaluate the need for remediation. Unless otherwise noted, all SOPs referenced in this work plan are contained in the Master Work Plan.

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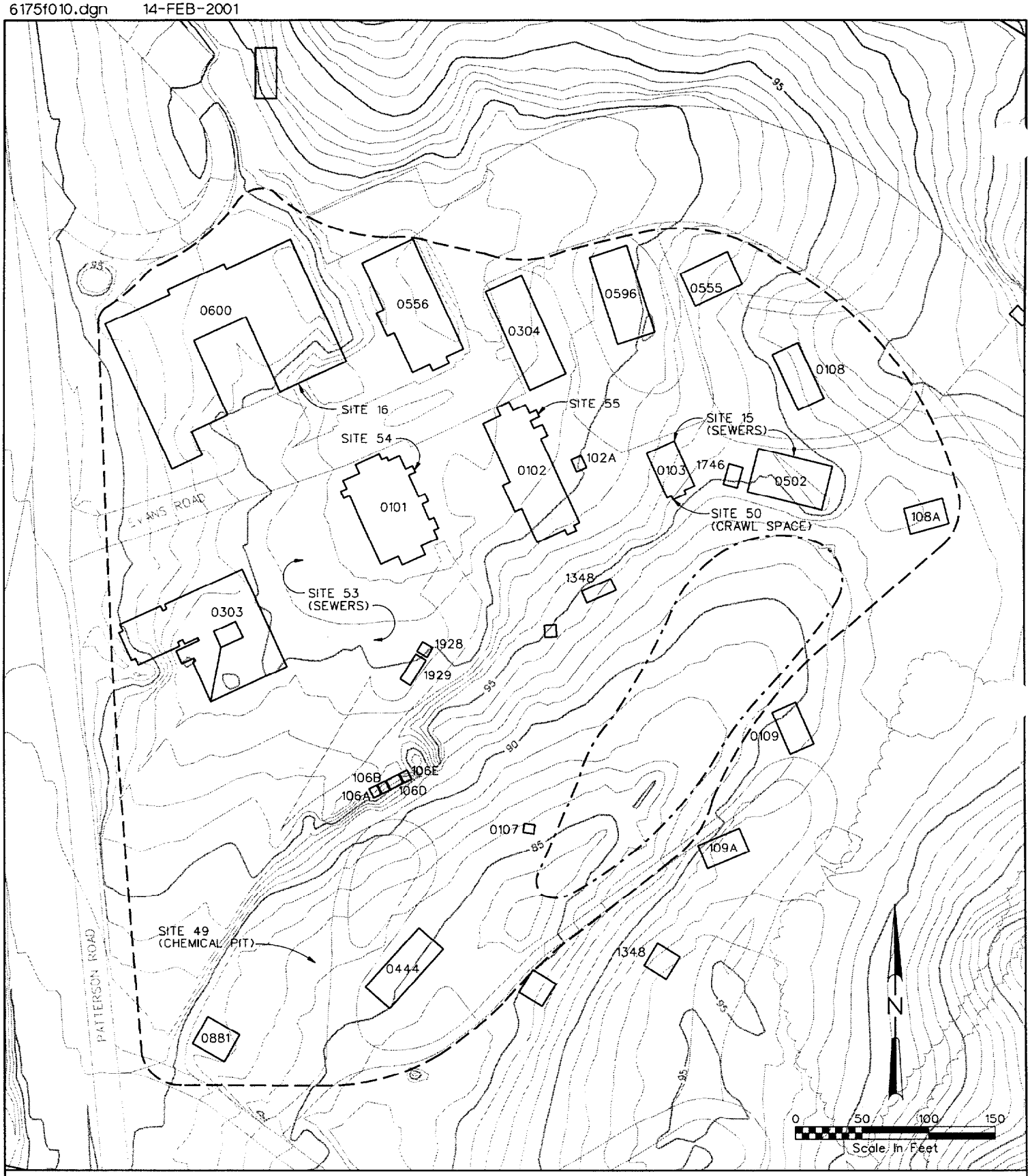

LEGEND

— - — - APPROXIMATE LIMITS OF WETLANDS

— — — PROPOSED LIMITS OF "LAB AREA"

Figure 1-1
LIMITS OF PROPOSED LAB AREA
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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1.1 IHDIV-NSWC Description and Environmental Setting

IHDIV-NSWC is a military facility consisting of the main installation on the Cornwallis Neck Peninsula and the Stump Neck Annex. The main installation contains approximately 2,500 acres. Slightly less than 1,000 additional acres are located across Mattawoman Creek at the Stump Neck Annex. IHDIV-NSWC is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, D.C. The main installation 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 1-2). The main installation includes Marsh Island and Thoroughfare Island, which are located in Mattawoman Creek. Elevations range from sea level to 111 feet on Cornwallis Neck.

Both the main installation (Cornwallis Neck Peninsula) and the Stump Neck Annex are on the National Priorities List (NPL). The main installation and Stump Neck Annex are separated by Mattawoman Creek (noncontiguous), have separate United States Environmental Protection Agency (USEPA) identification numbers, and perform dissimilar operations. Therefore, only the main installation will be addressed in this work plan. Investigation of the Stump Neck Annex is being conducted through the Resource Conservation and Recovery Act (RCRA) Corrective Action Program and the IR program.

1.1.1 Current and Historical Uses of IHDIV-NSWC

IHDIV-NSWC was established in 1890 and is the Navy's oldest continuously operating ordnance station. At various times during its operation, IHDIV-NSWC has served as a gun and armor proving ground, a powder factory, a propellant plant, and a research facility. The U.S. Government purchased Stump Neck Annex in 1901. The property provided a safety buffer for the testing of larger naval guns that were tested by firing into the Potomac River, and at Stump Neck.

The Indian Head installation was enlarged by another 1,160 acres of adjacent land in 1918, during World War I. This expansion included the purchase of Hopewell Farm and Hog Island, which was at that time an islet in Mattawoman Creek and has since become attached to the Cornwallis Neck peninsula. When the Dahlgren Naval Proving Ground was established as a separate command in 1932, IHDIV-NSWC was redesignated the Naval Powder Factory (Parsons 2000).

The production of gunpowder and development of new explosives during the onset of World War II resulted in the construction of several new facilities at Indian Head, as well as the construction of Route 210 as a Defense Access Road in 1943. Development and improvements at Indian Head continued throughout the 1950s and 1960s, and in 1966, IHDIV-NSWC was renamed the Naval Ordnance Station (NOS). Rum Point, an 80-acre promontory in Mattawoman Creek near Stump Neck, was also acquired in this year. Bullitt Neck was obtained in five small acquisitions between 1965 and 1966, in order to meet safety and security needs arising from explosive magazines on the Indian Head station (Parsons 2000).

After the Vietnam conflict, the mission of IHDIV-NSWC shifted from primarily a production facility to a highly technical engineering support operation. In 1987, the Naval Ordnance Station was established as a Center for Excellence to promote technological

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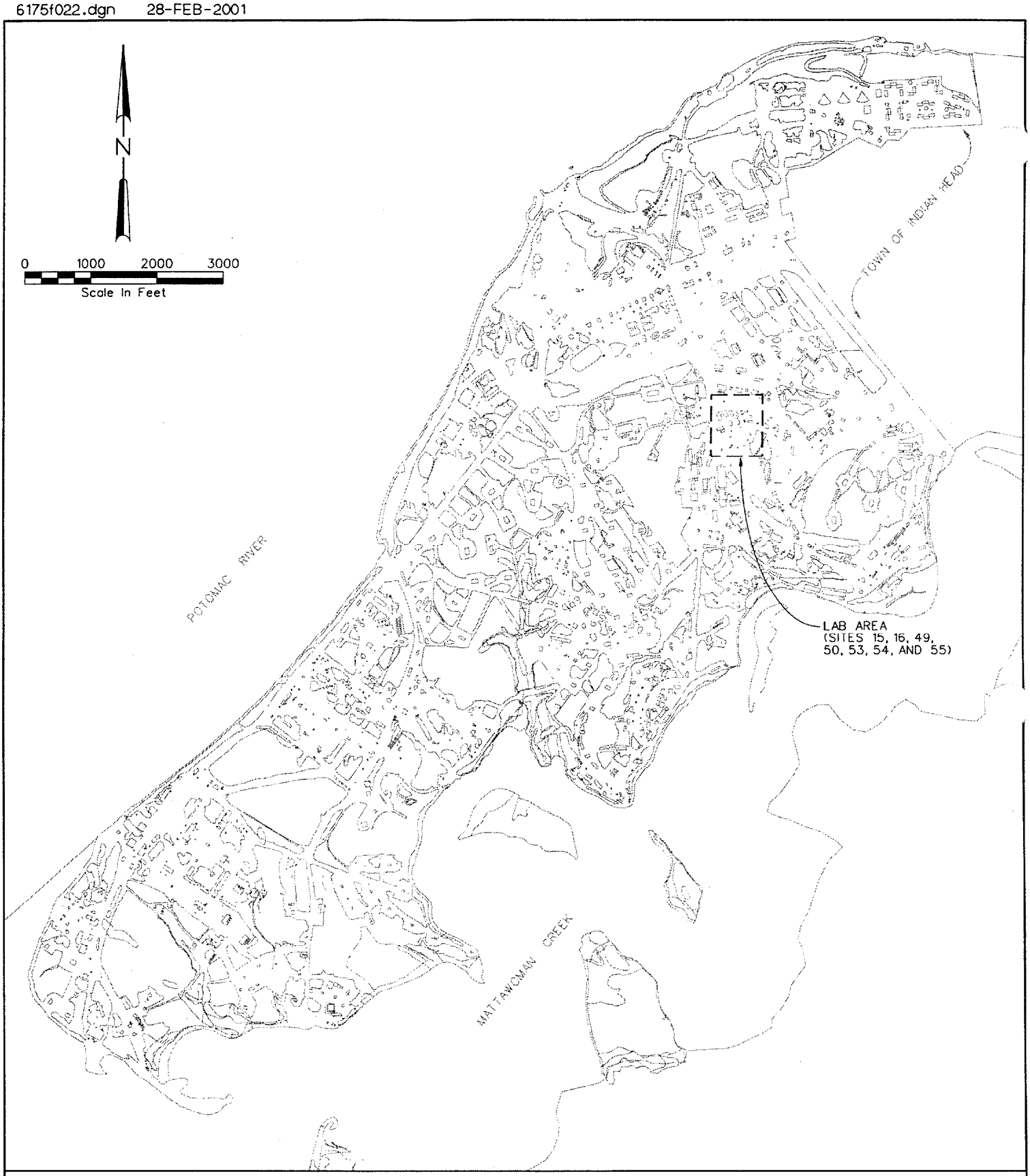

Figure 1-2
LOCATIONS OF SITES IN WORKPLAN
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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excellence in the following specialized fields: energetic chemicals; guns, rockets and missile propulsion; ordnance devices; explosives; safety and environmental protection; and simulators and training (Parsons 2000). Current military land use includes operations and training; production; maintenance and utilities; research, development, testing and evaluation; explosive storage; supply and non-explosive storage; administration; community facilities and services; housing; and open space.

Forest stands comprise approximately 47 percent or 1,603 acres of IHDIV-NSWC and include pine, pine-hardwood, and hardwood forest cover types. Recreation areas at Indian Head include approximately 1,150 acres of designated hunting areas, approximately 2 miles of shoreline fishing areas, and 1.5 miles of nature trails.

1.1.2 Surrounding Land Uses

IHDIV-NSWC is generally surrounded by commercial, residential, and State Park land to the east and south of the main installation and Stump Neck Annex. The town of Indian Head is located just east of IHDIV-NSWC where most residential developments are located. The Indian Head Highway (Route 210) extends eastward from IHDIV-NSWC main gate, attracting businesses and providing access to residential areas off the main highway. The Potomac River borders the main installation to the north and west, and Stump Neck to the west. Mason Neck National Wildlife Refuge is located across the Potomac River, north of the main installation. The Mattawoman Natural Environment Area is state-owned property located along the southern edge of Mattawoman Creek east of the main installation.

The Stump Neck Annex is bordered to the north by Mattawoman Creek, to the east by General Smallwood State Park and Sweden Point Marina, and to the south by Chicamuxen Creek, agricultural lands, and low-density residential development. The Chicamuxen Wildlife Management Area is located adjacent to and south of the Stump Neck Annex.

1.1.3 Climate

IHDIV-NSWC lies in the humid temperate continental climatic zone of the eastern United States. This zone has hot, humid summers, and relatively mild winters. Due to its proximity to the Potomac River and its tributaries, IHDIV-NSWC experiences less extreme temperatures, higher precipitation, and higher humidity compared to inland areas. The average daily maximum temperature is 67.5°F and the average daily minimum temperature is 45°F. The warmest part of the year is in late July and the coldest is in late January and early February. The growing season is approximately 190 days, from mid-April through mid-October (USDA SCS 1974).

1.1.4 Soils

IHDIV-NSWC lies within the Atlantic Coastal Plain physiographic province and is underlain by unconsolidated sand, gravel, and clay from the Pleistocene and Cretaceous Periods. The soils in this area consist of silty and sandy loams, with minor amounts of gravel. The soils tend to have low permeability and low shrink-swell potential. Four dominant soil associations are found at Indian Head (USDA SCS 1974):

- Beltsville-Gravelly Land-Bourne Association – The soils within this association are level to moderately sloping, moderately well-drained and loamy, and moderately deep. They also include dense, root-inhibiting fragipans and steep, gravelly soil materials.
- Beltsville-Exum-Wickham Association – This association is characterized by level to moderately sloping, moderately well-drained and well-drained loamy soils. Soils within this association are moderately deep, and include dense, root-inhibiting fragipans and steep, gravelly soil materials.
- Evesboro-Keyport-Elkton Association – This association is characterized by level to moderately sloping, excessively drained, sandy soils and moderately well-drained and poorly drained, level to gently sloping, loamy soils with clayey subsoil.
- Bibb-Tidal Marsh-Swamp Association – This association is characterized by level or nearly level, poorly drained, and generally located on floodplains and in miscellaneous unclassified wetlands.

The USDA soil survey identifies 31 soil map units within the boundaries of IHDIV-NSWC. Beltsville silt loam, 2 to 5 percent slope and Croom gravelly sandy loam, 10 to 15 percent slope, comprise just over 50 percent of the soils on IHDIV-NSWC. Beltsville silt loams are moderately well drained, strongly acidic soils that were formed in silty and moderately sandy materials. Croom gravelly sandy loams are well-drained gravelly soils that were formed in very old fluvial deposits of gravel, which contain varying level of sand and clay. They are found predominantly on upland areas and, due to their slope, have high erosion potential (Parsons 2000).

1.1.5 Hydrology

Major water bodies at Indian Head include the Potomac River, Mattawoman Creek, and Chicamuxen Creek. The Potomac River flows almost 400 miles from its headwaters in the Allegheny Mountains of West Virginia. Near Indian Head, the Potomac broadens and becomes saltier from the increasing influence of the Chesapeake Bay. Salinity ranges from 0.01 to 3.0 parts per thousand near IHDIV-NSWC, with the highest salinity values recorded during dry summer months. Mattawoman and Chicamuxen Creeks are tidal tributaries to the lower Potomac River. Chicamuxen Creek is more saline than Mattawoman Creek since it is more strongly influenced by the estuarine waters of the lower Potomac River.

The Potomac River bounds Cornwallis Neck to the north and northwest. Due to the topography of the peninsula, most of the surface water drainage on Cornwallis Neck flows into Mattawoman Creek, which forms its southeastern boundary. The Stump Neck peninsula is bounded by Mattawoman Creek to the north, the Potomac River to the northwest, and partially by Chicamuxen Creek to the southeast.

The Patapsco Formation aquifer supplies IHDIV-NSWC with the majority of groundwater required for production. It is recharged chiefly through precipitation and the water filters through the soil and is held primarily in sandy/gravelly formations (Parsons 2000). A single production well, Well 16A is screened in the deeper Patuxent aquifer.

1.1.6 Ecological Communities

1.1.6.1 Terrestrial Systems

IHDIV-NSWC comprises approximately 2,000 acres of terrestrial ecological communities on Cornwallis Neck and about 1,000 acres at Stump Neck. Terrestrial habitats in these areas are classified as forested uplands, open uplands, and terrestrial cultural uplands. The forested areas on IHDIV-NSWC are dominated by oaks, hickories, tulip tree (*Liriodendron tulipifera*) and pine. Flowering dogwood (*Cornus florida*), redbud (*Cercis canadensis*), and American holly (*Ilex opaca*) are typical of the upland understory. The forests are heavily fragmented by buildings, roads, and other structures. Terrestrial cultural uplands consist of areas that have been created, maintained, or modified by human activities. These areas are characterized as either mowed grass/landscaped areas, wildlife food plots, or successional fields and roadsides.

1.1.6.2 Wetland Systems

National Wetland Inventory (NWI) maps identify approximately 290 acres of wetlands on IHDIV-NSWC. Of this acreage, tidal estuarine systems comprise 234 acres, forested wetlands comprise 42 acres, emergent marshes and shrub swamps comprise 5.5 acres, and lacustrine systems comprise the remaining acreage. Approximately 17 miles of riverine systems also occur in this area.

At Indian Head, the tidal estuarine systems are associated with the Potomac River, Mattawoman Creek, and Chicamuxen Creeks. Mattawoman Creek marshes are typically dominated by wild rice (*Zizania aquatica*), big cordgrass (*Spartina cynosuriodes*), cattail (*Typha* spp.), rose-mallow (*Hibiscus moscheutos*), tickseed sunflowers (*Bidens* spp.), pickerelweed (*Pontederia cordata*), and arrow arum (*Peltandra virginica*). Intertidal shoreline fringe marshes are extremely rare and are dominated by water willow (*Justica americana*) or American threesquare (*Scirpus pungens*). The broad expansive marsh of Chicamuxen Creek contains an extremely diverse flora. An informal survey of this marsh conducted in 1988 identified more than 80 species of plants (MDNR 1992).

1.1.7 Fauna

The diverse ecological communities at Indian Head support many wildlife species. Faunal inventories were conducted by Maryland Natural Heritage as part of the 1991- 1992 rare, threatened, and endangered species survey. IHDIV-NSWC natural resources staff has conducted additional waterfowl and amphibian surveys. Currently, an estimated 15 species of damselflies, 26 species of dragonflies, 48 species of butterflies, 29 species of mammals, 23 species of reptiles, 20 species of amphibians, and 119 species of birds utilize the available habitat at IHDIV-NSWC (MDNR 1992; Parsons 2000). Lists of these species are provided in Appendices A and B.

1.1.8 Rare, Threatened and Endangered Species

A survey of rare, threatened, and endangered species was conducted by the Maryland Natural Heritage Program in 1991 - 1992. The survey focused on areas with a high potential for supporting rare, threatened, and endangered species. Tables 1-1 and 1-2 list the rare, threatened, and endangered flora and fauna identified on IHDIV-NSWC. Of these listed

species, the bald eagle (*Haliaeetus leucocephalus*) is the only know federally-listed threatened species identified on IHDIV-NSWC. The remainder of the species listed include five state-listed endangered plants, two state-listed threatened plants, one state-listed endangered invertebrate, and eighteen species of regional concern.

Three additional rare tree species were identified during the 1995 Urban Tree Inventory including the state-threatened eastern arborvitae (*Thuja occidentalis*), state-rare shingle oak (*Quercus imbricaria*), and potentially state-rare pussy willow (*Salix discolor*).

The 1991 - 1992 survey also identified ten areas of ecological significance at Indian Head (totaling 614 acres) that have the potential to support the long-term protection of the rare, threatened, and endangered species. These protection areas include Bullitt Neck Point, Cornwallis Neck Marshes, Hog Island Cove, Thoroughfare Island, Chicamuxen Creek Marsh, Magnolia Seep, Porter Woods, Rum Point, Stump Neck Beaver Marsh, and West Stump Neck Shoreline.

1.2 Document Organization

Three areas of investigation are addressed in this work plan. Section 3 contains site-specific information for the lab area sewers and storm drains (includes Sites 15, 16, and 53). Section 4 contains site-specific information for the lab area surface soils (Sites 50, 54, and 55). Section 5 contains site-specific information for Site 49. Each area of concern is contained in a separate chapter and consists of background information and a site description; a summary of previous environmental investigations performed at the site; data assessment and investigative scoping and a site-specific work plan summary.

1.3 Previous Investigation and Evaluation

In June 1982, Naval Energy and Environment Support Activity (NEESA) conducted an Initial Assessment Study (IAS). Submitted in May of 1983, the report evaluated the various sites at the IHDIV-NSWC to determine if a potential threat to human health or the environment existed. The report identified five sites (Sites 5, 6, 8, 12, and 25) as exhibiting a potential threat. A Navy Assessment and Control of Installation Pollutants (NACIP) Confirmation Study was conducted at three of these sites (Sites 5, 8, and 12) and was published in September 1985 by CH2M HILL. Removal Actions were subsequently conducted at Sites 5 and 8. A remedial investigation was completed at Site 12 in March, 1999. A draft final feasibility study for Site 12 was submitted in July, 2000.

A supplemental Preliminary Assessment (PA) Report was prepared by NEESA in January 1992. The report evaluated an additional 17 sites (Sites 39 to 55). All but two sites (Sites 51 and 52) were recommended for further work. As a follow-up to the supplemental PA, a Site Inspection (SI) was conducted on Sites 39 through 50, and Sites 53, 54, and 55 in two phases. Phase I focused on Site 42, Olsen Road Landfill. Phase II focused on the remainder of the sites. Based on the results of the SI all the sites were recommended for further study.

A Hazardous Ranking System (HRS) Final Scoring report was conducted and submitted by Ensafe/Allen & Hoshall on April 1, 1994. The HRS Report identified the Activity as scoring

50, which is above the 28.5 cut-off score. Therefore IHDIV-NSWC was proposed to the NPL on February 13, 1995, and was officially placed on the list on September 29, 1995.

TABLE 1-1
Rare Flora Found at NSWC Indian Head Division

Common Name	Scientific Name	Federal Status	State Status	Global/State Rank
Virginia snakeroot	*Aristolochia serpentaria*	NS	NS	G5/S3
Twining bartonia	*Bartonia paniculata*	NS	NS	G5/S3
Tickseed sunflower	*Bidens coronata*	NS	E	G5/S2S3
Swamp beggars-ticks	*Bidens discoidea*	NS	E	G5/S2S3
American bittersweet	*Celastrus scandens*	NS	NS	G5/SU
Virginia dayflower	*Commelina virginica*	NS	NS	G5/S3
Honeyvine	*Cynachum laeve*	NS	NS	G5/S3
Pumpkin ash	*Fraxinus profunda*	NS	EE[1]	G4/S2S3
Narrow melicgrass	*Melica mutica*	NS	T	G5/S1
Creeping cucumber	*Melothria pendula*	NS	E	G4/S1
Large-seeded forget-me-not	*Myosotis macrosperma*	NS	T	G5/S1
Smallflower baby blue eyes	*Nemophila aphylla*	NS	NS	G5/S1
Coolwort	*Pilea fontana*	NS	NS	G5/S2
Wafer-ash	*Ptelea trifoliata*	NS	NS	G5/S3
Shingle oak [2]	*Quercus imbricaria*	NS	NS	G5/S3
Pussy willow [2]	*Salix discolor*	NS	NS	G5/SU
River bulrush	*Scirpus fluviatilis*	NS	NS	G5/S3S4
Red-berried greenbriar	*Smilax walteri*	NS	E	G5/S3
Eastern arborvitae [2]	*Thuja occidentalis*	NS	T	G5/S1

Source: MDNR 1992.

(1) Although listed in the State Threatened and Endangered Species List as endangered extirpated, State regulations provide that such species be afforded the same protection as an endangered species upon the discovery of a viable, naturally occurring population.

(2) Source: Virginia Tech, 1995.

Federal Codes:	**State Codes:**
E = Endangered	E = Endangered
NS = No status	EE = Endangered extirpated
	T = Threatened

Global Ranks:
G4 = Apparently secure globally, though it may be quite rare in parts of its range.
G5 = Demonstrably secure globally, though it may be rare in parts of its range.

State Ranks:
S1 = Critically imperiled in the state because of extreme rarity, equivalent to being ranked as state rare.
S2 = Imperiled in the state because of rarity; equivalent to being ranked state rare.
S3 = Rare or uncommon in the state; equivalent to being ranked as watch list.
S4 = Apparently secure in state, with many occurrences.
SH = Of historical occurrence in the state but not verified in the past 20 years.
SU = Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the state.

TABLE 1-2
Rare Fauna Found at NSWC Indian Head Division

Common Name	Scientific Name	Federal Status	State Status	Global/State Rank
Birds				
Bald eagle	*Haliaeetus leucocephalus*	LT	E	G3/S1
Least bittern	*Ixobrychus exilis*	NS	I	G5/S2
Mammals				
Bobcat	*Lynx rufus*	NS	I	G5/S3
Southeastern shrew	*Sorex longirostris*	NS	NS	G5/S2
Amphibians/Reptiles				
Queen snake	*Regina septemvittata*	NS	NS	G5/S4
Invertebrates				
Sedge skimmer	*Euphyes dion*	NS	NS	G4/S3
Harvester	*Feniseca tarquinius*	NS	NS	G5/S4
Carolina satyr	*Hermeuptychia sosybius*	Ns	NS	G5Q/S1S3
Frosted elfin	*Incisalia irus*	NS	E	G4/S1
Yellow-sided skimmer	*Libellula flavida*	NS	NS	G5/S4
Treetop emerald	*Somatochlora provocans*	NS	NS	G3G4/S1

Source: MDNR 1992.

Federal Codes:
LT = Threatened
NS = No status

State Codes:
E = Endangered
I = In need of conservation

Global Ranks:
G3 = Either very rare and local throughout its range or found locally in a restricted range.
G4 = Apparently secure globally, though it may be quite rare in parts of its range.
G5 = Demonstrably secure globally, though it may be rare in parts of its range.
Q = Indicates taxonomic uncertainty.

State Ranks:
S1 = Critically imperiled in the state because of extreme rarity, equivalent to being ranked as state rare.
S2 = Imperiled in the state because of rarity; equivalent to being ranked state rare.
S3 = Rare or uncommon in the state; equivalent to being ranked as watch list.
S4 = Apparently secure in state, with many occurrences.
SH = Of historical occurrence in the state but not verified in the past 20 years.

Three of the four sites in this report were previously investigated as part of Phase II of the SI. These include Sites 49, 50, and 53. Sites 15 and 16 (Building 600 sewers and Buildings 103 and 502 sewers) have not been specifically investigated, although they are encompassed by Site 53. Results of the previous investigations were compared to USEPA Region III screening levels. The screening levels consist of Risk Based Concentrations (RBCs) and Soil Screening Levels (SSLs) published by USEPA Region III. Three of the four sites were qualitatively determined to be potentially ecologically sensitive and the data for those sites were additionally evaluated against the USEPA Region III BTAG screening levels for ecological risk evaluation. Tables 1-3 and 1-4 show human health and ecological screening concentrations, respectively, for analytes that will be analyzed during the investigation.

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
Volatiles (SW846-8260)					
Acetone	200,000,000	7,800,000	0.12	--	610
Acetonitrile	--	--	0.029	--	120
Acrolein	41,000,000	1,600,000	0.00001	--	0.042
Acrylonitrile	11,000	1,200	0.0000074	--	0.037
Allyl chloride	--	--	--	--	--
Benzene	200,000	22,000	0.0001	5	0.36
Bromodichloromethane	92,000	10,000	0.000054	100	0.17
Bromoform	720,000	81,000	0.2	100	8.50
Bromomethane	2,900,000	110,000	0.0021	--	8.5
2-Butanone (MEK)	1,200,000,000	47,000,000	0.4	--	1,900
Carbon disulfide	200,000,000	7,800,000	0.95	--	1,000
Carbon tetrachloride	44,000	4,900	0.00011	5	0.16
Chlorobenzene	41,000,000	1,600,000	0.04	100	110
Chloroethane	2,000,000	220,000	0.00096	--	8,600
Chloroform	940,000	100,000	0.000045	100	0.15
Chloromethane	440,000	49,000	0.00052	--	2.1
Chloroprene	--	--	--	--	--
Dibromochloromethane	68,000	7,600	0.000041	100	0.13
1,2-Dibromo-3-chloropropane	4,100	460	0.000044	0.2	0.047
1,2-Dibromoethane (EDB)	67	7.5	0.00000043	0.05	0.000[illegible]
Dibromomethane	--	--	--	--	61[illegible]
trans-1,4-Dichloro-2-butene	--	--	--	--	--
Dichlorodifluoromethane	410,000,000	16,000,000	0.55	--	350
1,1-Dichloroethane	200,000,000	7,800,000	0.23	--	800
1,2-Dichloroethane	63,000	7,000	0.000052	5	0.12
1,1-Dichloroethene	9,500	1,100	0.000018	7	0.044
1,2-Dichloroethene (total)	18,000,000	700,000	0.019	70	55.00
1,2-Dichloropropane	84,000	9,400	0.0004	5	0.16
cis-1,3-Dichloropropene	32,000	3,500	0.000027	--	0.077
trans-1,3-Dichloropropene	32,000	3,500	0.000027	--	0.077
1,4-Dioxane	520,000	58,000	0.0013	--	6.1
Ethylbenzene	200,000,000	7,800,000	0.75	700	1,300.00
Ethylmethacrylate	180,000,000	7,000,000	1	--	550
2-Hexanone	82,000,000	3,100,000	--	--	--
Iodomethane	--	--	--	--	--
Isobutanol	610,000,000	23,000,000	0.59	--	1,800
Methacrylonitrile	200,000	7,800	0.00021	--	1.0
Methylene chloride	760,000	85,000	0.00095	5	4.10
Methyl methacrylate	1,000,000,000	110,000,000	0.32	--	1,400
4-Methyl-2-pentanone	160,000,000	6,300,000	0.065	--	140
Propionitrile	--	--	--	--	--
Styrene	410,000,000	16,000,000	2.9	100	1,600.00
1,1,1,2-Tetrachloroethane	220,000	25,000	0.0002	--	0.053
1,1,2,2-Tetrachloroethane	29,000	3,200	0.000034	--	0.053
Tetrachloroethene	110,000	12,000	0.0024	5	1.10
Toluene	410,000,000	16,000,000	0.44	1,000	75[illegible]
1,1,1-Trichloroethane	41,000,000	1,600,000	0.51	200	540
1,1,2-Trichloroethane	100,000	11,000	0.000039	5	0.19

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
Trichloroethene	520,000	58,000	0.00077	5	1.60
Trichlorofluoromethane	610,000,000	23,000,000	1.1	--	1,300
1,2,3-Trichloropropane	820,000	91	0.00000052	--	1,500
Vinyl acetate	1,000,000,000	78,000,000	0.087	--	410
Vinyl chloride	3,000	340	0.0000079	2	0.019
Xylenes (total)	4,100,000,000	160,000,000	8.5	10,000	12,000
Semivolatiles (SW846-8270)					
Acenaphthene	120,000,000	4,700,000	5.2	--	370
Acenaphthylene	--	--	--	--	--
Acetophenone	200,000,000	7,800,000	0.000011		0.042
2-Acetylaminofluorene	--	--	--	--	--
4-Aminobiphenyl	--	--	--	--	--
Aniline	1,000,000	110,000	0.0068	--	12
Anthracene	610,000,000	23,000,000	23	--	1,800
Aramite	--	--	--	--	--
Benzo(a)anthracene	7,800	870	0.073	--	0.092
Benzo(b)fluoranthene	7,800	870	0.23	--	0.092
Benzo(k)fluoranthene	78,000	8,700	23	--	0.92
Benzo(g,h,i)perylene	--	--	--	--	--
Benzo(a)pyrene	780	87	0.019	0.2	0.0092
Benzoic acid	1,000,000,000	310,000,000	--	--	150,000
Benzyl alcohol	610,000,000	23,000,000	4.4	--	11,000
4-Bromophenyl-phenylether	--	--	--	--	--
Butylbenzyl phthalate	410,000,000	16,000,000	840	--	7,300
2-sec-Butyl-4,6-dinitrophenol	--	--	--	--	--
Carbazole	290,000	32,000	0.023	--	3.30
4-Chloroaniline	8,200,000	310,000	0.048	--	150
bis-(2-Chloroethoxy)methane	--	--	--	--	--
bis-(2-Chloroethyl)ether	5,200	580	0.0000022	--	0.0096
2,2'-oxybis(1-Chloropropane)	82,000	9,100	0.000084	--	--
4-Chloro-3-methylphenol	--	--	--	--	--
2-Chloronaphthalene	160,000,000	6,300,000	1.6	--	2,900
2-Chlorophenol	10,000,000	390,000	--	--	30
4-Chlorophenyl-phenylether	--	--	--	--	--
Chrysene	780,000	87,000	7.3	--	9.2
Dibenz(a,h)anthracene	780	87	0.07	--	0.0092
Dibenzofuran	8,200,000	310,000	0.38	--	24
Di-n-butylphthalate	200,000,000	7,800,000	250	--	3,700
1,2-Dichlorobenzene	180,000,000	7,000,000	0.46	600	550
1,3-Dichlorobenzene	61,000,000	2,300,000	0.0044	--	14
1,4-Dichlorobenzene	240,000	27,000	0.00036	75	0.47
3,3'-Dichlorobenzidine	13,000	1,400	0.00025	--	0.15
2,4-Dichlorophenol	6,100,000	230,000	0.06	--	110
2,6-Dichlorophenol	--	--	--	--	--
Diethylphthalate	1,000,000,000	63,000,000	23	--	29,000
Dimethylaminoazobenzene	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	--	--	--	--	--
3,3'-Dimethylbenzidine	620	69	--	--	0.0073

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
a,a-Dimethylphenethylamine	--	--	--	--	--
2,4-Dimethylphenol	41,000,000	1,600,000	0.34	--	730
Dimethylphthalate	1,000,000,000	780,000,000	--	--	370,000
1,3-Dinitrobenzene	200,000	7,800	0.0018	--	3.7
4,6-Dinitro-2-methylphenol	200,000	7,800	--	--	4
2,4-Dinitrophenol	4,100,000	160,000	--	--	73
2,4-Dinitrotoluene	4,100,000	160,000	0.029	--	73
2,6-Dinitrotoluene	2,000,000	78,000	0.012	--	37
Di-n-octylphthalate	41,000,000	1,600,000	120000	--	730
Diphenylamine	51,000,000	2,000,000	1.3	--	910
bis-(2-Ethylhexyl)phthalate	410,000	46,000	140	6	4.8
Ethyl methanesulfonate	--	--	--	--	--
Fluoranthene	82,000,000	3,100,000	310	--	1,500
Fluorene	82,000,000	3,100,000	6.8	--	2,400
Hexachlorobenzene	3,600	400	0.0026	1	0.042
Hexachlorobutadiene	73,000	8,200	0.092	--	0.86
Hexachlorocyclopentadiene	14,000,000	550,000	100	50	260
Hexachloroethane	410,000	46,000	0.018	--	4.8
Hexachlorophene	610,000	23,000	100	--	11.00
Hexachloropropene	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	7,800	870	0.64	--	0.092
Isophorone	6,000,000	670,000	0.021	--	71
Isosafrole	--	--	--	--	--
Methapyrilene	--	--	--	--	--
3-Methylcholanthrene	--	--	--	--	--
Methyl methanesulfonate	--	--	--	--	--
2-Methylnaphthalene	4,100,000	1,600,000	1.1	--	120
2-Methylphenol	100,000,000	3,900,000	--	--	1,800
3-Methylphenol	100,000,000	3,900,000	--	--	180
4-Methylphenol	10,000,000	390,000	--	--	180
Naphthalene	4,100,000	1,600,000	0.0077	--	65
1,4-Naphthoquinone	--	--	--	--	--
1-Naphthylamine	--	--	--	--	--
2-Naphthylamine	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--
Nitrobenzene	1,000,000	39,000	0.0012	--	3.5
2-Nitrophenol	--	--	--	--	2,300
4-Nitrophenol	16,000,000	630,000	0.087	--	290
4-Nitroquinoline-1-oxide	--	--	--	--	--
n-Nitroso-di-n-butylamine	1,100	120	0.0000014	--	0.0019
n-Nitrosodiethylamine	38	4.30	0.00000011	--	0.00045
n-Nitrosodimethylamine	110	13.00	0.00000028	--	0.0013
n-Nitrosodiphenylamine	1,200,000	130,000	0.038	--	14
n-Nitroso-di-n-propylamine	820	91	0.00000024	--	0.0096
n-Nitrosomethylethylamine	260	29	--	--	0.00
n-Nitrosomorpholine	--	--	--	--	--
n-Nitrosopiperidine	--	--	--	--	--

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
n-Nitrosopyrrolidine	2,700	300	--	--	0.032
5-Nitro-o-toluidine	--	--	--	--	--
Pentachlorobenzene	1,600,000	63,000	1	--	29
Pentachloroethane	--	--	--	--	--
Pentachloronitrobenzene	22,000	2,500	0.0041	--	0.26
Pentachlorophenol	48,000	5,300	--	1	0.56
Phenacetin	--	--	--	--	--
Phenanthrene		--	--	--	--
Phenol	1,000,000,000	47,000,000	6.7	--	22,000
4-Phenylenediamine	390,000,000	15,000,000	--	--	6,900
2-Picoline	--	--	--	--	--
Pronamide	--	--	--	--	--
Pyrene	61,000,000	2,300,000	34	--	180
Pyridine	2,000,000	78,000	--	--	37
Safrole	--	--	--	--	--
1,2,4,5-Tetrachlorobenzene	610,000	23,000	0.033	--	11
2,3,4,6-Tetrachlorophenol	61,000,000	2,300,000	--	--	1,100
2-Toluidine	--	--	--	--	--
1,2,4-Trichlorobenzene	20,000,000	780,000	0.38	70	190
2,4,5-Trichlorophenol	200,000,000	7,800,000	--	--	3,700
2,4,6-Trichlorophenol	520,000	58,000	--	--	6.1
1,3,5-Trinitrobenzene	61,000,000	2,300,000	--	--	1,100
Organochlorine Pesticides (SW846-8081)					
Aldrin	340	38	0.00038	--	0.0039
alpha-BHC	910	100	0.000045	--	0.011
beta-BHC	3,200	350	0.00016	--	0.037
delta-BHC	3,200	350	0.00016	--	0.037
gamma-BHC (Lindane)	4,400	490	0.00022	0.2	0.052
alpha-Chlordane	16,000	1,800	0.046	2	0.19
gamma-Chlordane	16,000	1,800	0.046	2	0.19
Chlorobenzilate	21,000	2,400	0.0013	--	0.25
4,4'-DDD	24,000	2,700	0.56	--	0.28
4,4'-DDE	17,000	1,900	1.8	--	0.20
4,4'-DDT	17,000	1,900	0.058	--	0.20
Diallate	--	--	--	--	--
Dieldrin	360	40	0.00011	--	0.0042
Endosulfan I	12,000,000	470,000	0.98	--	220
Endosulfan II	12,000,000	470,000	0.98	--	220
Endosulfan sulfate	12,000,000	470,000	0.98	--	--
Endrin	610,000	23,000	0.27	2	11
Endrin aldehyde	--	--	--	--	--
Heptachlor	1,300	140	0.042	0.4	0.015
Heptachlor epoxide	630	70.00	0.0012	--	0.0074
Isodrin	--	--	--	--	--
Kepone	--	--	--	--	--
Methoxychlor	10,000,000	390,000	15	40	180
Toxaphene	5,200	580	0.031	3.0	0.061

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
Organophosphorous Pesticides (SW846-8141)					
Dimethoate	---	--	--	--	--
Disulfoton	82,000	3,100	0.0032	--	1.5
Famphur	--	--	--	--	--
Parathion ethyl	12,000,000	470,000	0.5	--	--
Parathion methyl	12,000,000	470,000	0.5	--	--
Phorate	--	--	--	--	--
Sulfotepp	--	--	--	--	--
Thioazin	--	--	--	--	--
o,o,o-Triethylphosphorothioate	--	--	--	--	--
PCBs (SW846-8082)					
Aroclor-1016	2,900	320	0.21	0.50	0.96
Aroclor-1221	2,900	320	--	0.50	0.033
Aroclor-1232	2,900	320	--	0.50	0.033
Aroclor-1242	2,900	320	--	0.50	0.033
Aroclor-1248	2,900	320	--	0.50	0.033
Aroclor-1254	2,900	320	0.054	0.50	0.033
Aroclor-1260	2,900	320	--	0.50	0.033
PCB Congeners (NOAA)[P]	--	--	--	--	--
Herbicides (SW846-8150)					
2,4-D	20,000,000	780,000	0.45	70	370
2,4,5-T	20,000,000	780,000	0.098	--	370
2,4,5-TP (Silvex)	16,000,000	630,000	1.1	50	290
Dinoseb	2,000,000	78,000	0.0087	7	37
Dioxins					
2,3,7,8-TCDD	0.000038	0.0000043	0.00000043	3E-11	0.00000045
1,2,3,7,8-PeCDD		--	--	--	--
1,2,3,6,7,8-HxCDD		--	--	--	--
1,2,3,4,7,8-HxCDD		--	--	--	--
1,2,3,7,8,9-HxCDD		--	--	--	--
1,2,3,4,6,7,8-HpCDD		--	--	--	--
1,2,3,4,6,7,8,9-OCDD		--	--	--	--
2,3,7,8-TCDF		--	--	--	--
1,2,3,7,8-PeCDF		--	--	--	--
2,3,4,7,8-PeCDF		--	--	--	--
1,2,3,6,7,8-HxCDF		--	--	--	--
1,2,3,7,8,9-HxCDF		--	--	--	--
1,2,3,4,7,8-HxCDF		--	--	--	--
2,3,4,6,7,8-HxCDF		--	--	--	--
1,2,3,4,6,7,8-HpCDF		--	--	--	--
1,2,3,4,7,8,9-HpCDF		--	--	--	--
1,2,3,4,6,7,8,9-OCDF		--	--	--	--

Table 1-3
Human Health Screening Values
For Groundwater, Soil, and Sediment

Compound	Soil and Sediment			Groundwater	
	Human Health RBC		Soil Screening Levels (SSLs)	Drinking Water MCLs	Human Health RBC
	Industrial Soil ug/kg	Residential Soil ug/kg	mg/kg	ug/L	ug/L
Inorganics (ILM03)					
Aluminum	1,000,000,000	78,000,000	--	--	37,000
Antimony	820,000	31,000	0.66	6	15
Arsenic	3,800	430	0.0013	5	0.045
Barium	140,000,000	5,500,000	110	2,000	2,600
Beryllium	4,100,000	160,000	58	4	73
Cadmium	2,000,000	78,000	2.7	5	18
Calcium	--	--	--	--	--
Chromium	6,100,000	230,000	2.1	100	110
Cobalt	120,000,000	4,700,000	--	--	2,200
Copper	82,000,000	3,100,000	530	1300	1,500
Cyanide	41,000,000	1,600,000	7.4	200[c]	730
Iron	610,000,000	23,000,000	--	--	11,000
Lead	--	--	--	15[f]	--
Magnesium	--	--	--	--	--
Manganese	290,000,000	11,000,000	330	--	730
Mercury	--	--	--	2	--
Nickel	41,000,000	1,600,000	--	1,000	730
Potassium	--	--	--	2	--
Selenium	10,000,000	390,000	0.95	50	180
Silver	10,000,000	390,000	1.6	--	180
Sodium	--	--	--	--	--
Sulfide (EPA 376.1)	--	--	--	--	--
Thallium	160,000	6,300	0.18	2	--
Tin (SW846-6010)	1,000,000,000	310,000	--	--	22,000
Vanadium	14,000,000	550,000	260	--	260
Zinc	610,000,000	23,000,000	680	--	11,000

Notes:

MCL - Maximum Contaminant Level
(T) - These are not MCLs but action levels for tap water
* RBCs are used for screening only when MCLs are not available.
4-Nitrophenol human health RBC value was substituted as a surrogate for 2-nitrophenol
Technical grade BHC human health RBC value was substituted as a surrogate for delta-BHC
[P] - PCB congeners analyzed by the NOAA method have a detection limit range of 0.07-1.84 ng/g and include th4e following PCB compounds: PCB 8, 18, 28, 44, 52, 66, 77, 101 128, 138, 153, 170, 180, 187, 195, 206, and 209. PCB 77 and PCB 126 are co-planer PCBs.

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Surface Water/Groundwater (Fresh)						
1,1,1,2-Tetrachloroethane	2400	ug/L	USEPA 1995			
1,1,1-Trichloroethane	9400	ug/L	USEPA 1995			
1,1,2,2-Tetrachloroethane	2400	ug/L	USEPA 1995			
1,1,2-Trichloroethane	9400	ug/L	USEPA 1995			
1,1-Dichloroethane	1600	ug/L	USEPA 1995 (with safety factor of 100)			
1,1-Dichloroethene	1160	ug/L	USEPA 1995 (with safety factor of 10)			
1,2,4,5-Tetrachlorobenzene	50	ug/L	USEPA 1995			
1,2,4-Trichlorobenzene	50	ug/L	USEPA 1995			
1,2-Dibromoethane	180	ug/L	USEPA 1995 (with safety factor of 100)			
1,2-Dichlorobenzene	763	ug/L	USEPA 1995			
1,2-Dichloroethane	20000	ug/L	USEPA 1995			
1,2-Dichloroethene (total)	1160	ug/L	USEPA 1995 (with safety factor of 10)			
1,2-Dichloropropane	5700	ug/L	USEPA 1995			
1,3-Dichlorobenzene	763	ug/L	USEPA 1995			
1,3-Dichloropropene	244	ug/L	USEPA 1995			
1,4-Dichlorobenzene	763	ug/L	USEPA 1995			
2,4,5-Trichlorophenol	63	ug/L	USEPA 1995			
2,4,6-Trichlorophenol	970	ug/L	USEPA 1995			
2,4-Dichlorophenol	365	ug/L	USEPA 1995			
2,4-Dimethylphenol	530	ug/L	Federal Register 59:3762 (1994)			
2,4-Dinitrophenol	150	ug/L	USEPA 1995			
2,4-Dinitrotoluene	230	ug/L	USEPA 1995			
2-Butanone	14000	ug/L	Suter and Tsao 1996			
2-Chloronaphthalene	620	ug/L	USEPA 1995			
2-Chlorophenol	97	ug/L	USEPA 1995 (with safety factor of 10)			
2-Hexanone	4280	ug/L	USEPA 1995 (with safety factor of 100)			
2-Methylphenol	13	ug/L	Suter and Tsao 1996			
2-Nitrophenol	150	ug/L	USEPA 1994			
4,4'-DDD	0.06	ug/L	USEPA 1995 (with safety factor of 10)			
4,4'-DDE	105	ug/L	USEPA 1995 (with safety factor of 10)			
4,4'-DDT	0.001	ug/L	USEPA 1995			
4,6-Dinitro-2-methylphenol	2.3	ug/L	USEPA 1999a			
4-Bromophenyl-phenylether	1.5	ug/L	USEPA 1996			
4-Chloro-3-methylphenol	0.3	ug/L	USEPA 1999a			
4-Chloroaniline	50	ug/L	Buchman 1999			
4-Methyl-2-pentanone	4600	ug/L	USEPA 1995 (with safety factor of 100)			
4-Nitrophenol	150	ug/L	USEPA 1995			
Acenaphthene	520	ug/L	USEPA 1995			
Acetone	90000	ug/L	USEPA 1995 (with safety factor of 100)			
Acrolein	21	ug/L	USEPA 1995			
Acrylonitrile	2600	ug/L	USEPA 1995			
Aldrin	0.3	ug/L	USEPA 1995 (with safety factor of 10)			
alpha-BHC	2.2	ug/L	Suter and Tsao 1996			
alpha-Chlordane	0.17	ug/L	Suter and Tsao 1996			
Aluminum	87	ug/L	USEPA 1999b			
Ammonia	17	ug/L	USEPA 1995			
Anthracene	0.73	ug/L	Suter and Tsao 1996			
Antimony	30	ug/L	USEPA 1995			
Aroclor-1016	0.014	ug/L	USEPA 1995			
Aroclor-1221	0.28	ug/L	Suter and Tsao 1996			
Aroclor-1232	0.58	ug/L	Suter and Tsao 1996			
Aroclor-1242	0.053	ug/L	Suter and Tsao 1996			
Aroclor-1248	0.081	ug/L	Suter and Tsao 1996			
Aroclor-1254	0.033	ug/L	Suter and Tsao 1996			
Aroclor-1260	94	ug/L	Suter and Tsao 1996			
Arsenic	150	ug/L	USEPA 1999b			
Barium	1000	ug/L	USEPA 1995 (with safety factor of 10)			
Benzene	530	ug/L	USEPA 1995 (with safety factor of 10)			
Benzo(a)anthracene	6.3	ug/L	USEPA 1995			
Benzo(a)pyrene	0.014	ug/L	Suter and Tsao 1996			
Benzoic Acid	42	ug/L	Suter and Tsao 1996			
Beryllium	5.3	ug/L	USEPA 1995			
beta-BHC	2.2	ug/L	Suter and Tsao 1996			
bis(2-Chloroethoxy)methane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
bis(2-Chloroethyl)ether	2380	ug/L	USEPA 1999a			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
bis(2-Ethylhexyl)phthalate	30	ug/L	USEPA 1995			
Bromochloromethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Bromodichloromethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Butylbenzylphthalate	22	ug/L	USEPA 1999a			
Cadmium	0.83	ug/L	USEPA 1999b	25		
Carbon disulfide	2	ug/L	USEPA 1995			
Carbon tetrachloride	3520	ug/L	USEPA 1995 (with safety factor of 10)			
Chlordane	0.17	ug/L	Suter and Tsao 1996			
Chlorobenzene	130	ug/L	USEPA 1996			
Chloroform	1240	ug/L	USEPA 1995			
Chloromethane	5500	ug/L	USEPA 1999a			
Chromium	11.4	ug/L	USEPA 1999b			
cis-1,2-Dichloroethene	1160	ug/L	USEPA 1995 (with safety factor of 10)			
cis-1,3-Dichloropropene	244	ug/L	USEPA 1995			
Cobalt	23	ug/L	Suter and Tsao 1996			
Copper	2.9	ug/L	USEPA 1999b	25		
Cyanide	5.2	ug/L	USEPA 1995			
delta-BHC	2.2	ug/L	Suter and Tsao 1996			
Dibenzofuran	20	ug/L	USEPA 1996			
Dibromochloromethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Dibromomethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Dichlorodifluoromethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Dieldrin	0.056	ug/L	USEPA 1999b			
Diethylphthalate	220	ug/L	USEPA 1996			
Dimethyl phthalate	330	ug/L	USEPA 1999a			
Di-n-butylphthalate	33	ug/L	USEPA 1996			
Dinitrophenol	150	ug/L	USEPA 1995			
Di-n-octyl phthalate	3	ug/L	Buchman 1999			
Endosulfan	0.056	ug/L	USEPA 1995			
Endosulfan I	0.056	ug/L	USEPA 1995			
Endosulfan II	0.056	ug/L	USEPA 1995			
Endosulfan sulfate	0.056	ug/L	USEPA 1995			
Endrin	0.036	ug/L	USEPA 1999b			
Endrin aldehyde	0.036	ug/L	USEPA 1996			
Endrin ketone	0.036	ug/L	USEPA 1996			
Ethylbenzene	3200	ug/L	USEPA 1995 (with safety factor of 10)			
Fluoranthene	398	ug/L	USEPA 1995 (with safety factor of 10)			
Fluorene	430	ug/L	USEPA 1995			
Fluoride	2000	ug/L	USEPA 1995			
gamma-BHC (Lindane)	0.08	ug/L	USEPA 1995			
gamma-Chlordane	0.17	ug/L	Suter and Tsao 1996			
HCH-Technical	10	ug/L	USEPA 1995 (with safety factor of 10)			
Heptachlor	0.0069	ug/L	USEPA 1996			
Heptachlor epoxide	0.0069	ug/L	Suter and Tsao 1996			
Hexachlorobenzene	3.68	ug/L	USEPA 1995			
Hexachlorobutadiene	9.3	ug/L	USEPA 1995			
Hexachlorocyclopentadiene	5.2	ug/L	USEPA 1995			
Hexachloroethane	540	ug/L	USEPA 1995			
Iron	320	ug/L	USEPA 1995			
Isophorone	11700	ug/L	USEPA 1995 (with safety factor of 10)			
Lead	0.5	ug/L	USEPA 1999b	25		
Manganese	120	ug/L	Suter and Tsao 1996			
Mercury	0.91	ug/L	USEPA 1999b			
Methoxychlor	0.03	ug/L	USEPA 1995			
Methyl bromide	110	ug/L	USEPA 1999a			
Methylene chloride	2200	ug/L	Suter and Tsao 1996			
Naphthalene	100	ug/L	USEPA 1995			
Nickel	16.1	ug/L	USEPA 1999b	25		
Nitrobenzene	2700	ug/L	USEPA 1995 (with safety factor of 10)			
n-Nitrosodiphenylamine	585	ug/L	USEPA 1995 (with safety factor of 10)			
Parathion	0.013	ug/L	USEPA 1995			
Pentachlorobenzene	50	ug/L	USEPA 1995			
Pentachloroethane	1100	ug/L	USEPA 1995			
Pentachlorophenol	15.0	ug/L	USEPA 1999b		7.8	
Phenanthrene	6.3	ug/L	USEPA 1995			
Phenol	256	ug/L	USEPA 1999a			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Polychlorinated biphenyls (PCBs)	0.14	ug/L	Suter and Tsao 1996			
Selenium	5	ug/L	USEPA 1995			
Silver	0.36	ug/L	Suter and Tsao 1996			
Tetrachloroethene	840	ug/L	USEPA 1995			
Thallium	40	ug/L	USEPA 1995			
Toluene	1700	ug/L	USEPA 1995 (with safety factor of 10)			
Toxaphene	0.011	ug/L	USEPA 1996			
trans-1,2-Dichloroethene	1160	ug/L	USEPA 1995 (with safety factor of 10)			
trans-1,3-Dichloropropene	244	ug/L	USEPA 1995			
Tribromomethane	320	ug/L	USEPA 1996			
Tributyltin	0.063	ug/L	USEPA 1999b			
Trichlorobenzene	50	ug/L	USEPA 1995			
Trichloroethene	21900	ug/L	USEPA 1995			
Trichlorofluoromethane	1100	ug/L	USEPA 1995 (with safety factor of 10)			
Vanadium	10000	ug/L	USEPA 1995			
Vinyl chloride	1160	ug/L	USEPA 1995 (with safety factor of 10)			
Xylene, total	130	ug/L	USEPA 1995			
Zinc	37	ug/L	USEPA 1999b	25		
Surface Water/Groundwater (Marine)						
1,1,1,2-Tetrachloroethane	623	ug/L	USEPA 1995 (with safety factor of 10)			
1,1,1-Trichloroethane	3120	ug/L	USEPA 1995 (with safety factor of 10)			
1,1,2,2-Tetrachloroethane	623	ug/L	USEPA 1995 (with safety factor of 10)			
1,1,2-Trichloroethane	3120	ug/L	USEPA 1995 (with safety factor of 10)			
1,1-Dichloroethane	3200	ug/L	USEPA 1995 (with safety factor of 100)			
1,1-Dichloroethene	22400	ug/L	USEPA 1995 (with safety factor of 10)			
1,2,4,5-Tetrachlorobenzene	129	ug/L	USEPA 1995			
1,2,4-Trichlorobenzene	129	ug/L	USEPA 1995			
1,2-Dichlorobenzene	129	ug/L	USEPA 1995			
1,2-Dichloroethane	1130	ug/L	USEPA 1995 (with safety factor of 100)			
1,2-Dichloroethene (total)	22400	ug/L	USEPA 1995 (with safety factor of 10)			
1,2-Dichloropropane	3040	ug/L	USEPA 1995			
1,3-Dichlorobenzene	28.5	ug/L	USEPA 1999a			
1,3-Dichloropropene	79	ug/L	USEPA 1995 (with safety factor of 10)			
1,4-Dichlorobenzene	129	ug/L	USEPA 1995			
2,4,5-Trichlorophenol	11	ug/L	USEPA 1995			
2,4-Dimethylphenol	110	ug/L	Federal Register 59:3762 (1994)			
2,4-Dinitrophenol	485	ug/L	USEPA 1995 (with safety factor of 10)			
2,4-Dinitrotoluene	370	ug/L	USEPA 1995			
2-Chloronaphthalene	0.75	ug/L	USEPA 1995 (with safety factor of 10)			
2-Methylnaphthalene	30	ug/L	USEPA 1995 (with safety factor of 10)			
2-Nitrophenol	485	ug/L	USEPA 1994			
4,4'-DDD	0.025	ug/L	USEPA 1999a			
4,4'-DDE	1.4	ug/L	USEPA 1995 (with safety factor of 10)			
4,4'-DDT	0.001	ug/L	USEPA 1995			
4-Chloroaniline	129	ug/L	Buchman 1999			
4-Nitrophenol	485	ug/L	USEPA 1995 (with safety factor of 10)			
Acenaphthene	710	ug/L	USEPA 1995			
Acenaphthylene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Aldrin	0.13	ug/L	USEPA 1995 (with safety factor of 10)			
alpha-BHC	0.034	ug/L	USEPA 1995 (with safety factor of 10)			
alpha-Chlordane	0.004	ug/L	USEPA 1995			
Ammonia	17	ug/L	USEPA 1995			
Anthracene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Antimony	500	ug/L	USEPA 1995			
Aroclor-1016	0.03	ug/L	USEPA 1995			
Aroclor-1221	0.03	ug/L	USEPA 1995			
Aroclor-1232	0.03	ug/L	USEPA 1995			
Aroclor-1242	0.03	ug/L	USEPA 1995			
Aroclor-1248	0.03	ug/L	USEPA 1995			
Aroclor-1254	0.03	ug/L	USEPA 1995			
Aroclor-1260	0.03	ug/L	USEPA 1995			
Arsenic	36	ug/L	USEPA 1999b			
Barium	1000	ug/L	USEPA 1995 (with safety factor of 10)			
Benzene	700	ug/L	USEPA 1995			
Benzo(a)anthracene	8.13	ug/L	USEPA 1995			
Benzo(a)pyrene	0.021	ug/L	USEPA 1995 (with safety factor of 10)			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Benzo(b)fluoranthene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Benzo(g,h,i)perylene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Benzo(k)fluoranthene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Beryllium	1500	ug/L	USEPA 1995			
beta-BHC	0.034	ug/L	USEPA 1995 (with safety factor of 10)			
bis(2-Chloroethoxy)methane	6400	ug/L	USEPA 1995			
bis(2-Ethylhexyl)phthalate	360	ug/L	USEPA 1995			
Bromochloromethane	6400	ug/L	USEPA 1995			
Bromodichloromethane	6400	ug/L	USEPA 1995			
Butylbenzylphthalate	29.4	ug/L	USEPA 1999a			
Cadmium	9.4	ug/L	USEPA 1999b			
Carbon disulfide	2	ug/L	USEPA 1995			
Carbon tetrachloride	5000	ug/L	USEPA 1995 (with safety factor of 10)			
Chlordane	0.004	ug/L	USEPA 1995			
Chlorobenzene	105	ug/L	USEPA 1999a			
Chloroform	815	ug/L	USEPA 1999a			
Chloromethane	2700	ug/L	USEPA 1999a			
Chromium	50.4	ug/L	USEPA 1999b			
Chrysene	30	ug/L	USEPA 1995 (with safety factor of 10)			
cis-1,2-Dichloroethene	22400	ug/L	USEPA 1995 (with safety factor of 10)			
cis-1,3-Dichloropropene	79	ug/L	USEPA 1995 (with safety factor of 10)			
Copper	3.7	ug/L	USEPA 1999b			
Cyanide	1	ug/L	USEPA 1995			
delta-BHC	0.034	ug/L	USEPA 1995 (with safety factor of 10)			
Dibenz(a,h)anthracene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Dibromochloromethane	6400	ug/L	USEPA 1995			
Dibromomethane	6400	ug/L	USEPA 1995			
Dichlorodifluoromethane	6400	ug/L	USEPA 1995			
Dieldrin	0.0019	ug/L	USEPA 1995			
Diethylphthalate	75.9	ug/L	USEPA 1999a			
Dimethyl phthalate	580	ug/L	USEPA 1999a			
Di-n-butylphthalate	3.4	ug/L	USEPA 1995			
Dinitrophenol	485	ug/L	USEPA 1995 (with safety factor of 10)			
Di-n-octyl phthalate	3.4	ug/L	USEPA 1995			
Endosulfan	0.0087	ug/L	USEPA 1995			
Endosulfan I	0.0087	ug/L	USEPA 1995			
Endosulfan II	0.0087	ug/L	USEPA 1995			
Endosulfan sulfate	0.0087	ug/L	USEPA 1995			
Endrin	0.0023	ug/L	USEPA 1995			
Endrin aldehyde	0.0023	ug/L	USEPA 1995			
Endrin ketone	0.0023	ug/L	USEPA 1995			
Ethylbenzene	43	ug/L	USEPA 1995 (with safety factor of 10)			
Fluoranthene	16	ug/L	USEPA 1995			
Fluorene	30	ug/L	USEPA 1995 (with safety factor of 10)			
gamma-BHC (Lindane)	0.016	ug/L	USEPA 1995 (with safety factor of 10)			
gamma-Chlordane	0.004	ug/L	USEPA 1995			
HCH-Technical	0.034	ug/L	USEPA 1995 (with safety factor of 10)			
Heptachlor	0.0036	ug/L	USEPA 1995			
Heptachlor epoxide	0.0036	ug/L	USEPA 1995			
Hexachlorobenzene	129	ug/L	USEPA 1995			
Hexachlorobutadiene	3.2	ug/L	USEPA 1995 (with safety factor of 10)			
Hexachlorocyclopentadiene	0.7	ug/L	USEPA 1995 (with safety factor of 10)			
Hexachloroethane	94	ug/L	USEPA 1995 (with safety factor of 10)			
Indeno(1,2,3-cd)pyrene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Isophorone	1290	ug/L	USEPA 1995 (with safety factor of 10)			
Lead	8.5	ug/L	USEPA 1999b			
Manganese	10	ug/L	USEPA 1995			
Mercury	1.1	ug/L	USEPA 1999b			
Methoxychlor	0.03	ug/L	USEPA 1995			
Methyl bromide	120	ug/L	USEPA 1999a			
Methylene chloride	6400	ug/L	USEPA 1995			
Naphthalene	230	ug/L	USEPA 1995 (with safety factor of 10)			
Nickel	8.3	ug/L	USEPA 1995			
Nitrobenzene	668	ug/L	USEPA 1995 (with safety factor of 10)			
n-Nitrosodiphenylamine	330000	ug/L	USEPA 1995 (with safety factor of 10)			
PAH (total)	30	ug/L	USEPA 1994			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Pentachlorobenzene	129	ug/L	USEPA 1995			
Pentachloroethane	281	ug/L	USEPA 1995			
Pentachlorophenol	7.9	ug/L	USEPA 1995			
Phenanthrene	4.6	ug/L	USEPA 1995			
Phenol	580	ug/L	USEPA 1995 (with safety factor of 10)			
Polychlorinated biphenyls (PCBs)	0.03	ug/L	USEPA 1995			
Pyrene	30	ug/L	USEPA 1995 (with safety factor of 10)			
Selenium	71	ug/L	USEPA 1999b			
Silver	0.23	ug/L	USEPA 1999a			
Tetrachloroethene	450	ug/L	USEPA 1995			
Thallium	213	ug/L	USEPA 1995 (with safety factor of 10)			
Toluene	37	ug/L	USEPA 1999a			
Toxaphene	0.21	ug/L	USEPA 1996			
trans-1,2-Dichloroethene	22400	ug/L	USEPA 1995 (with safety factor of 10)			
trans-1,3-Dichloropropene	79	ug/L	USEPA 1995 (with safety factor of 10)			
Tribromomethane	640	ug/L	USEPA 1999a			
Tributyltin	0.01	ug/L	USEPA 1999b			
Trichlorobenzene	129	ug/L	USEPA 1995			
Trichloroethene	200	ug/L	USEPA 1995 (with safety factor of 10)			
Trichlorofluoromethane	6400	ug/L	USEPA 1995			
Vanadium	10000	ug/L	USEPA 1995			
Vinyl chloride	22400	ug/L	USEPA 1995 (with safety factor of 10)			
Xylene, total	135	ug/L	USEPA 1995			
Zinc	86	ug/L	USEPA 1999b			
Sediment (Fresh and Marine)						
1,1,1-Trichloroethane	31	ug/kg	USEPA 1995			
1,1,2-Trichloroethane	31	ug/kg	USEPA 1995			
1,2,4-Trichlorobenzene	40	ug/kg	USEPA 1995			
1,2-Dichlorobenzene	35	ug/kg	USEPA 1995			
1,4-Dichlorobenzene	110	ug/kg	USEPA 1995			
2,4-Dimethylphenol	29	ug/kg	USEPA 1995			
2-Methylnaphthalene	70	ug/kg	USEPA 1995			
2-Methylphenol	63	ug/kg	USEPA 1995			
4,4'-DDD	16	ug/kg	USEPA 1995			
4,4'-DDE	2.2	ug/kg	USEPA 1995			
4,4'-DDT	1.58	ug/kg	USEPA 1995			
4-Methylphenol	670	ug/kg	USEPA 1995			
Acenaphthene	16	ug/kg	USEPA 1995			
Acenaphthylene	44	ug/kg	USEPA 1995			
alpha-BHC	6	ug/kg	Ontario Ministry of the Environment 1993			
Anthracene	85.3	ug/kg	USEPA 1995			
Antimony	150	mg/kg	USEPA 1995			
Aroclor-1016	22.7	ug/kg	USEPA 1995			
Aroclor-1221	22.7	ug/kg	USEPA 1995			
Aroclor-1232	22.7	ug/kg	USEPA 1995			
Aroclor-1242	22.7	ug/kg	USEPA 1995			
Aroclor-1248	22.7	ug/kg	USEPA 1995			
Aroclor-1254	22.7	ug/kg	USEPA 1995			
Aroclor-1260	22.7	ug/kg	USEPA 1995			
Arsenic	8.2	mg/kg	USEPA 1995			
Benzo(a)anthracene	261	ug/kg	USEPA 1995			
Benzo(a)pyrene	430	ug/kg	USEPA 1995			
Benzo(b)fluoranthene	3200	ug/kg	USEPA 1995			
Benzo(g,h,i)perylene	670	ug/kg	USEPA 1995			
Benzoic Acid	65	ug/kg	USEPA 1995			
Benzyl Alcohol	57	ug/kg	USEPA 1995			
beta-BHC	5	ug/kg	Ontario Ministry of the Environment 1993			
bis(2-Ethylhexyl)phthalate	1300	ug/kg	USEPA 1995			
Butylbenzylphthalate	63	ug/kg	USEPA 1995			
Cadmium	1.2	mg/kg	USEPA 1995			
Chromium	81	mg/kg	Long et al. 1995			
Chrysene	384	ug/kg	USEPA 1995			
Copper	34	mg/kg	USEPA 1995			
Cyanide	0.1	mg/kg	Ontario Ministry of the Environment 1993			
Dibenz(a,h)anthracene	63.4	ug/kg	USEPA 1995			
Dibenzofuran	540	ug/kg	USEPA 1995			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Diethylphthalate	200	ug/kg	USEPA 1995			
Dimethyl phthalate	71	ug/kg	USEPA 1995			
Di-n-butylphthalate	1400	ug/kg	USEPA 1995			
Di-n-octyl phthalate	6200	ug/kg	USEPA 1995			
Ethylbenzene	10	ug/kg	USEPA 1995			
Fluoranthene	600	ug/kg	USEPA 1995			
Fluorene	19	ug/kg	USEPA 1995			
Heptachlor	0.3	ug/kg	Buchman 1999			
Heptachlor epoxide	5	ug/kg	Ontario Ministry of the Environment 1993			
Hexachlorobenzene	22	ug/kg	USEPA 1995			
Hexachlorobutadiene	11	ug/kg	USEPA 1995			
Indeno(1,2,3-cd)pyrene	600	ug/kg	USEPA 1995			
Lead	46.7	mg/kg	USEPA 1995			
Mercury	0.15	mg/kg	USEPA 1995			
Naphthalene	160	ug/kg	USEPA 1995			
Nickel	20.9	mg/kg	USEPA 1995			
n-Nitrosodiphenylamine	28	ug/kg	USEPA 1995			
PAH (total)	4022	ug/kg	Long et al. 1995			
Parathion	31	ug/kg	USEPA 1995			
Pentachlorophenol	360	ug/kg	USEPA 1995			
Phenanthrene	240	ug/kg	USEPA 1995			
Phenol	420	ug/kg	USEPA 1995			
Polychlorinated biphenyls (PCBs)	22.7	ug/kg	USEPA 1995			
Pyrene	665	ug/kg	USEPA 1995			
Selenium	1	mg/kg	Buchman 1999			
Silver	1	mg/kg	USEPA 1995			
Tetrachloroethene	57	ug/kg	USEPA 1995			
Trichlorobenzene	40	ug/kg	USEPA 1995			
Trichloroethene	41	ug/kg	Buchman 1999			
Vanadium	57	mg/kg	Buchman 1999			
Xylene, total	40	ug/kg	USEPA 1995			
Zinc	150	mg/kg	USEPA 1995			
Sediment (Fresh)						
Aldrin	2	ug/kg	Ontario Ministry of the Environment 1993			
alpha-Chlordane	7	ug/kg	Ontario Ministry of the Environment 1993			
Aluminum	25500	mg/kg	Buchman 1999			
Barium	500	mg/kg	Beyer 1990			
Benzo(k)fluoranthene	240	ug/kg	Ontario Ministry of the Environment 1993			
Chlordane	7	ug/kg	Ontario Ministry of the Environment 1993			
Cobalt	50	mg/kg	Ontario Ministry of the Environment 1993			
Dieldrin	2	ug/kg	Ontario Ministry of the Environment 1993			
Endrin	3	ug/kg	Ontario Ministry of the Environment 1993			
gamma-BHC (Lindane)	3	ug/kg	Ontario Ministry of the Environment 1993			
gamma-Chlordane	7	ug/kg	Ontario Ministry of the Environment 1993			
Iron	188400	mg/kg	Buchman 1999			
Manganese	460	mg/kg	Ontario Ministry of the Environment 1993			
Sediment (Marine)						
Aldrin	9.5	ug/kg	Buchman 1999			
alpha-Chlordane	0.5	ug/kg	Long and Morgan 1990			
Aluminum	18000	mg/kg	Buchman 1999			
Barium	48	mg/kg	Buchman 1999			
Benzo(k)fluoranthene	1800	ug/kg	Buchman 1999			
Chlordane	0.5	ug/kg	Long and Morgan 1990			
Cobalt	10	mg/kg	Buchman 1999			
Dieldrin	0.715	ug/kg	Buchman 1999			
Endrin	0.02	ug/kg	Long and Morgan 1990			
gamma-BHC (Lindane)	0.32	ug/kg	Buchman 1999			
gamma-Chlordane	0.5	ug/kg	Long and Morgan 1990			
Iron	220000	mg/kg	Buchman 1999			
Manganese	260	mg/kg	Buchman 1999			
Surface Soil						
1,1,1,2-Tetrachloroethane	300	ug/kg	USEPA 1995			
1,1,1-Trichloroethane	300	ug/kg	USEPA 1995			
1,1,2,2-Tetrachloroethane	300	ug/kg	USEPA 1995			
1,1,2-Trichloroethane	300	ug/kg	USEPA 1995			
1,1-Dichloroethane	300	ug/kg	USEPA 1995			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
1,2,4,5-Tetrachlorobenzene	100	ug/kg	USEPA 1995			
1,2,4-Trichlorobenzene	1270	ug/kg	Efroymson et al. 1997b			
1,2-Dibromoethane	5000	ug/kg	USEPA 1995			
1,2-Dichlorobenzene	100	ug/kg	USEPA 1995			
1,2-Dichloroethane	401	ug/kg	MHSPE 1994			2
1,2-Dichloroethene (total)	300	ug/kg	USEPA 1995			
1,2-Dichloropropane	38800	ug/kg	Efroymson et al. 1997b			
1,3-Dichloropropene	300	ug/kg	USEPA 1995			
1,4-Dichlorobenzene	1280	ug/kg	Efroymson et al. 1997b			
2,3,4,6-Tetrachlorophenol	100	ug/kg	USEPA 1995			
2,4,5-Trichlorophenol	430	ug/kg	Efroymson et al. 1997a			
2,4,6-Trichlorophenol	580	ug/kg	Efroymson et al. 1997b			
2,4-Dichlorophenol	13400	ug/kg	Efroymson et al. 1997b			
2,4-Dimethylphenol	100	ug/kg	USEPA 1995			
2,4-Dinitrophenol	20000	ug/kg	Efroymson et al. 1997a			
2,6-Dichlorophenol	100	ug/kg	USEPA 1995			
2-Chloronaphthalene	1033	ug/kg	MHSPE 1994			2
2-Chlorophenol	100	ug/kg	USEPA 1995			
2-Methylphenol	100	ug/kg	USEPA 1995			
4,4'-DDD	100	ug/kg	USEPA 1995			
4,4'-DDE	100	ug/kg	USEPA 1995			
4,4'-DDT	100	ug/kg	USEPA 1995			
4-Methyl-2-pentanone	10000	ug/kg	USEPA 1995 (with safety factor of 10)			
4-Methylphenol	100	ug/kg	USEPA 1995			
4-Nitrophenol	380	ug/kg	Efroymson et al. 1997b			
Acenaphthene	2500	ug/kg	Efroymson et al. 1997a			
Acenaphthylene	100	ug/kg	USEPA 1995			
Aldrin	100	ug/kg	USEPA 1995			
alpha-BHC	100000	ug/kg	USEPA 1995			
alpha-Chlordane	100	ug/kg	USEPA 1995			
Aluminum	50	mg/kg	Efroymson et al. 1997a			
Anthracene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Antimony	5	mg/kg	Efroymson et al. 1997a			
Aroclor-1016	100	ug/kg	USEPA 1995			
Aroclor-1221	100	ug/kg	USEPA 1995			
Aroclor-1232	100	ug/kg	USEPA 1995			
Aroclor-1242	100	ug/kg	USEPA 1995			
Aroclor-1248	100	ug/kg	USEPA 1995			
Aroclor-1254	100	ug/kg	USEPA 1995			
Aroclor-1260	100	ug/kg	USEPA 1995			
Arsenic	60	mg/kg	Efroymson et al. 1997b			
Barium	500	mg/kg	Efroymson et al. 1997a			
Benzene	105	ug/kg	MHSPE 1994			2
Benzo(a)anthracene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Benzo(a)pyrene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Benzo(b)fluoranthene	100	ug/kg	USEPA 1995			
Benzo(g,h,i)perylene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Benzo(k)fluoranthene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Beryllium	10	mg/kg	Efroymson et al. 1997a			
beta-BHC	100000	ug/kg	USEPA 1995			
Bromochloromethane	300000	ug/kg	USEPA 1995 (with safety factor of 10)			
Bromodichloromethane	45000	ug/kg	USEPA 1995 (with safety factor of 10)			
Cadmium	4	mg/kg	Efroymson et al. 1997a			
Carbon tetrachloride	1000000	ug/kg	Efroymson et al. 1997b			
Chlordane	100	ug/kg	USEPA 1995			
Chlorobenzene	2400	ug/kg	Efroymson et al. 1997b			
Chloroform	1000	ug/kg	MHSPE 1994			2
Chromium	0.4	mg/kg	Efroymson et al. 1997b			
Chrysene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
cis-1,2-Dichloroethene	300	ug/kg	USEPA 1995			
cis-1,3-Dichloropropene	300	ug/kg	USEPA 1995			
Cobalt	100	mg/kg	USEPA 1995			
Copper	50	mg/kg	Efroymson et al. 1997b			
Cyanide	0.06	mg/kg	Eisler 1991			
delta-BHC	100000	ug/kg	USEPA 1995			
Dibenz(a,h)anthracene	100	ug/kg	USEPA 1995			

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)
Dieldrin	100	ug/kg	USEPA 1995			
Diethylphthalate	13400	ug/kg	Efroymson et al. 1997a			
Dimethyl phthalate	10640	ug/kg	Efroymson et al. 1997b			
Di-n-butylphthalate	200000	ug/kg	Efroymson et al. 1997a			
Dinitrophenol	100	ug/kg	USEPA 1995			
Endrin	100	ug/kg	USEPA 1995			
Endrin aldehyde	100	ug/kg	USEPA 1995			
Endrin ketone	100	ug/kg	USEPA 1995			
Ethylbenzene	5005	ug/kg	MHSPE 1994			2
Fluoranthene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Fluorene	1700	ug/kg	Efroymson et al. 1997b			
Fluoride	1	mg/kg	USEPA 1995			
gamma-BHC (Lindane)	100	ug/kg	USEPA 1995			
gamma-Chlordane	100	ug/kg	USEPA 1995			
HCH-technical	100000	ug/kg	USEPA 1995			
Heptachlor epoxide	100	ug/kg	USEPA 1995			
Hexachlorocyclopentadiene	1000	ug/kg	Efroymson et al. 1997a			
Indeno(1,2,3-cd)pyrene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Iron	200	mg/kg	Efroymson et al. 1997b			
Lead	50	mg/kg	Efroymson et al. 1997a			
Magnesium	4400	mg/kg	USEPA 1995			
Manganese	500	mg/kg	Efroymson et al. 1997a			
Mercury	0.1	mg/kg	Efroymson et al. 1997b			
Methoxychlor	100	ug/kg	USEPA 1995			
Methylene chloride	1001	ug/kg	MHSPE 1994			2
Naphthalene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Nickel	30	mg/kg	Efroymson et al. 1997a			
Nitrobenzene	2260	ug/kg	Efroymson et al. 1997b			
n-Nitrosodiphenylamine	1090	ug/kg	Efroymson et al. 1997b			
PAH (total)	4100	ug/kg	MHSPE 1994			2
Pentachlorobenzene	1150	ug/kg	Efroymson et al. 1997b			
Pentachlorophenol	3000	ug/kg	Efroymson et al. 1997a			
Phenanthrene	see PAH, total; 100	ug/kg	MHSPE 1994; USEPA 1995			
Phenol	1880	ug/kg	Efroymson et al. 1997b			
Pyrene	100	ug/kg	USEPA 1995			
Selenium	1.8	mg/kg	USEPA 1995			
Silver	2	mg/kg	Efroymson et al. 1997a			
Styrene	10010	ug/kg	MHSPE 1994			2
Tetrachloroethene	401	ug/kg	MHSPE 1994			2
Thallium	1	mg/kg	Efroymson et al. 1997a			
Toluene	13005	ug/kg	MHSPE 1994			2
trans-1,2-Dichloroethene	300	ug/kg	USEPA 1995			
trans-1,3-Dichloropropene	300	ug/kg	USEPA 1995			
Tribromomethane	114700	ug/kg	USEPA 1995 (with safety factor of 10)			
Trichlorobenzene	100	ug/kg	USEPA 1995			
Trichloroethene	6000	ug/kg	MHSPE 1994			2
Vanadium	2	mg/kg	Efroymson et al. 1997a			
Vinyl chloride	300	ug/kg	USEPA 1995			
Xylene, total	2505	ug/kg	MHSPE 1994			2
Zinc	50	mg/kg	Efroymson et al. 1997a			

the Region 3 BTAG (CH2M HILL 2000). Where more than one final screening value was available for a specific medium and chemical (e.g., one value for soil fauna and one value for soil flora), the lowest of these values was selected. Screening values can be adjusted based on modifying factors such as hardness or total organic carbon (TOC). Fresh surface water screening values for several divalent metals are presented based on a water hardness of 25 mg/L. Surface soil screening values based on Dutch soil standards for certain organic chemicals are presented based on a TOC value of two percent. Two percent is the minimum default value for these screening values.

References:

Beyer, W.N. 1990. Evaluating soil contamination. U.S. Fish and Wildlife Service Biological Report 90(2). 25 pp.

Buchman, M.F. 1999. NOAA screening quick reference tables. NOAA HAZMAT Report 99-1, Seattle, WA. 12 pp.

CH2M HILL, Inc. 2000. Technical memorandum - alternate screening values - ecological risk assessment, IR sites 5, 7, 8, 9, 10, 11, 12, 13, 16, and SWMU-3. Naval Amphibious Base (NAB) Little Creek, Virginia Beach, Virginia. Final. January.

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten. 1997a. Toxicological benchmarks for screening contaminants of potential concern for effects on terrestrial plants: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-85/R3.

Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997b. Toxicological benchmarks for screening contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic process: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-126/R2.

Table 1-4
Medium-Specific Screening Values for Screening Ecological Risk Assessments
NSWC Indian Head

Chemical	Screening Value	Units	Reference	Hardness (mg/L)	pH	TOC (%)

Eisler, R. 1991. Cyanide hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildlife Service Biological Report 85(1.23), Contaminant Hazard Reviews Report No. 23. 55 pp.

Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management. 19:81-97.

Ministry of Housing, Spatial Planning and Environment (MHSPE). 1994. Intervention values. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, Netherlands. 9 May. DBO/07494013.

Ontario Ministry of Environment and Energy (MOE). 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. ISBN 0-7729-9248-7. 27 pp.

Suter, G.W. II and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. Environmental Restoration Division, ORNL Environmental Restoration Program, ES/ER/TM-96/R2. 54 pp.

U.S. Environmental Protection Agency (USEPA). 1999a. Supplemental guidance to RAGS: Region 4 ecological risk assessment bulletins. August.

U.S. Environmental Protection Agency (USEPA). 1999b. National recommended water quality criteria - correction. EPA/822/Z-99/001.

U.S. Environmental Protection Agency (USEPA). 1996. Ecotox thresholds. Eco Update, Volume 3, Number 2. EPA/540/F-95/038. 12 pp.

U.S. Environmental Protection Agency (USEPA) Region III. 1995. Revised Region III BTAG screening levels. Memorandum from R.S. Davis to Users. 9 August.

U.S. Environmental Protection Agency (USEPA). 1995b. Internal report on summary of measured, calculated and recommended log kow values. Environmental Research Laboratory, Athens, GA. 10 April.

U.S. Environmental Protection Agency (USEPA). 1994. Water quality criteria summary. Office of Science and Technology, Health and Ecological Criteria Division, Washington, DC.

1.4 Work Plan Summary

The location of the lab area addressed by this work plan is shown on Figure 1-1 and the proposed activities are summarized on Table 1-5. A summary of previous investigations performed at the sites is also included on the table. As shown on the table, additional environmental investigative work is proposed for some of the sites.

TABLE 1-5
Site Summary
Indian Head Division, Naval Surface Warfare Center
Indian Head, Maryland

Site No.	Work Plan Section	Site Name	Previous Investigations Performed	Work Proposed
Lab Area Sewers and Storm Drains (Includes Sites 15,16,and 53)	3	Mercury Contamination of the Sewage System, Buildings 600, 556, 304, 596, 555, 303, 101, 102, 103, 502, 108, 108A, and 444.	Sediment and soil sampling in and adjacent to sewer and storm drain systems in Site 53 (lab area).	Determine extent of contamination; additional sediment and soil boring sampling, ecological sampling in downstream creek.
Lab Area Surface Soils (Includes Sites 50, 54, and 55)	4	Surface soil sampling around Buildings 600, 556, 304, 596, 555, 303, 101, 102, 103, 502, 108, 108A, and 444.	Sampling at Buildings 101 and 102. Crawl space soil sampling in Building 103.	Determine extent of surface soil contamination in lab area, and sediment and surface water contamination in the wetlands area.
49	5	Chemical Disposal Pit	Pit Sediment Sampling and Soil Boring Sampling	Determine extent of contamination; sediment, soil, and rubble sampling

1.5 Data Quality Level

Data will be analyzed in accordance with the specifications identified in the Master Quality Assurance Project Plan (Master QAPP).

1.6 Project Organization

This RI phase of the project will be performed by CH2M HILL with support from the Navy. The Navy RPM will be Mr. Rob Sadorra.

Mr. Jeff Morris, Code 1810
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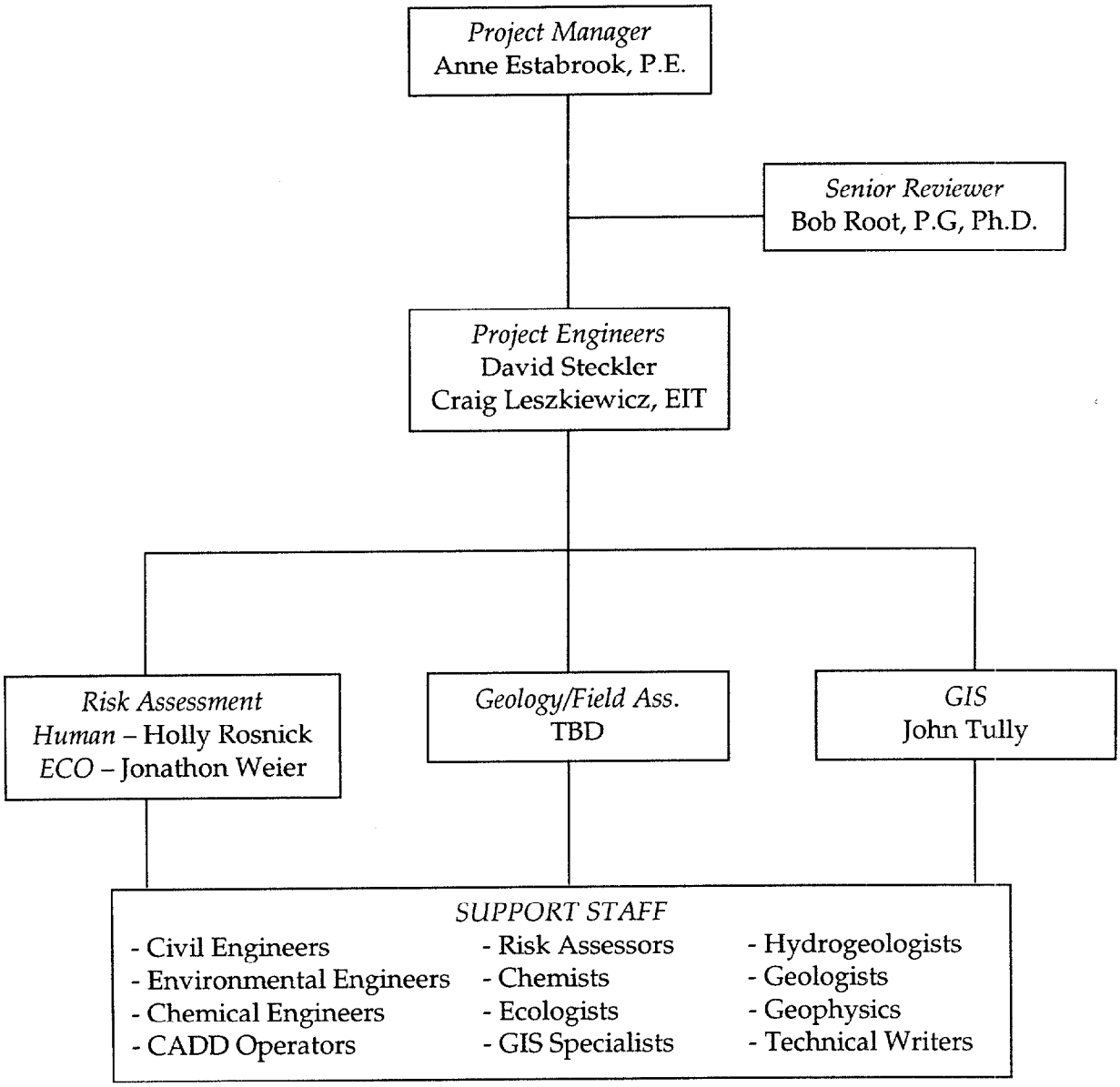
The CH2M HILL Project Organization is shown on Figure 1-3.

FIGURE 1-3
Project Organization Chart



2.0 Field Operations

2.1 Work Plan Summary

The proposed environmental sampling to be conducted at the subject sites are summarized in Table 2-1. The specific locations and analysis to be performed at each site is discussed in detail in the site specific sections (sections 3.0, 4.0 and 5.0).

2.2 General Field Operations

This section provides information on the general field operations and the basis for selection of the location of the environmental sampling to be conducted.

2.2.1 Mobilization/Demobilization

The field crew will consist of a Field Operations Leader (FOL), qualified technicians, and specialized subcontractors. Depending on the tasks to be conducted, the size and make up of the field team will vary. Prior to mobilization, all field team members will review the project documents including the site specific Health and Safety Plan provided in the Master WP addendum (CH2M HILL, March 2000).

The equipment required for field operations will be brought to the site by the CH2M HILL field team. All required bottle ware will be shipped directly to the site by the laboratory. Demobilization will entail following proper decontamination procedures for all site personnel and equipment. All sampling equipment used for collecting samples will be decontaminated prior to beginning field sampling, between collection of each sample, and at the end of the sampling event. Decontamination procedures are discussed in IHDIV-NSWC SOP SA-13. The investigation derived waste (IDW) is to be handled in accordance with IHDIV-NSWC SOP SA-13, and field records will be kept as directed in IHDIV-NSWC SOP SA-12.

2.2.2 Field Sampling

The proposed locations of samples to be collected is provided in the site specific sections of this document, however it should be noted that field judgment should be used to fine tune the location of the sample collection to include observations made in the field. The field team shall consider topography, stressed vegetation, erosion and seeps, changes in type of vegetation, discolorations, accessibility, and past sampling experiences.

The specific locations of all field sampling points is based on the evaluation of historical site data. Duplication of previous sampling activities conducted at the various sites was limited

TABLE 2-1

WORK PLAN SUMMARY TABLE
INDIAN HEAD, MARYLAND

Site Name	Work Plan Summary	Soil Sampling			Groundwater Sampling		Surface Water Samples	Sediment Samples	Other Samples
		Number of Surface Soil Samples	Number of Soil Borings/ Subsurface Samples	Number of Soil Boring Samples	Number of New Wells	Number of Wells to Sample			
Lab Area Sewers and Storm Drains (Includes Sites 15, 16, and 53)	Determine extent of contamination; additional sediment and soil boring sampling, ecological sampling in downstream creek.	---	24	---	---	---	---	13	---
Lab Area Surface Soils (Includes Sites 50, 54, and 55)	Determine extent of surface soil contamination in lab area, and sediment and surface water contamination in the wetlands area.	78	---	---	---	---	3	6	---
Site 49 - Chemical Disposal Pit	Additional soil samples, sediment and concrete samples proposed to evaluate extent of contamination	2	3	---	---	---	---	0-1*	1**

* Number of samples is contingent on the location of chemical pit outfall
** Concrete rubble sample

to data verification in an attempt to minimize duplication of efforts. The following criteria were considered in selecting sample locations.

- Historical use/cause of potential contamination
- Site layout, topography, and drainage characteristics
- Type of contamination
- Mobility of contamination
- Potential off site transport pathways of contaminants

The equipment required to perform a given type of sampling is common among the sites where that type of sampling will be performed. The majority of the sampling to be performed includes:

- Surface Soil Sampling; IHDIV-NSWC SOP SA-03
- Sediment Sampling; IHDIV-NSWC SOP SA-02
- Subsurface Soil Sampling; IHDIV-NSWC SOP SA-03
- Hydraulic Push Sampling; IHDIV-NSWC SOP SA-06
- Headspace Sampling; IHDIV-NSWC SOP SA-05
- Surface Water Sampling; IHDIV-NSWC SOP SA-02

The SOPs listed above discuss the equipment and procedures required to perform each type of sampling.

2.3 Sample Handling

Sample handling includes the field-related considerations regarding the selection of sample containers and preservatives, allowable holding times, and the analyses required. These topics are discussed in the site specific sections. The sample identification system to be applied to the samples and the shipping requirements are discussed below.

2.3.1 Sample Identification System

Each sample will be designated by an alphanumeric code that identifies the site and matrix sampled and contains a sequential sample number. Site-specific procedures are elaborated below.

Location types will be identified by a two-letter code. Each sampling location will be identified with a two-digit number corresponding to the well or sampling location.

The following is a general guide for sample identification:

First Segment of Sample Number	Second Segment of Sample Number	Third Segment of Sample Number		
Naval Installation Abbreviation	Site Number	Sample Type	Sample Location	Additional Qualifiers (sample depth, date)
A	ANN	AA	NN	NNNN

Symbol Definition:

"A"	=	Alphabetic
"N"	=	Numeric

Site Abbreviation:

A	=	One letter abbreviation identifying the Naval Installation where the sample was collected. (i.e. Indian Head = I)

Site Number:

ANN	=	One letter and two numbers identifying the site on the facility where the sample was collected (i.e. S53 = Site 53)

Sample Type:

SS	=	Surface Soil Sample
SB	=	Subsurface Soil Sample
SD	=	Sediment Sample
SW	=	Surface Water Sample
GW	=	Grab Groundwater Sample
MW	=	Monitoring Well Sample
WS	=	Waste (solid)
TB	=	Trip Blank
EB	=	Equipment Blank
FB	=	Field Blank

Sample Location:

MM	=	QC Samples – 2-digit month of sampling event
NN	=	All other Samples - Unique 2-digit sample number.

Additional Qualifiers:

MMYY	=	Monitoring Well and Grab Groundwater Samples - 2-digit month and 2-digit year of sampling event (i.e. Jan 2001 = 0101)
BDED	=	Surface Soil, Subsurface Soil, and Sediment Samples – 2-digit begin depth and 2-digit end depth rounded up to nearest foot (i.e. 2′ – 2′ 6″ = 0203)
DDYY	=	QC Samples – 2-digit day and 2-digit year of sampling event

Examples of this numbering approach are:

IS53SS040001	The 4th surface soil sample collected from 0 ft to 1 ft at Site 53
IS53GW020800	The 2nd grab GW sample collected at Site 53 in August 2000
IS53WS01	The 1st waste sample collected from drums at Site 53

Examples of this numbering approach for QA/QC samples are:

IS53FB100196	Field blank collected at Site 53 on October 1, 1996
IS53TB07299701	First trip blank collected at Site 53 on July 29, 1997
IS53EB080198	Equipment blank collected at Site 53 on August 1, 1998

2.3.2 Sample Packaging and Shipping

Samples will be packaged in accordance with IHDIV-NSWC SOP SA-11 "Non-Radiological Sample Handling." The samples will be either picked up at the site by the analytical laboratory or sent Federal Express. The sample shall be tightly packed in a cooler with Vermiculite packaging material and ice as a preservative. The FOL is responsible for completion of the following forms:

- Sample labels and Chain-of-Custody seals
- Chain-of-Custody forms
- Appropriate labels and forms required for shipment

Custody of the samples must be maintained and documented at all times. Chain-of-Custody begins with the collection of the samples in the field and is continued through the analysis of the sample at the analytical laboratory.

3.0 Lab Area Sewers and Storm Drains: Sites 15, 16, and 53 (Buildings 556, 304, 596, 555, 108, 108A, 303, and 444)

3.1 Background Information and Site/Building Descriptions

3.1.1 Site 15 – Mercury Deposits in Manhole, Fluorine Lab

Site 15 is the location of the Fluorine Laboratory (Building 502) and the Surveillance/Sample Control Building (Building 103), facilities constructed in 1942 and 1902, respectively. Building 502 housed a laboratory to develop, provide, and analyze bench scale quantities of experimental chemicals and fuels. The wide variety of products and processes developed in Building 502 required a wide variety of equipment such as water aspirators and condensers of different size and capacities, as well as jacketed reactors and vessels up to 50-gallons capacity.

Building 103 contained facilities to analyze raw materials and manufactured propellants for surveillance tests. Laboratory equipment containing mercury was reportedly used at different times throughout the history of Building 103. The equipment included nitrometers, pycnometers, talianis, and thermometers. The wastewater from this facility consists of water, acetone, and alcohol used to wash laboratory glassware. The general site location and layout is shown in Figure 3-1.

The wastewater from Buildings 502 and 103 was discharged through underground pipes and combined in a storm drain manhole approximately 100 feet from Building 502. This manhole is designated "B" on Figure 3-1. It is in this manhole that 10 pounds of mercury were recovered in 1969 (NEESA, 1992). From this manhole, the wastewater flowed in a southeasterly direction, eventually emptying into the Mattawoman Creek. This manhole received wastewater discharge four days per week between 1942 and the late 1980's.

Contaminants known to be in the wastewater included mercury, lead, total suspended solids, and oil/grease. Average combined wastewater discharges from Buildings 502 and 103 were estimated 1,150 gallons per day, or 4,600 gallons per week into the manhole over the 40+ year period of operation (NEESA, 1992).

As indicated previously, 10 pounds of mercury were recovered from manhole "B" in 1969. In the summer of 1981, NOS personnel removed small quantities of mercury from Building 502 floor drains (NEESA, 1983). Team site reconnaissance indicated no evidence of mercury or lead precipitates in either the manhole or ditch or any signs of stressed vegetation in the vicinity of the buildings. In 1985, the public works department contracted for the replacement of the two sinks in Building 103. After replacing the two sinks, the contractor reported to public works that the sinks connected to a single drain line that discharged to the soil

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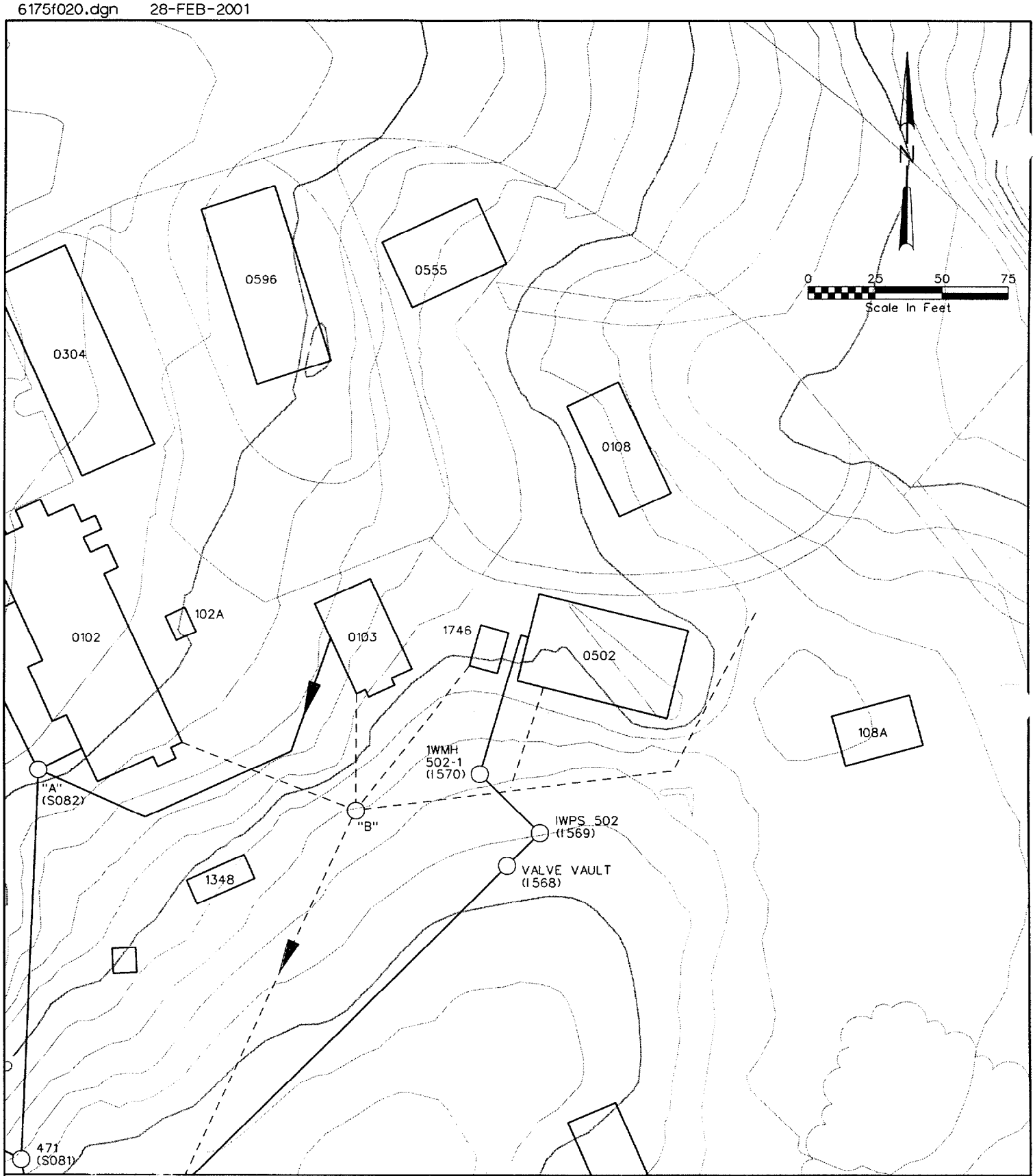

LEGEND

— — — STORM SEWER

——— SANITARY SEWER

○ MANHOLE

NOTES:

1. SEVERAL MANHOLES HAVE MULITPLE DESIGNATIONS AS ASSIGNED IN THE PAST INVESTIGATIONS.
2. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 15. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
3. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 3-1
SITE 15 -
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

beneath the building, and there was no existing connection to a storm or sanitary sewer system (NEESA, 1992). Prior to this it was believed that the sink discharge line connected to a sewer from Building 102 before connecting to manhole "B." This configuration is described in the 1981 Point Source Pollution Abatement Study by Indian Head (NOS Indian Head, 1981). After the discovery of the discharge to the soil, a four-inch diameter polyvinylchloride (PVC) pipe was installed from the sink drainage line to manhole "A," west of Building 102 as shown in Figure 3-1.

3.1.2 Site 16 – Laboratory Chemical Disposal, Building 600

Site 16 consists of the sewers draining the Research and Development Building (Building 600). Built in 1944, Building 600 contained chemical research laboratories and division offices (see Figure 3-2). Reportedly, waste chemicals were disposed of into the plumbing system where they combined with sanitary sewage and flowed to the sewage treatment plant. Approximately 80 chemical compounds were generated or procured by this facility on an annual basis. Chemicals used in quantities exceeding ten gallons per year included acids, amines (RNH3), cyanide compounds, and both chlorinated and non-chlorinated solvents. Other materials used in Building 600 in smaller quantities included alkalies, alcohols, aldehydes, metals and metal compounds (including zinc, iron, cadmium, lead, and mercury), and asbestos.

Each individual laboratory within Building 600 generally maintained an area for disposal of waste materials. The design of these areas varied according to the type of waste (e.g., solid, liquid, explosive, etc.) generated by the specific laboratory. The wastes were stored in small quantities in bags or containers prior to disposal. The storage locations were indoors at Building 600 over concrete floors. According to the lab representatives, each laboratory generated very small quantities of wastes which were typically collected and disposed of through on-site units such as the burn point or containerized and transported to the permitted RCRA hazardous waste storage facility in Building 455.

The wastes managed at Building 600 were laboratory wastes including hydrochloric and sulfuric acid, dimethylamine, acrylonitrile, chlorine, methyl chloride, chloroform, carbon tetrachloride, acetaldehyde, dioxane, cyclohexane, dimethyl formamide, toluene, pyridine and butyl acetate.

Analysis of the wastewater detected amines (RNH3), metals (cadmium, lead, zinc, copper, mercury, silver), cyanides, nitrate esters (RNO3), trichloroethylene (TCE) and methylene chloride. Mercury, zinc, and silver were also found to be present in low concentrations (PSPAS, July 1981).

3.1.3 Site 53 – Mercury Contamination in the Sewage System

Site 53 - Mercury Contamination in the Sewage System consists of the sewage system for the general laboratory area in the northeastern part of the IHDIV-NSWC (see Figure 3-3). The sewage system consists of both the storm sewer lines and the sanitary sewer lines from several buildings in the area. The general laboratory area has the highest local topographic elevation for the area.

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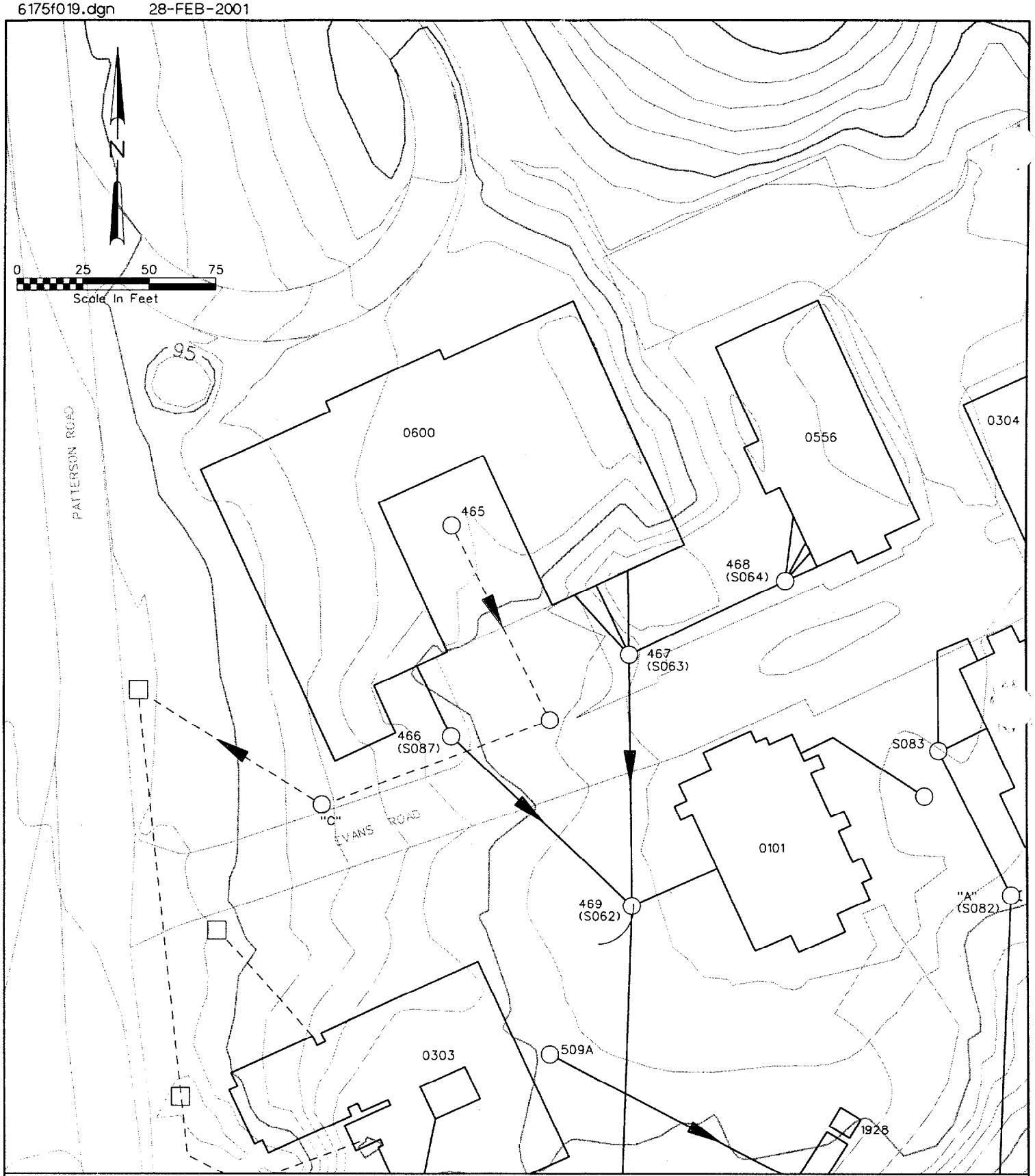

LEGEND

- ○ MANHOLE
- □ GRATE
- - - - STORM SEWER
- ——— SANITARY SEWER

NOTES:

1. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
2. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 16. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
3. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 3-2
SITE 16 -
EXISTING STORM AND
SANITARY SEWER SYSTEMS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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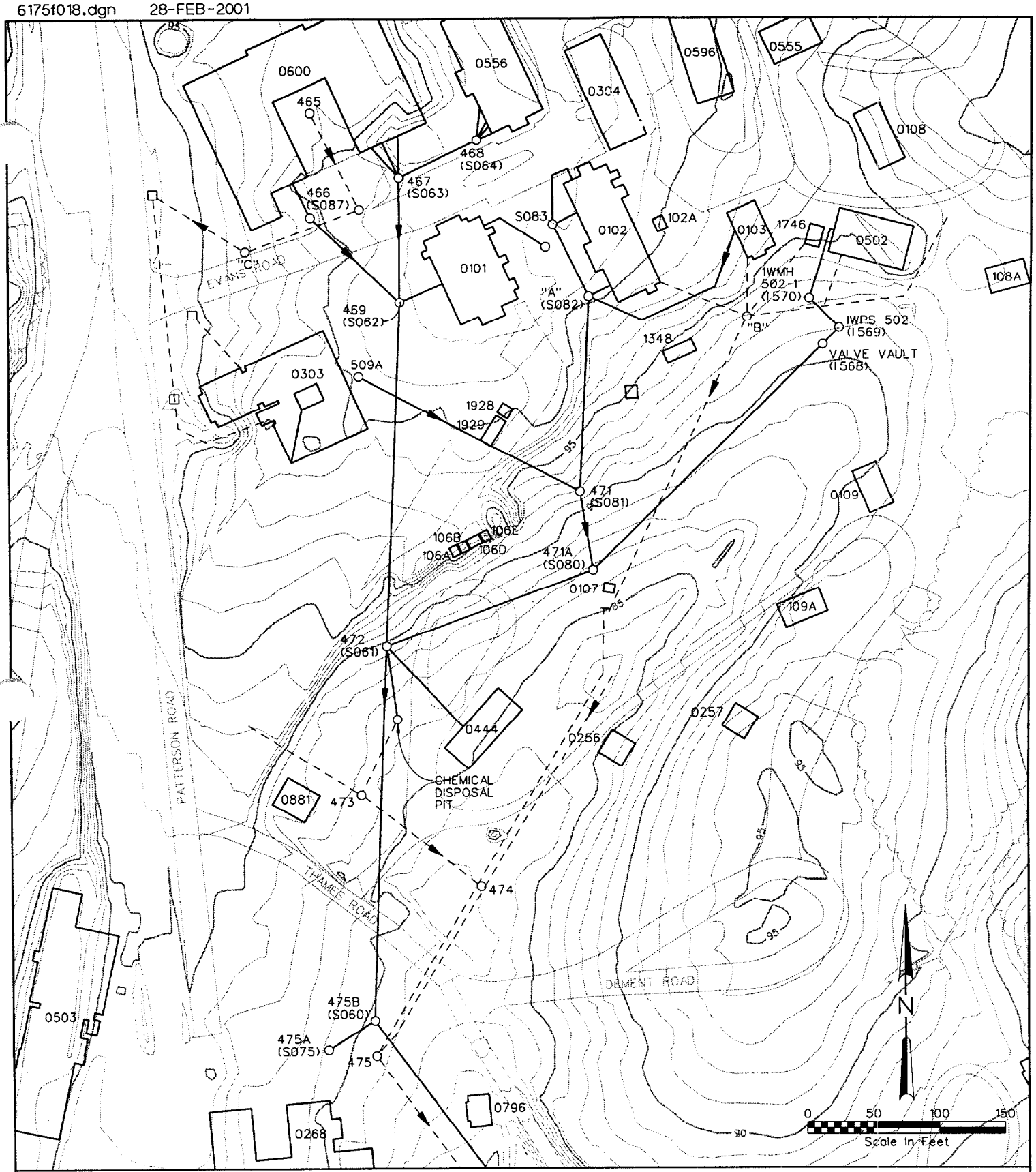

LEGEND

- ○ MANHOLE
- □ GRATE
- - - - STORM SEWER
- ——— SANITARY SEWER

NOTES:

1. SEE TABLE 3-1 FOR PIPE SIZE AND TYPE.
2. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
3. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 53. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
4. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 3-3
SITE 53 -
EXISTING SANITARY
AND STORM SEWERS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

According to Indian Head Public Works personnel, all sewage generated by the lab area was piped directly to the Mattawoman Creek starting in the early 1900's. This practice was altered in the early 1940's when the sanitary and storm sewer systems were separated. A WWTP (Site 2 – not an IR site number) occupying buildings 1470 through 1474 to the southwest of the lab area near Mattawoman Creek was brought on line during this time and thereafter sanitary sewage was treated there prior to discharge.

In 1970, a full-scale WWTP was built in order to supplement the aging Site 2 WWTP with increased demand. This new WWTP was designated Site 1 (again, not an IR site number) and was located north of the lab area on the non-restricted side of the IHDIV-NSWC in Buildings 1704 through 1710, near the marina. When the Site 2 WWTP was taken off-line in 1985, the sanitary sewage treated there was redirected to the Site 1 WWTP via Lift Station 11 (Building 1701). The Site 1 WWTP currently handles all of the sanitary sewage generated by the lab area. Sanitary sewage from the laboratory area flows south from the area via manhole 472 to Lift Station 11 and is then pumped to the Site 1 WWTP. Storm water from the lab area flows to manhole 474 and then flows to an outfall on Mattawoman Creek.

A holding tank was installed to hold industrial waste water generated by Buildings 103 and 502 in 1995. This tank drains to the sanitary sewer system via manhole 471A; however, it is not currently in use.

Laboratory workers from Building 102 reported that approximately a liter of mercury was lost per month down the sinks. Over the 77-year period that the Building 102 laboratory operated without mercury traps on the sinks (1909 – 1986), it is estimated that 28,000 pounds of mercury were discharged to the drain lines (NEESA, 1992). Additional quantities of mercury may have been disposed of down the drain lines from similar mercury handling and disposal procedures practiced at the other laboratory buildings.

In 1969, approximately 10 pounds of mercury were recovered from a storm sewer manhole located south of Building 103 (manhole "B" in the PA prepared by NEESA, 1992). In early 1989, approximately 1 pound of mercury was recovered from the sanitary storm sewer manhole located east of Building 102 (manhole "A" in PA). Both of these manholes have drain line connections to Building 102.

After mercury was discovered in the manhole east of Building 102 in 1989, other manholes in the vicinity and down-line of the laboratory buildings were inspected for mercury. No visible mercury was discovered. Since then, the manholes in the vicinity and down-line of the laboratory facilities have been regularly inspected for signs of visible mercury. In addition, the sewer lines in the area of Building 102 were blocked off with sandbags, and mercury traps were installed on the lines.

In late 1988, a video survey was performed to determine the condition of the gravity sewer lines in the laboratory area. The sewer lines "in the vicinity of the laboratory buildings" were found to be in poor condition and in need of repair or replacement (NEESA, 1992). The vitrified clay and terra-cotta pipes were either broken, cracked, sagging, separated, or in some cases, collapsed. Therefore, the concern exists that the mercury has contaminated the soils surrounding the sewer lines. Sometime between the 1988 video survey and the 1998 manhole survey conducted by RJN Group, several of the most damaged runs of sanitary

sewer were lined (see Table 3-1). Also, free phase mercury was reportedly encountered by a contractor making repairs to the sewer system in 1998, though information on this is limited.

In late 1988, mercury levels in the sanitary sewage sludge measured at levels up to 150 ppm (NEESA, 1992). The maximum allowable amount of mercury in Class I sanitary sewage sludge is 10 ppm (memorandum, NAVORDSTA Indian Head, Code 0411C, Investigation of Mercury Hazard in Building 102, January 28, 1988). Mercury levels in the WWTP sludge dropped below 10 ppm between 1993 and 1996 and have remained within allowable levels since. The elevated mercury levels detected in the sludge in 1988 can probably be attributed to the disturbance of the damaged pipe sections during lining operations, and the subsequent disturbance of mercury trapped in those lines. The decrease in mercury contamination may also be attributed to the cleaning and relining of the Lift Station 11 during this time period. Appendix C contains the sewage plant sludge analyses for the period of 1987 to 1999, and correspondence pertaining to them.

3.2 Previous Environmental Investigation

3.2.1 Site 15 – Mercury Deposits in Manhole, Fluorine Lab

Site 15 was included as part of the IAS of the IHDIV-NSWC performed by NEESA in 1983, and the Phase II RCRA Facility Assessment performed by A.T. Kearney, Inc. in 1988. Although these reports thoroughly outline the site background, no environmental sampling was performed in either the IAS or the assessment.

The first "sampling" performed on Site 15 is discussed briefly in the PA performed by NEESA in 1992. In this report, it is stated that 10 pounds of mercury were recovered from manhole "B" in 1969. In the PA, manhole "B" is considered part of Site 53. However, manhole "B" is also included in Site 15.

Sampling was conducted during the Site Inspection (SI) Study performed by Ensafe/Allen & Hoshall (E/A&H) in 1994. The study was performed to determine if contamination was present in the surface soil beneath Building 103. The surface soil under Building 103 has been designated as Site 50, and is discussed later in this report.

3.2.2 Site 16 – Laboratory Chemical Disposal, Building 600

Other than the screening of the wastewater generated at Building 600, there have been no environmental investigations performed specifically for Site 16. Site 16 was included as part of the IAS performed by NEESA in 1983, and the Phase II RCRA Facility Assessment performed by A.T. Kearney, Inc. in 1988. Although these reports thoroughly outline the site background, no environmental sampling was performed in either the IAS or the assessment.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO60 – SO59 475B – 479A	? / 8"	1976		Line was inaccessible due to chemical odor. Smoke passed through line during test. No repairs recommended
NO SAMPLING PROPOSED IN THIS SEGMENT		1988	Sag: 12 through 83, 92 through 99, 114 through 157, 170 through 277 Cracked Joint: 167 Offset joint: 257	
		1998	@ MH-SO60: Root growth – None Deposition – None Structural condition – good Line/grade – good Visible infiltration – None Drop connection – No	Pipe Lined. Void in annular space, liner folded. No info @MH-SO59.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO60 – SO75 475B – 475A	Vitrified Clay /10″	1976	MH-475B : 30 Drop in manhole : 25 MH-475A : 0	General condition of line is good. No repairs recommended
		1988	N/A	
NO SAMPLING PROPOSED IN THIS SEGMENT		1998	@MH-SO60: Root growth – None Deposition – None Structural condition – poor Line/grade – sag Visible infiltration – None Drop connection – yes @MH-SO75: Root growth – none Deposition – 0.5″ sludge Structural condition – fair Line/grade – offset Visible infiltration – no Drop connection – no	

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO61 – SO60 472 – 475B **NO SAMPLING PROPOSED IN THIS SEGMENT**	Terra Cotta / 12"	1976	MH-472: 281 Cracks: 200 Light roots at joint: 126 Drop into manhole: 6 MH-475B: 0	The pipe is cracked at 200'. Light roots at joint at 126'. Replacement of pipe from 200' to 206' and grouting of joint at 126' is recommended.
		1988	Longitudinal cracked pipe: 5 through 7, 12 through 16 Offset joint: 72, 279, 281 Broken pipe: 87 through 94 Cracked joint: 96, 276 Hole in pipe: 107 Sag: 186 through 194 Drop connection: 280	
		1998	@MH-SO61: Root growth – None Deposition – None Structural condition – good Line/grade – good Visible infiltration – None Drop connection – no @MH-SO60: Root growth – none Deposition – none Structural condition – good Line/grade – good Visible infiltration – no Drop connection – no	Pipe Lined

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO62 – SO61 469 – 472 NO SAMPLING PROPOSED IN THIS SEGMENT	Terra Cotta / 12″	1976	MH-469: 280 Beginning of crack: 235 End of crack: 230 Beginning of infiltration deposits at joints: 225 End of infiltration deposits at joints: 235 Possible light crack in crown: 54 Roots at joint: 47 Roots at joint: 44 Beginning of roots at joint: 40 End of roots at joint: 11 MH-472	Pipe is cracked from 235′ to 230′ and from 54′ to 47′. Appears to be infiltration deposits at joints from 225′ to 135′. There are roots at most joints from 47′ to MH-472
		1988	Cracked joint: 11, 39, 66, 109, 146, 192 Longitudinal cracked pipe: 25 through 29, 45 through 57 Mineral deposit (evidence of past infiltration): 64, 80, 82, 86, 90, 98, 116, 119, 150 Cracked pipe: 140 Offset joint: 221, 223, 243, 249 Sag: 223 through 229, 251 through 255	
		1998	@MH-SO62: Root growth – None Deposition – None Structural condition – good Line/grade – good Visible infiltration – None Drop connection – no @MH-SO61: Root growth – none Deposition – none Structural condition – fair Line/grade – good Visible infiltration – no Drop connection – yes	PVC liner installed from MH-SO62 towards MH-SO61. Liner is 8″ short of manhole, hence poor pipe seal. Fold in liner above the flowline.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO63 – SO62 467 – 469 NO SAMPLING PROPOSED IN THIS SEGMENT	Terra Cotta / 12"	1976		Line was inaccessible due to steam and chemical odors. During smoke test, smoke passed through line and came out of roof vent on Bldg. 600. No repairs are recommended.
		1988	Longitudinal cracked pipe: 2 through 28, 63 through 67, 85 through 89 Sag: 2 through 11 Mineral deposits (evidence of past infiltration): 35, 50, 53, 57, 63, 67, 73, 85 Cracked pipe: 42, 44	
		1998	@MH-SO62: Root growth – none Deposition – none Structural condition – good Line/grade – good Visible infiltration – no Drop connection – no	Pipe segment lined. Liner is 8" short of MH-SO62, hence poor pipe seal. No info @ MH-SO63.
SO64 – SO63 468 – 467 NO SAMPLING PROPOSED IN THIS SEGMENT	Terra Cotta / 8"	1976		Pipe was inaccessible due to steam and chemical odors. Smoke passed through line during test and came out of roof vent on Bldg. 556.
		1988	Mineral deposits (evidence of past infiltration): 5, 7, 9, 11, 15, 21, 27, 32, 60, 66, 68 Cracked joint: 21, 30, 38, 56, 62, 66 Longitudinal cracked pipe: 39 through 40, 44 through 54 Broken pipe: 50 through 54, 68 through 75	
		1998		No info found.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO87 – SO62 466 – 469 SAMPLING PROPOSED IN THE FOLLOWING AREA: ENTIRE PIPE	Terra Cotta / 8″	1976		Pipe was inaccessible due to steam. During smoke test, smoke passed through line. No repairs recommended.
		1988	Longitudinal cracked pipe: 2 through 4, 24 through 29, 32 through 36, 50 through 54, 58 through 74, 76 through 84 Cracked joint: 4, 20, 24, 36, 42, 50, 84, 89 Offset joint: 7, 32, 87 Broken pipe: 20 through 24, 58 through 63, 76 through 80	
		1998	@MH-SO62: Root growth – none Deposition – 4″ sand Structural condition – fair Line/grade – good Visible infiltration – no Drop connection – no	No info @MH-SO87
Bldg. 600 – SO87 Bldg. 600 – 466 NO SAMPLING PROPOSED IN THIS SEGMENT	?./ 8″?	1976		No info found.
		1988		No info found.
		1998		No info found.
Bldg. 600 – SO63 Bldg. 600 – 467 NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron./ 4″	1976		No info found.
		1988	Sag: 1, 17 Offset joint: 20	
		1998		No info found.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
Bldg. 556 – SO64 Bldg. 556 – 468 NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron / 4″	1976		No info found.
		1988	Offset joint: 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 Broken pipe: 14, 15 Mineral deposits (evidence of past infiltration): 14, 17, 18 Sag: 14, 18	
		1998		No info found.
Bldg. 556A – SO64 Bldg. 556A – 468 NO SAMPLING PROPOSED IN THIS SEGMENT	Vitrified Clay / 6″	1976		
		1988	Offset joint: 3, 4, 5, 7, 8, 9, 10, 12, 13, 16, 18, 28, 30, 34, 35, 40 Service connection: 6, 8, 17, 29 SJ: 9, 15	
		1998		No info found.
Bldg. 556B – SO64 Bldg. 556B – 468 NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron / 4″	1976		No info found.
		1988	Service connection: 4, 7 Broken pipe: 10	
		1998		No info found.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
Bldg. 556C – SO64 Bldg. 556C – 468 NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron / 4″	1976		No info found.
		1988	Offset joint: 15, 25, 30	
		1998		No info found.
Bldg. 101 – SO62 Bldg. 101 – 469 NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron / 4″	1976		No info found.
		1988	Offset joint: 6, 9, 12, 17, 22, 27, 32, 37	
		1998	@MH-SO62: Root growth – none Deposition – 4″ sand Structural condition – good Line/grade – good Visible infiltration – no Drop connection – no	4″ lateral was leaking dye from floor above manhole.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO94 – SO81 ? – 471 NO SAMPLING PROPOSED FOR THIS PIPE SEGMENT	? / 8″	1976		No info found.
		1988		No info found.
		1998	@MH-SO81: Root growth – none Deposition – none Structural condition – ? Line/grade – ? Visible infiltration – ? Drop connection – ?	Line blocked upstream of SO81. Could not enter manhole because of slab size. No info @MH-SO94
SO81 – SO80 471 – 471A NO SAMPLING PROPOSED IN THIS SEGMENT	?. / 6″	1976		No info found.
		1988	Roots: 23, 24, 28, 29, 35, 36, 38, 42, 45, 48, 52 Hole in pipe: 38 Mineral deposits (evidence of past infiltration): 51	
		1998	@MH-SO81: Root growth – none Deposition – none Structural condition – fair Line/grade – good Visible infiltration – no Drop connection – no	No info @ MH-SO80

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO82 – SO81 "A" – 471 SAMPLING PROPOSED FOR THE ENTIRE PIPE SEGMENT	Terra Cotta / 6"	1976		No info found.
		1988	Roots: 7, 15, 21, 25, 29, 37, 39, 52, 56, 60, 63, 65, 66, 68, 70, 72, 74, 76, 82, 84, 86, 88, 90, 93, 95, 97, 99, 103, 105, 107, 113 Mineral deposits (evidence of past infiltration): 33 Cracked joint: 47, 52, 72, 93, 100, 103 Offset joint: 109, 111, 113, 115	1 lb of Hg found in MH-SO82 in 1989
		1998	@MH-SO81: Root growth – none Deposition – none Structural condition – ? Line/grade – ? Visible infiltration – ? Drop connection – ?	No info found @MH-SO82. Could not enter MH-SO81 because of slab size.
SO81 – ? 471 – ? NO SAMPLING PROPOSED FOR PIPE SEGMENT	Cast iron / 4"	1976		No info found.
		1988		No info found.
		1998	@MH-SO81: Root growth – none Deposition – none Structural condition – poor Line/grade – good Visible infiltration – ? Drop connection – ?	Do not know where this pipe comes from.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
SO81 – ? 471 – ? NO SAMPLING PROPOSED FOR PIPE SEGMENT	Terra Cotta./ 6"	1976		No info found.
		1988		No info found.
		1998	@MH-SO81: Root growth – none Deposition – none Structural condition – poor Line/grade – good Visible infiltration – ? Drop connection – ?	Do not know where this pipe comes from.
SO80 – SO61 471A – 472 NO SAMPLING PROPOSED FOR PIPE SEGMENT	Vitrified clay / 8"	1976		The general condition of the line is good. No repairs are recommended.
		1988	Cracked joint: 29 Sag: 35 through 50, 147 through 151 Hole in pipe: 127	
		1998	@MH-SO61: Root growth – none Deposition – none Structural condition – fair Line/grade – good Visible infiltration – no Drop connection – yes	No info @ MH-SO80.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
Bldg. 444 – SO61 Bldg. 444 – 472 NO SAMPLING PROPOSED FOR PIPE SEGMENT	Vitrified clay / 6″	1976		No info found.
		1988	Offset joint: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48 Sag: 4, 7, 19, 38 Mineral deposits (evidence of past infiltration): 45 Broken pipe: 51	
		1998	@MH-SO61: Root growth – none Deposition – none Structural condition – good Line/grade – good Visible infiltration – no Drop connection – yes	This service connection was described as a 3″ plastic pipe. This may have replaced the original 6″ V.C pipe, or the pipe may be lined.
SO83 – SO82 ? - ? SAMPLING PROPOSED FOR THE FOLLOWING AREAS: 6′ 18′ 42′ –49′	Terra Cotta / 6″	1976		No info found.
		1988	Offset joint: 6, 18 Cracked pipe: 42 Roots: 42, 52 Cracked joint: 49	Information incomplete. Xerox cut off. 1 lb of Hg found in MH-SO82 in 1989
		1994		81.4 mg/kg of Hg detected in sediments in MH-SO83.
		1998		No info found.

TABLE 3-1
SANITARY SEWER LINE CONDITION SURVEY SUMMARY
SITE 53 – MERCURY CONTAMINATION OF THE SEWAGE SYSTEM
INDIAN HEAD, MARYLAND

LINE SEGMENT	TYPE / DIA.	DATE OBSERVED	DEFECT: FOOTAGE	COMMENTS
Bldg. 102 – SO82 Bldg. 102 - ? NO SAMPLING PROPOSED IN THIS SEGMENT	Vitrified clay / 6"	1976		No info found.
		1988	Offset joint: 2, 4, 6, 8, 10, 12, 15, 17, 18, 21, 24, 27, 30, 33, 48 Broken pipe: 15, 17 Sag: 17, 29 Service connection: 22	1 lb of Hg found in MH-SO82 in 1989
		1998		No info found.
Bldg. 102A – SO82 Bldg. 102A - ? NO SAMPLING PROPOSED IN THIS SEGMENT	PVC / 4"	1976		No info found.
		1988	Sag: 60 Service connection: 98	1 lb of Hg found in MH-SO82 in 1989
		1998		No info found.
Bldg. 102 – SO83 Bldg. 102 - ? NO SAMPLING PROPOSED IN THIS SEGMENT	Cast iron / 4"	1976		No info found.
		1988	Sag: 1, 9 Offset joint: 10, 12, 15, 20 Cracked pipe: 14 Mineral deposits (evidence of past infiltration): 15 Service connection: 22	Info incomplete. Xerox cut off
		1994		81.4 mg/kg of Hg detected in sediments of MH-SO83.
		1998		No info found.

REFERENCES:

1976: Robinson Pipe Cleaning Co. closed circuit TV inspection logs.

1988: RJN Group video pipe condition survey (annotated figure).

1994: Site Inspection Report

1998: Infiltration and Inflow Investigation for Wastewater Collection System, RJN Group, 1998.

STORM SEWER LINE CONDITION SURVEY SUMMARY:

Not one of the line segment/manhole condition survey reports (1976, 1988, & 1998) contained any information pertaining to the condition of the storm sewer line segments and/or manholes. It is assumed that the focus of these reports was strictly on the sanitary lines. However, the Preliminary Assessment Report states that approximately 10 lbs of mercury was recovered in 1969 from the manhole that receives storm lines from Bldgs. 102, 103, 1746, and 502. This manhole can be identified as the first upstream manhole from MH-474 (not to be confused with MH-473). Additionally, the Site Inspection Reported (1994), states that approximately 52.0 mg/kg of mercury was detected in the sediments of this same manhole, and 2.5 mg/kg of mercury was detected in the sediments of MH-473. MH-473 is located downstream of the chemical disposal pit north of Bldg. 444. No further information on the storm sewer lines is available at this time.

3.2.3 Site 53 – Mercury Contamination in the Sewage System

Sampling was conducted during the SI (E/A & H, 1994) to determine if contamination exists as a result of disposal procedures in conjunction with a faulty sanitary sewer system. The sampling and analysis conducted during the SI is provided in Table 3-2.

Sludge samples were collected from within the identified manholes in the vicinity of Buildings 102 and 103 and subsurface soil samples were collected from soil borings advanced in the general vicinity of the sewer lines. The locations of the sludge samples and soil borings along with the analytical results which exceeded the EPA Region III screening levels are shown on Figure 3-4.

Soil borings were installed as close as possible to the sanitary line in the areas recommended in the PA (between manholes 469 and 472, between manholes "A" and 471, and between Building 303 and manhole 471, see Figure 3-4). Soil samples collected from boring 53SB01 were analyzed for volatile and semivolatile organic contaminants, TAL, and TPH. No volatile or semivolatile organic contaminants, or TPHs were reported above method detection limits. Arsenic was detected in soil sample 53SB0102 at 9.3 mg/kg. This concentration is above the site-specific statistical background level of 2.18 ppm (reported in Draft Background Investigation Report, Brown & Root Environmental, December, 1997); however, it is not above the current action level and arsenic may be naturally occurring.

Soil samples collected from borings 53SB02 through 53SB13 were analyzed for mercury and nitrate esters; no target compounds were detected.

Sludge samples were collected from storm drain and sanitary manholes in the vicinity of the laboratories. Thirteen manholes were scheduled to be sampled, however, only four of the manholes contained adequate sediment volume for the analyses. Sludge samples were analyzed for mercury and nitrate esters. Mercury was detected in sediments taken from storm drain manhole "B" (where mercury was recovered in 1969) at 52 mg/kg, in a sanitary manhole near Building 102 at 81.4 mg/kg, and at a storm drain manhole south of Building 881 at 2.5 mg/kg. Mercury was not detected in sediment in the fourth manhole (storm drain near southern corner of Building 600). Nitroglycerine, RDX, and PETN also were detected in manhole "B" (sample 53DM02).

Although it was planned to install monitoring wells during the SI, no monitoring wells were installed because groundwater was not encountered. During the field work, 13 borings were installed, 10 at a depth of 12 feet, and 3 at depths of 30 to 40 feet. No shallow water-bearing zone was encountered in any of the borings. One of the deep borings (53SB02) was located near the southeastern edge of Thames Road, northwest of Building 444. The SI Report described the occurrence of a marker bed at 41 feet deep in that boring, indicating the bottom of the Lowland Deposits, and suggesting that no shallow water-bearing zone should be expected. The same marker bed was found in a boring located between Buildings 881 and 444 (49SB01) at a depth of 32 feet. (Note that the ground surface at 53SB01 is 6 to 7 feet higher than at 49SB01.) A third boring (53SB13), located approximately 60 feet south of the southeastern corner of Building 502, encountered the marker bed at 35 feet deep. The SI Report described the marker bed as a unit of the Tertiary Brandywine Formation. The unit is a medium to fine-grained reddish to white quartz sand; is moderately cemented and very hard; and was impenetrable by split-spoon sampling.

TABLE 3-2

PREVIOUS INVESTIGATION
SITE 53 - Mercury Contamination in the Sewage System
INDIAN HEAD, MARYLAND

Sample Media:	Shallow soil profile (0-12 feet) Sludge (sewer lines)			
Sampling Performed:	**Type**	**Number**	**Sample/Location**	**Total**
	Shallow soil borings (adjacent to sewer lines)	13	1	13
	Sludge (from sewer manholes)	4	1	4
Analyses Performed:	**Media**	**Analyses**		
	Soil (adjacent to sewer lines)	SB01 - TCL, BNA, TAL, TPH SB02-SB15 - Mercury, Nitrate Esters		
	Sludge (sewer manhole)	Mercury, Nitrate Esters		

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

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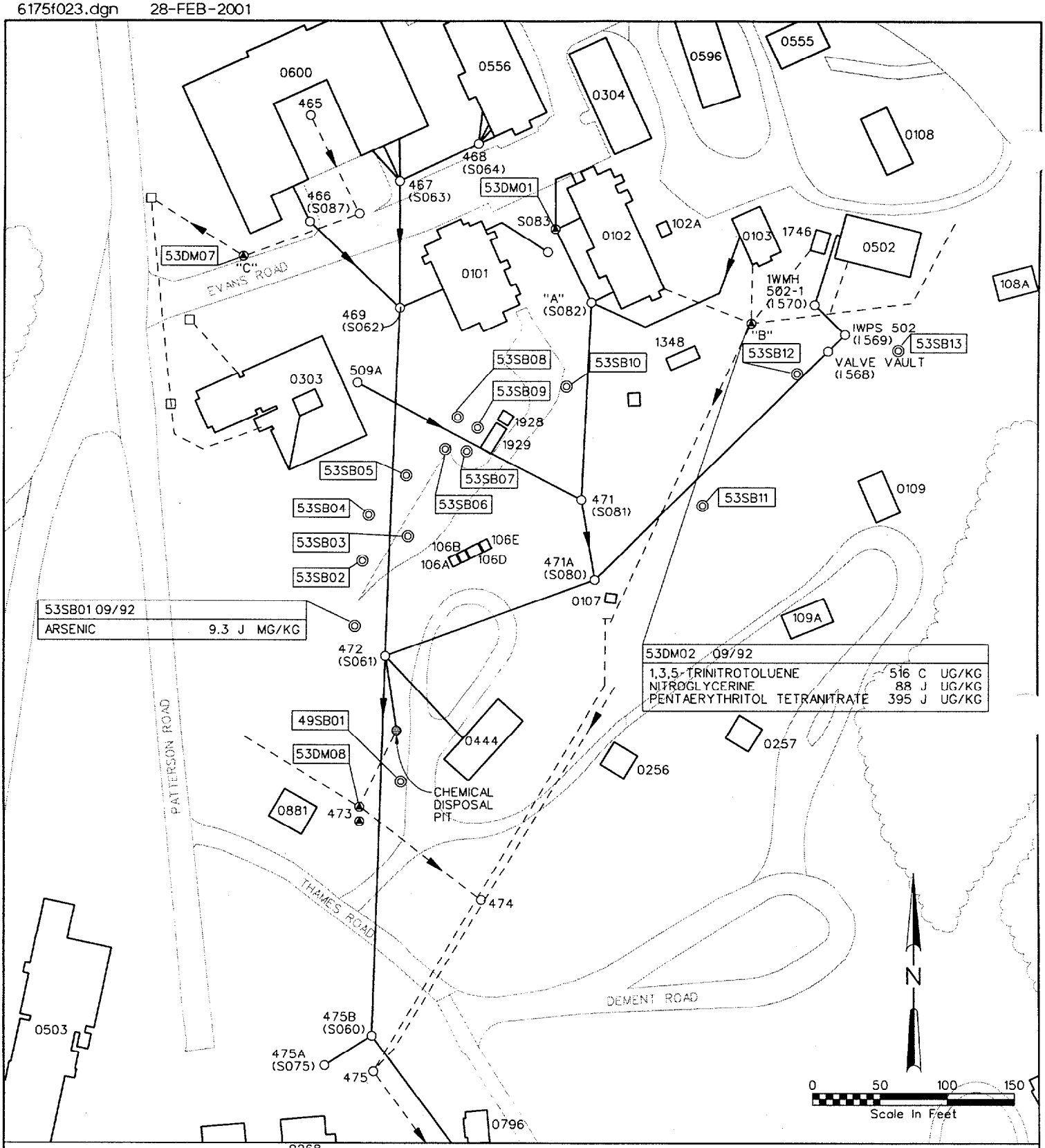

LEGEND

- SEDIMENT SAMPLE LOCATION
- SOIL BORING SAMPLE LOCATION
- MANHOLE
- GRATE
- STORM SEWER
- SANITARY SEWER

NOTES:

1. SEE TABLE 3-1 FOR PIPE SIZE AND TYPE.
2. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
3. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 53. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
4. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 3-4
SITE 53 -
LOCATIONS OF SOIL BORING AND SEDIMENT SAMPLES AND EPA III RBC EXCEEDANCES FROM E/A&H SI (1994)
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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Soil samples collected during the SI field work were uniform throughout the site, and consisted of stiff to hard brown and green silty clay with little moisture. Blow counts averaged 40 blows per foot. Test results from two Shelby Tube samples indicated hydraulic conductivities of 7.1×10^{-8} cm/sec and 1×10^{-6} cm/sec.

Soil borings 53SB0103 and 53SB1303 were analyzed for cation exchange capacity (CEC) and total organic carbon (TOC). The CEC values (milli-equivalence per 100 grams) were within the typical range for silty clays (10 to 40 meq/100g) (Drever, 1988, E/A & H, 1994). A higher CEC value indicates that more sites are available for bonding. A high number of bonding sites increases the potential for adsorption of contaminants and a retarded rate of contaminant migration. CEC values are affected by several factors, including composition of clay minerals, pH, and the nature of the cations present. TOC concentrations were also in the average range for silty clays. The potential for a contaminant to partition to or become absorbed to the soil particles increases as TOC content increases. In other words, the potential distance for contamination migration through the soil profile decreases with increasing TOC. The SI concluded that these results indicate low potential for contaminant migration in site soils.

The SI Report concluded that, "If contamination, particularly mercury, had entered the soil system via the sewer lines, the extent of contamination would be limited to the soil in contact with joints and/or fractures in the pipes by the natural soil properties."

3.3 Human Health Risk Assessment

A human health risk assessment for Sites 15, 16, and 53 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance with Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate whether site concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Sites 15, 16, and 53 human health risk assessment including the screening methods for determination of chemicals of potential concern (COPCs) and the exposure scenarios to be evaluated.

Site 15 is the location of the Fluorine Laboratory (Building 502) and the Surveillance/Sample Control Building (Building 103). Site 16 consists of the sewers draining the Research and Development Building (Building 600), which houses research laboratories and division offices. Site 53 (Mercury Contamination in the Sewage System) consists of the sewage system for the general laboratory area in the northeastern part of the IHDIV-NSWC. It is not anticipated that these sites will be used for residential development in the future. However, Navy policy is to evaluate a hypothetical conservative scenario of future residential use. Therefore, the USEPA Region III soil risk-based concentrations (RBCs) for the resident will be used for screening the subsurface soil data. The sediment samples collected at the sites will be screened against ten times the residential soil RBC. The constituents with maximum detected concentrations exceeding the screening value will be retained as COPCs and will be evaluated quantitatively in the risk assessment.

Table 3-3 summarizes the potential receptors that will be evaluated in the human health risk assessment. The trespasser adult and adolescent are included in the evaluation because although the sites are posted to restrict access, and is partially fenced, the fence is not

Table 3-3
POTENTIAL EXPOSURE PATHWAYS
SITES 15, 16, and 53 - Underground Sewer Lines
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current					Future							
		Industrial Worker	Trespasser/Visitor		Recreational User		Resident		Construction Worker	Industrial Worker	Trespasser/Visitor		Recreational User	
			Adult	Adolescent	Adult	Child	Adult	Child			Adult	Adolescent	Adult	Child
Subsurface Soil														
	Ingestion	X					X	X	X	X	X	X		
	Dermal	X					X	X	X	X	X	X		
	Inhalation	X					X	X	X	X	X	X		
Sediment**														
	Ingestion	X*			X*	X*				X*			X*	X*
	Dermal	X*			X*	X*				X*			X*	X*
	Inhalation													

X Quantitative evaluation.

* Current and Future are the same.

** Industrial worker would be exposed to sediment in manholes.

Notes:

For subsurface soil exposure, current industrial worker would be worker repairing lines, future industrial worker would be person who works at site.

For future scenarios, assumed subsurface soil could be accessible as surface soil, after site disturbance.

continuous along the river and people could enter the sites. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. The current and future industrial workers are not considered the same type of worker. The current industrial worker is considered a worker who may repair the sewer line at the site. The future industrial worker is considered a worker whose main area of work is at the site, and would be exposed to accessible site media on a daily basis. For the future exposure scenarios, it is assumed that the current subsurface soil may be disturbed during construction activities and placed on the surface as surface soil.

3.4 Ecological Risk Assessment – Screening Level Problem Formulation

The sewers and storm drains within the Laboratory Area are connected to the sanitary sewer systems. Because they do not daylight into a surface water body and releases associated with failed piping would involve subsurface soil only, there are no complete exposure pathways linking chemical contamination to ecological receptors. Ecological concerns associated with lab area releases to surface soil, and the surface water and sediment in the downgradient wetland, are addressed in Section 4.0.

3.5 Work Plan

Past remedial efforts and reports of past investigations in the lab area sewers and storm drains indicate that the gross mercury contamination has been removed from the sewer system, the depth to groundwater exceeds 30 to 40 feet, and the soil conditions at the site will inhibit the migration of contamination. What the past investigations did not clearly establish was the extent of the subsurface contamination adjacent to the damaged pipe sections, the complete extent of manhole sediment contamination, and the extent of contamination downstream of the site where the storm drain system discharges to the Mattawoman Creek. The scope of this investigation was developed to address these data gaps.

The proposed scope for the field investigation is summarized in Table 3-4. Table 3-5 summarizes the sampling and analysis program, and Table 3-6 provides the sample bottleware, preservation, and holding time requirements. Locations of the samples to be collected are provided in Figure 3-5.

3.5.1 Subsurface Soil

Field activities during the SI included sampling subsurface soil for a variety of contaminants at 13 locations at Site 53. The goal of the SI was to sample soil near sections of sanitary sewer lines that the video surveying had indicated to be damaged sufficiently that contaminants might leak from the pipes and contaminate the adjoining soil. A comparison of the available results of the 1988 video survey (summarized in Table 3-1) and analytical results from the SI shows no correlation between damaged sections of sanitary sewer pipe and detections of mercury. Borings SB03 through SB09 were advanced in the general vicinity of cracks, and offset and broken joints identified in the video survey, however there were no detections of mercury in these borings. It appears that none of the soil borings were

TABLE 3-4

SITE SPECIFIC WORK PLAN
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis
Subsurface Soil	Soil adjacent to manhole structures downgradient of damaged sanitary sewer lines, and soil adjacent to damaged pipe segments.	Determine whether potential discharges from broken sanitary sewer lines have contaminated surrounding subsurface soils.	Collect subsurface soil samples using direct push rig.	Downgradient of previously identified broken sewer lines, and adjacent to damaged pipe sections next to buildings, see Figure 3-6	24	TAL inorganics. Five samples will also be analyzed for TCL VOCs and SVOCs, and explosives.
Sediment	Manholes in vicinity of Lab Area	Determine whether sediment collected in manholes is contaminated.	Collect sediment samples from manhole using a scoop attached to a rod.	See Figure 3-6	13	TCL VOCs and SVOCs, TAL inorganics, ammonium perchlorate and explosives.

TABLE 3-5

SUMMARY OF SAMPLING PROGRAM
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Sample Media	Sample ID Number	Sample Depth/Location	Analysis									
			TCL VOCs	TCL SVOCs	TAL Inorganics	TAL Organics	Explosives	Ammonium Perchlorate	Ph	TOC	Hardness	Grain Size
Subsurface Soil	IS53SB01*BDED*	Upgradient of MH466*			X							
	IS53SB02*BDED*	Upgradient of MH467*			X							
	IS53SB03*BDED*	Upgradient of MH467*			X							
	IS53SB04*BDED*	Upgradient of MH468*			X							
	IS53SB05*BDED*	Upgradient of MH468*			X							
	IS53SB06*BDED*	Upgradient of MH469*			X							
	IS53SB07*BDED*	Upgradient of MH469*			X							
	IS53SB08*BDED*	Upgradient of MH469*			X							
	IS53SB09*BDED*	Upgradient of MH SO83*			X							
	IS53SB10*BDED*	Upgradient of MH "A" (SO82)*			X							
	IS53SB11*BDED*	Upgradient of MH "A" (SO82)*			X							
	IS53SB12*BDED*	Upgradient of MH471 (SO81)*			X							
	IS53SB13*BDED*	Upgradient of MH471 (SO81)*	X	X	X		X					
	IS53SB14*BDED*	Upgradient of MH "B"*	X	X	X		X					
	IS53SB15*BDED*	Upgradient of MH "B"*	X	X	X		X					
	IS53SB16*BDED*	Upgradient of MH "B"*	X	X	X		X					
	IS53SB17*BDED*	Upgradient of "dry well" east of Bldg 101*	X	X	X		X					
	IS53SB18*BDED*	Pipe segment between MH466 & MH 469*			X							
	IS53SB19*BDED*	Pipe segment between MH466 & MH 469*			X							
	IS53SB20*BDED*	Pipe segment between SO83 & SO82*			X							
	IS53SB21*BDED*	Pipe segment between SO83 & SO82*			X							
	IS53SB22*BDED*	Pipe segment between SO82 & SO81*			X							
	IS53SB23*BDED*	Pipe segment between SO82 & SO81*			X							
	IS53SB24*BDED*	Pipe segment between SO82 & SO81*			X							
Sediment	IS53SD01*BDED*	MH474*	X	X	X		X	X				
	IS53SD02*BDED*	MH473*	X	X	X		X	X				
	IS53SD03*BDED*	MH472*	X	X	X		X	X				
	IS53SD04*BDED*	MH471*	X	X	X		X	X				
	IS53SD05*BDED*	Manhole "A" (SO82)*	X	X	X		X	X				
	IS53SD06*BDED*	SO83*	X	X	X		X	X				
	IS53SD07*BDED*	Manhole "B"*	X	X	X		X	X				
	IS53SD08*BDED*	MH469*	X	X	X		X	X				
	IS53SD09*BDED*	MH466*	X	X	X		X	X				
	IS53SD10*BDED*	Manhole "C"*	X	X	X		X	X				
	IS53SD11*BDED*	MH465*	X	X	X		X	X				
	IS53SD12*BDED*	MH467*	X	X	X		X	X				
	IS53SD13*BDED*	MH468*	X	X	X		X	X				

* Refer to Figures 3-6 for proposed subsurface soil, and manhole sediment sample locations.

BDED - Refers to sample beginning depth (BD) and ending depth (ED) (for example 0405 = 4 to 5 feet below ground surface)

TABLE 3-6

BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Subsurface Soil	TCL VOCs - CLP OLM04.0	5	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	5	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	24	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	5	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
Sediment	TCL VOCs - CLP OLM04.0	13	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	13	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	13	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	13	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	13	1	4 oz. glass	Cool to 4 degrees C	14 days to analysis

CWM - Clear Wide Mouth
* - Includes analysis for nitrate esters (nitroglycerine, nitrocellulose, nitroguanidine) and pentaerythritol tetranitrate (PETN) in Modified SW-846-8330.

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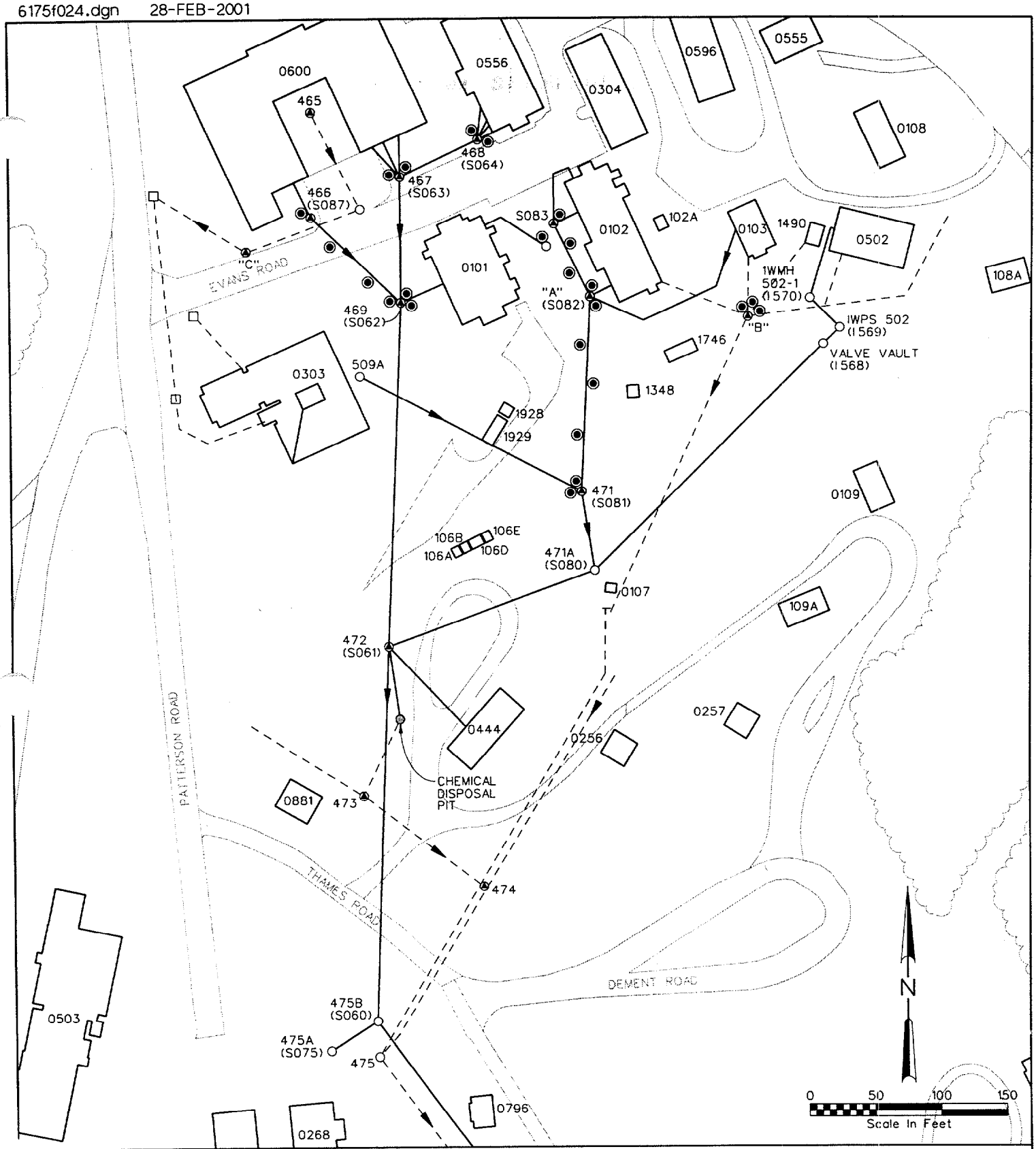

LEGEND

- PROPOSED SEDIMENT SAMPLE LOCATION
- PROPOSED SUBSURFACE SOIL SAMPLE LOCATION
- MANHOLE
- GRATE
- STORM SEWER
- SANITARY SEWER

NOTES:

1. REFER TO TABLE 3-4 FOR SAMPLE ID'S.
2. SEE TABLE 3-1 FOR PIPE SIZE AND TYPE.
3. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
4. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 53. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
5. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 3-5
LAB AREA -
PROPOSED SUBSURFACE SOIL
AND SEDIMENT LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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drilled less than about 10 feet from the sewer lines and some were as far away as 25 feet. Given the low mobility of mercury and nitrate esters in the environment, it is unlikely that any contaminants that may have leaked from the lines would have migrated so far from the lines. In addition, they likely would have migrated either downward toward the water table or laterally along the bedding (if any) around the sewer lines.

Part of the difficulty in sampling subsurface soil near the sewers for the 1994 SI may have been in actually finding the sewers. CH2M HILL proposes that methods be used that would better ensure that the sewers and areas of potential mercury accumulation are located. The direct-push method will be used. This method will allow sampling subsurface soil with less risk of breaking into a sewer than using a hollow-stem auger or similar heavy-duty equipment.

Direct-push soil borings are proposed at locations identified as likely locations for the accumulation of mercury that has leaked from the sewer lines. These locations are limited to the sewer lines that are the closest to the buildings. Although nearly all of the sewer lines contain cracks and potential integrity breaches, it is assumed that most of the mercury will have leaked out of the lines that are closest to the source (i.e. the buildings). Additionally, sample locations will be biased near manholes. It is assumed that any mercury that has leaked out of a sewer line will run down gradient along the pipe bedding and accumulate at the lowest point of the sewer pipe run adjacent to a manhole structure. Due to the nature of the in-situ soils, it is assumed that the mercury will not be able to permeate down into the water table, but will follow the more permeable pipe bedding. By locating samples near the manholes, the number of pipes present in the vicinity, pipe depths, and orientations can be estimated by observing their outfalls in the manhole structure. The proposed subsurface soil sampling locations are shown in Figure 3-5.

It is assumed that only one sample will be collected at each location, unless obvious contamination suggests the need for additional sampling. An estimated 24 subsurface soil samples will be collected and submitted for analysis by a contract laboratory. All of the soil samples will be analyzed for Target Analyte List (TAL) inorganics. The wide variety of chemicals used in the buildings served by the sewer lines suggests that an estimated 5 samples also should be analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), and explosives (including pentaerythritol tetranitrate (PETN) and the nitrate esters nitroglycerine and nitroguanidine).

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates will be analyzed in addition to laboratory QA/QC samples, including MS/MSD samples. Analysis of the samples will be performed in accordance with the Navy guidance for Level D.

3.5.2 Sediment

The SI reported that 13 manholes in the lab area were scheduled for sampling but only 4 manholes contained sufficient sediment to sample. Another attempt is proposed to collect sediment samples in the remaining nine manholes, and those sampled as part of the SI will be re-sampled to evaluate the changes in sediment quality over time. It is believed that the installation of pipe linings in several of the sanitary sewers may have forced collected

sediments into the manholes, providing enough sediment to sample. The pipe linings were installed some time between 1988 and 1998 according to the video pipe condition survey conducted by RJN Group in 1988 and the Infiltration and Inflow Investigation for the Wastewater Collection System in the Lab Area conducted by RJN Group in 1998. The results of these surveys are shown in Table 3-1.

Thirteen sediment samples will be collected from the manholes shown in Figure 3-5 by scooping the bottom of the manhole with a dipper attached to a rod or stick. Areas of the manhole bottom where sediment tends to accumulate will be targeted for sampling. The sediment then will be transferred to the sampling containers.

All sediment samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, ammonium perchlorate, and explosives (including PETN, nitroglycerine and nitroguanidine).

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates will be analyzed in addition to laboratory QA/QC samples, including MS/MSD samples. Analysis of the samples will be performed in accordance with the Navy guidance for Level D.

4.0 Lab Area Surface Soils

4.1 Background Information and Site/Building Descriptions

4.1.1 Site 50 – Building 103 Crawl Space

Site 50 – Building 103 Crawl Space is located in the laboratory area of the northeast part of the IHDIV-NSWC as shown in Figure 4-1. Building 103 is a small one story building with a concrete block foundation, built in approximately 1902. Laboratory equipment containing mercury has been reportedly used in Building 103 at different times. The equipment includes nitrometers, pycnometers, talianis, and thermometers.

Spent mercury handling procedures at Building 103 and other buildings in the laboratory area that used mercury consisted of pouring spent mercury into "slop jars" and running tap water into the jar over a sink to remove sulfuric acid from the mercury. Spills often occurred while transferring the spent mercury from nitrometers, and slop jars often broke. In addition, mercury was inadvertently washed out of the jars.

In 1985, while replacing two sinks in Building 103, workers discovered that the two sinks connected to a single drain line discharged directly to the soil beneath the building and did not connect to the storm or sanitary sewer system. After the discovery, a four-inch diameter PVC pipe was installed from the sink drain line to the manhole west of Building 102 (NEESA, 1992). The quantity of solvents and mercury discharged to the soil from 1902 to 1985 is unknown (EnSafe/Allen & Hoshell, 1994).

The crawl space below Building 103 is divided in half by a central load-bearing wall, running approximately east-west. The ground in the northern part of the crawl space is relatively flat, however, the southern section slopes to the southwest. The entrance to the crawl space is along the southern wall. The drain from the two sinks was located in the southwest corner of the northern section of the crawl space. A small ditch exists along the west wall of the southern section of the crawl space. It drains to a shallow depression in the southwest corner, forming a collection point for runoff.

The area around Building 103 is similar to the ground surface in the crawl space. The topography at the northern end of the building is relatively flat, while the ground slopes to the south at the southern end of the building.

4.1.2 Site 54 – Building 101 Mercury Contamination

Building 101 is located in the laboratory area in the northeastern part of the IHDIV-NSWC as shown in Figure 1-1. In the mid-1980's, an NSWC employee in Building 101 detected mercury droplets and an organic solvent odor in the basement office when solvents were discharged through the pipe system (NEESA, 1992) suggesting a potential leaky drainage pipe. In January 1990, several droplets of mercury were discovered resting on the insulation of a steam pipe located in the southeast corner room of the basement in Building 101

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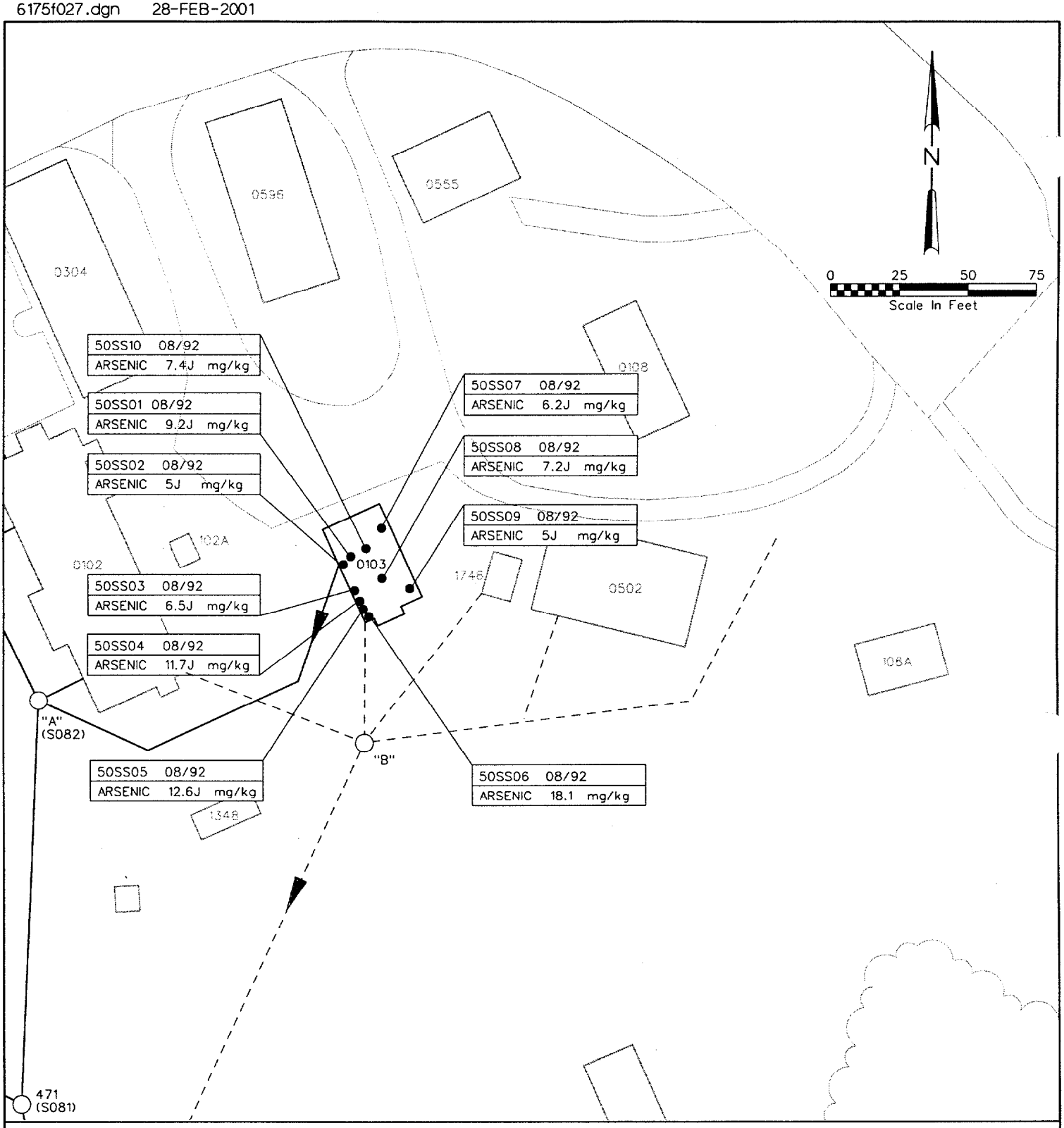


LEGEND

- - - - - STORM SEWER

——— SANITARY SEWER

○ MANHOLE

● SURFACE SOIL SAMPLE

NOTES:

1. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN THE PAST INVESTIGATIONS.
2. SEWER SYSTEMS SHOWN ONLY IN VICINITY OF SITE 15. ONLY SEWER SEGMENTS AND MANHOLES OF CONCERN ARE SHOWN.
3. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 4-1
SITE 50 -
LOCATIONS OF CRAWL SPACE SURFACE SOIL SAMPLES AND EPA REGION III EXCEEDANCES FROM E/A&H SI (1994)
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

(NEESA, 1992). When NSWC Safety Office personnel began removing the drop ceiling tiles, mercury vapors were detected in the breathing zone, but no visible signs of mercury on the ceiling tile tracks were observed (NEESA, 1992).

4.1.3 Site 55 – Building 102

Building 102 is located in the center of the lab area as shown in Figure 1-1. Building 102, constructed in 1909, was used as a laboratory for testing nitrocellulose by the nitrometer method. Other mercury-containing equipment including pycnometers, talianis, vacuum stability testing equipment, and thermometers were used to determine the densities and sensitivity of propellants throughout the 80 years of laboratory operations in Building 102.

On October 6, 1987, metallic mercury was discovered dripping from the ceiling onto the sink table top of the coffee mess, located in the northern end of the basement of Building 102. The source of the mercury was believed to be the equipment located on the first floor (NEESA, 1992). Ceiling tiles were removed, revealing the original tongue and groove wood flooring. A layer of asbestos sheeting was found beneath this wood flooring. Plastic sheeting was placed under the ceiling to capture the mercury leaking from the wooden floor above. An estimated 2 ounces of mercury leaked onto the plastic sheeting from the wooden floor, necessitating the closure of the northern end of the building to protect the health of employees (NEESA, 1992). Building 102 was abandoned in February 1989 and the water supply to Building 102 was terminated to help alleviate high mercury levels in the sanitary sewage sludge (NEESA, 1992).

Interviews with past facility employees as to historical operations of Building 102 revealed that the wooden floor was not sealed with an impervious surface until the early 1960's (NEESA, 1992). According to employee interviews, a major spill occurred upstairs in Building 102 in the early 1960's before the impervious concrete floor was installed.

In the mid-1970's the nitrometer was moved to the southern room in the basement of Building 102 (NEESA, 1992). The floor drains in the basement were plugged in the early 1980's to prevent the release of mercury in case of a spill (NEESA, 1992).

In 1986 mercury traps were installed in the sinks where mercury was handled. When the U-joints were removed to install the traps, the plumber noted "about a teaspoon" of mercury in each U-joint (NEESA, 1992). After the building was closed, the sinks were salvaged for use in other buildings. Additional mercury was found in the piping and U-joints when the sinks were removed (NEESA, 1992).

Visual inspection and the record search for Building 102 revealed that the friable and non-friable asbestos containing materials (ACM) are present throughout the structure (NEESA, 1992). Possible sources include thermal system insulation (TSI) on the steam and hot water lines, asbestos mud on the steam and hot water pipe elbows, transite wall board, ceiling tiles, asphalt-asbestos floor tiles, floor mastic, batt insulation in the ceiling and walls, flooring felts, and heating, ventilation, and air conditioning (HVAC) system insulation. The ACMs observed during the 1992 site visit were deteriorated and friable, creating a possible fiber release hazard (NEESA, 1992).

4.1.4 Other Buildings

In 1993, total mercury analysis was performed by an IHDIV-NSWC laboratory on surface soil samples randomly collected near Buildings 102, 108, 109A, 444, 556 and 1797 (Building 1797 is not located in the lab area). Analyses were performed in accordance with Method 7471 of *Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 2*, November 1990, USEPA Office of Solid Waste. Mercury was detected in all samples except the Building 556 sample at concentrations of 0.216 to 128 mg/kg (wet weight). The highest concentrations were detected near Building 108 (4.05 mg/kg), Building 102 (25.2 mg/kg) and Building 444 (128 mg/kg). The memorandum documenting these results is included in Appendix D.

Most of the structures in the lab area have been used as laboratories or chemical storage at one time or another during their history. Accounts of various personnel currently or formerly employed in the labs have indicated that historical practices, such as disposing of unusable chemicals directly on the ground surface outside the laboratory doors, may have led to surface soil contamination in the lab area.

Given the evidence that surface soil contamination may be wide spread throughout the lab area, the Indian Head Installation Restoration Team (IHIRT) has elected to broaden the investigative scope beyond the buildings identified as IR sites in the PA (Sites 50, 54, and 55), to include other buildings in the laboratory area (see Figure 1-1). Other buildings included in the lab area surface soil study are 108, 108A, 303, 304, 444, 555, 556, 596 and 1348. Limited historical information is available for Buildings 303, 304, 555, and 596 in the *Summary of Use Report, Buildings 303, 304, 555, and 596*, prepared by James E. Dolph, Industrial Historian, Portsmouth Naval Shipyard, dated May 27, 2000 and is summarized below.

4.1.4.1 Building 303

According to the *Summary of Use Report*, Building 303 was built in 1918. It served as a chemical laboratory office building from 1918 to 1949. Building 303 was designated a "Production & Safety Office Building" from 1957 to 1959. From 1961 to 1967, Building 303 was designated a "Production Building." As of 1999, Building 303 was used as an office building.

Historical notes in the *Summary Use Report* indicate that an architectural plan dated 1940 shows two photographic darkrooms and a general workroom in the basement of Building 303. Additionally, an architectural plan dated 1944 shows that all spaces on the first floor are offices, an architectural plan dated 1956 shows a paper cutting room, paper dipping machine and chemical storage room in the basement, and a plan dated 1978 shows that all spaces in the basement and on the first floor are offices.

4.1.4.2 Building 304

According to a *Summary of Use Report*, Building 304 was built in 1918 with later additions built in 1940 and 1941. From 1918 to 1949 Building 304 was used as a chemical laboratory storehouse. No record of building use between 1950 and 1957 was found, but it was again described as a storehouse from 1957 to 1961. In 1961, Building 304 also was used as "Retail

Outlet #4." As of 1999, Building 304 was still in use as a storehouse, but also contained a wastewater laboratory.

As part of a hazardous materials survey performed in 1980, a list of all of the materials stored in Building 304 was compiled. This list is shown in the *Summary of Use Report* in Appendix E.

As part of the NAVORDSTA Oil/Hazardous Substance Contingency Plan in 1986, a list of materials stored in Building 304 was compiled. This list is also shown in the *Summary of Use Report* in Appendix E.

4.1.4.3 Building 555

According to the *Summary of Use Report*, Building 555 was built in 1944. It served as a "Surveillance Magazine" from 1944 to 1949. From 1957 to 1961 Building 555 was designated "Magazine 2Y2." From 1967 to 1976 Building 555 was used as an "Explosive Test Laboratory." As of 1999, Building was designated as a Magazine and "Explosive Test Laboratory."

Historical notes in the *Summary Use Report* indicate that in 1968 an architectural plan was drawn for a proposal for renovations associated with "Mixing and Measuring." Additionally, an architectural plan dated 1974 indicates that a "Rolling Mill" was in the building.

As part of a hazardous materials survey performed in 1980, a list of all of the materials stored in Building 555 was compiled. This list is shown in the *Summary of Use Report* in Appendix E.

As part of the NAVORDSTA Oil/Hazardous Substance Contingency Plan in 1986, a list of materials stored in Building 555 was compiled. This list is also shown in the *Summary of Use Report* in Appendix E.

4.1.4.4 Building 596

According to the *Summary of Use Report*, Building 596 was built in 1945. In 1949, the building was used as "Surveillance Magazine #4." From 1957 to 1961 Building 596 was used as "Magazine 2Y1." In 1976 the building was used for "stability testing." As of 1999, Building 596 was designated as a Magazine and "Stability Test Building."

4.2 Previous Environmental Investigation

4.2.1 Site 50 – Building 103 Crawl Space

Sampling was conducted during the SI to determine if contamination was present in the surface samples beneath Building 103. A summary of the samples collected beneath the building is provided in Table 4-1. Sampling results are shown in Table 4-2.

A total of 10 surface soil samples were collected from beneath Building 103 during the SI Study. The locations of these soil samples and the analytical results which exceed EPA Region III RBC screening levels are provided in Figure 4-1. Arsenic was the only contaminant detected which exceeded the screening levels.

TABLE 4-1

PREVIOUS INVESTIGATION
SITE 50 - Building 103 Crawl Space
INDIAN HEAD, MARYLAND

Sample Media:	Surface Soil			
Sampling Performed:	**Type**	**Number**	**Sample/Location**	**Total**
	Surface Soil	10	1	10
Analyses Performed:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL, Nitrate Esters		

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

TABLE 4-2

PREVIOUS INVESTIGATION
SITE 50 - Building 103 Crawl Space
INDIAN HEAD, MARYLAND

Parameter	Average	Minimum	Maximum	Frequency
VOCs (ug/kg)				
Acetone	530.00	530.00	530.00	1/12
Trichloroethane	10.00	10.00	10.00	1/12
BNAs (ug/kg)				
Anthracene	41.67	26.00	65.00	3/12
2,4-Dinitrotoluene	4950.00	4200.00	5700.00	2/12
Pyrene	96.67	29.00	280.00	6/12
Benzo(g,h,I)perylene	46.50	33.00	60.00	2/12
Indeno(1,2,3-cd)pyrene	46.50	32.00	61.00	2/12
Benzo(b)fluoranthene	96.50	28.00	150.00	4/12
Fluoranthene	176.83	28.00	440.00	6/12
Benzo(k)fluoranthene	73.00	20.00	130.00	3/12
Chrysene	63.71	28.00	200.00	7/12
Benzo(a)pyrene	76.00	52.00	100.00	2/12
Dibenz(a,h)anthracene	37.00	37.00	37.00	1/12
Benzo(a)anthracene	59.20	17.00	160.00	5/12
2,6-Dinitrotoluene	290.00	290.00	290.00	1/12
Di-n-butylphthalate	5350.00	3900.00	6800.00	2/12
Phenanthrene	112.50	29.00	370.00	6/12
N-Nitrosodiphenylamine (1)	290.00	280.00	300.00	2/12
Carbazole	53.00	31.00	75.00	2/12
TALs (mg/kg)				
Iron	25753.64	1780.00	142000.00	11/11
Lead	425.57	61.60	1260.00	11/11
Mercury	24.00	1.80	100.00	11/11
Silver	6.40	4.20	8.60	2/11
Arsenic	8.39	3.40	18.10	11/11
Cadmium	4.80	3.00	7.20	4/11
Copper	40.36	7.90	155.00	11/11
Zinc	792.09	125.00	3170.00	11/11

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

Two VOCs were reported in soil samples from Site 50. Acetone was detected in sample 50SS10 at 530.0 μg/kg. Acetone was also indicated in the laboratory blank. 1,1,1-Trichloroethane was reported at an estimated concentration of 10.0 μg/kg in sample 50SS05 which is well below screening levels.

Eight metal analytes were reported at concentrations that exceeded the background concentrations. These metals were iron, lead, mercury, silver, arsenic, cadmium, copper, and zinc. Only arsenic was detected above the EPA Region III screening level.

4.2.2 Site 54 – Building 101 Mercury Contamination

During the SI sampling conducted in August 1992, the carpeted basement floor in Building 101 appeared to be stained in the northwest corner. Several ceiling tiles and the sheetrock wall also appeared stained. There were no visible mercury droplets on the horizontal surfaces sampled. Mercury vapors were monitored during the sampling process (E/A&H, 1992). There were two brief intervals when mercury vapors were as high as 0.33 mg/m^3, but no significant levels of mercury vapors were detected during the remainder of the sampling process.

Sampling was conducted to determine if select horizontal surfaces, bulk building materials, and the concrete floor had been contaminated by mercury spills and release. A summary of the sampling and analysis conducted during the SI Study is provided in Table 4-3. Sampling results are shown in Table 4-4.

Five wipe samples, five bulk materials samples, and five concrete samples collected from the basement floor were used to characterize this site (E/A&H, 1994).

The mercury concentrations detected from wipe tests ranged from 0.53 to 75.4 μg/100 cm^2 (E/A&H, 1994). The overall range of mercury concentrations detected in the bulk materials samples was 0.45 to 776 mg/kg. The highest reported level of mercury for wipe and bulk material samples was detected in samples collected adjacent to one another. This suggests a local "hot spot" (E/A&H, 1994).

The range of mercury detected in concrete samples was from 0.21 mg/kg to 0.59 mg/kg, with an average concentration of approximately 0.46 mg/kg. No nitrate esters were detected in concrete samples (E/A&H, 1994).

According to the 1994 SI (E/A&H, 1994), this area should remain closed to personnel. Non-impervious materials (metal pipes and other metal materials only) could possibly be decontaminated and reused. Other porous building materials (ceiling tiles, sheet rock, floor tile, etc.) will likely require removal and disposal.

4.2.3 Site 55 – Building 102

Sampling was conducted to determine if selected horizontal surfaces, bulk building materials, and the concrete floor have been contaminated by mercury spills and releases. A summary of the sampling and analyses performed during the SI is provided in Table 4-5. Sampling results are shown in Table 4-6.

TABLE 4-3

PREVIOUS INVESTIGATION
SITE 54 - Building 101: Mercury Contamination
INDIAN HEAD, MARYLAND

Sample Media:	Horizontal surfaces, building materials, concrete floor			
Sampling Performed:	**Type**	**Number**	**Sample/Location**	**Total**
	Wipe (horizontal surfaces)	5	1	5
	Bulk building materials	5	1	5
	Concrete	5	1	5
Analyses Performed:	**Media**	**Analyses**		
	Wipe (horizontal surfaces)	Mercury		
	Building materials	Mercury		
	Concrete	Mercury, Nitrate Esters		

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

TABLE 4-4

PREVIOUS INVESTIGATION
Site 54 - Building 101 Mercury Contamination
INDIAN HEAD, MARYLAND

Sampling Location	Mercury ug/100 cm2	Mercury mg/kg	Nitrate Esters ug/g
Wipe Samples			
On conduit above ceiling tile in NE corner.	8.60	N/A	N/A
On drainage pipe above ceiling tile in NE corner.	3.00	N/A	N/A
Top right corner of air conditioner, east wall.	75.40	N/A	N/A
On water line at east wall.	0.53	N/A	N/A
Steam pipe above ceiling, 10 feet from east wall at northcentral section of room.	14.10	N/A	N/A
Bulk Samples			
Ceiling tile, above air conditioner at east wall.	N/A	776.00	N/A
Pipe insulation, steam pipe above air conditioner at east wall.	N/A	0.45	N/A
Floor tile, near the center of the east wall, at corner of load column and east wall.	N/A	3.50	N/A
Pipe mortar, steam pipe elbow on 6-inch steam pipe at east wall.	N/A	2.10	N/A
Sheet rock, 10 feet from air conditioner, top of north wall.	N/A	5.80	N/A
Concrete Samples			
Corner 1.5 feet from east wall.	N/A	BDL	BDL
Near the center of the area between the north wall and the load column.	N/A	0.59	BDL
At drain pipe, north wall.	N/A	0.38	BDL
Corner at east wall and load column, below air conditioner.	N/A	0.56	BDL
Directly between first two concrete samples.	N/A	0.21	BDL

BDL - Below detection limits

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

TABLE 4-5

PREVIOUS INVESTIGATION
SITE 55 - Building 102
INDIAN HEAD, MARYLAND

Sample Media:	Horizontal surfaces, building materials, concrete floor			
Sampling Performed:	**Type**	**Number**	**Sample/Location**	**Total**
	Wipe (horizontal surfaces)	5	1	5
	Bulk building materials	5	1	5
	Concrete	5	1	5
Analyses Performed:	**Media**	**Analyses**		
	Wipe (horizontal surfaces)	Mercury		
	Building materials	Mercury		
	Concrete	Mercury, Nitrate Esters		

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

TABLE 4-6

PREVIOUS INVESTIGATION
Site 55 - Building 102
INDIAN HEAD, MARYLAND

Sampling Location	Mercury ug/100 cm2	Mercury mg/kg	Nitrate Esters ug/g
Wipe Samples			
Room 2, floor tile surface, halfway between the sink and the west wall, 2 feet from divider wall.	4.2 4.6	N/A	N/A
Room 2, steam pipe surface at divider wall above ceiling.	368.00	N/A	N/A
Room 2, conduit surface at divider wall, near towel dispenser.	0.44	N/A	N/A
Room 1, copper water line surface at east wall.	1.30	N/A	N/A
Room 2, floor tile surface 8 feet from divider wall by air conditioner.	0.10	N/A	N/A
Bulk Samples			
Room 2, sheet rock, top center of divider wall, above sink.	N/A	29.6 19.1	N/A
Room 2, floor tile, center of divider wall, below sink.	N/A	30.40	N/A
Room 1, ceiling tile, at intersection of divider wall and copper water pipe.	N/A	4.60	N/A
Room 2, pipe insulation, steam pipe at divider wall.	N/A	BDL	N/A
Room 2, ceiling tile, near center of room next to second sprinkler from divider wall.	N/A	0.16	N/A
Concrete Samples			
Room 2, left of doorway between rooms 1 & 2, next to divider wall, under former sink location.	N/A	4.4 35.2	HMX 1.940C 2.580C
Room 2, 1 foot left of above sample, along divider wall.	N/A	21.40	HMX 3.830C
Room 2, next to divider wall, at corner of divider wall and west wall.	N/A	86.80	BDL
Room 1, at center of divider wall, at wall.	N/A	7.90	BDL
Room 2, below air conditioner.	N/A	2.50	BDL

BDL - Below detection limits

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

A wide range of mercury concentrations was detected in the wipe samples: 0.10 to 368 μg/100 cm^2 (E/A&H, 1994). Analytical results of one of the wipe samples suggests a local "hot spot" where mercury was indicated at 368 μg/100 cm^2.

Mercury concentrations detected in the bulk material samples ranged from 0.16 to 30.4 mg/kg (E/A&H, 1994).

The range of mercury concentrations detected in the concrete samples was from 2.5 mg/kg to 86.8 mg/kg (E/A&H, 1994).

The nitrate ester compound, HMX, was detected in three of the concrete samples.

According to the 1994 SI (E/A&H, 1994), Building 102 should remain closed to area personnel. Further investigation should include collection of bulk materials samples from all building materials (E/A&H, 1994). Non-impervious materials (metal pipes and other metal materials only) could possibly be decontaminated and reused. Other porous building materials (ceiling tiles, sheet rock, floor tile, etc.) likely will require removal and disposal.

4.2.4 Other Buildings

Limited unvalidated analytical data are available for Buildings 102, 108, and 444 as described in Section 4.1.4. There is no known existing data available for the other buildings in the lab area.

4.3 Human Health Risk Assessment

A human health risk assessment for Sites 50, 54, and 55 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance with Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate whether site concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Sites 50, 54, and 55 human health risk assessment including the screening methods for determination of COPCs and the exposure scenarios to be evaluated.

Site 50 (Building 103 Crawl Space), Site 54 (Building 101), and Site 55 (Building 102) are located in the laboratory area of the northeast part of the IHDIV-NSWC. Based on the location of these sites, it is not anticipated that they will be used for residential development in the future. However, Navy policy is to evaluate a hypothetical conservative scenario of future residential use. Therefore, the Region III soil RBCs for the resident will be used for screening the surface soil data. The sediment samples collected from the wetlands area to the southeast of the lab area will be screened against ten times the residential soil RBC. The surface water samples collected from the wetlands area to the southeast of the lab area will be screened against ten times the tap water RBC. The constituents with maximum detected concentrations exceeding the screening value will be retained as COPCs and will be evaluated quantitatively in the risk assessment.

Table 4-7 summarizes the potential receptors that will be evaluated in the human health risk assessment. The trespasser adult and adolescent are included in the evaluation because although the site is posted to restrict access, and is partially fenced, the fence is not

continuous along the river and people could access the site. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years.

4.4 Ecological Risk Assessment – Screening Level Problem Formulation

The section presents the first step in assessing the potential ecological risks associated with site-related chemicals present in the surface soil, sediment, and surface water within the Laboratory Area. In addition to grass and trees of the maintained areas around the laboratory buildings, there is a small emergent wetland that receives local runoff and blow-off water from the steam system.

The assessment is conducted following the Navy-Tier II ecological risk assessment (ERA) approach for Region III, which is based on the process described in the USEPA guidance document *Process for Designing and Conducting Ecological Risk Assessments* (USEPA 1997) and Navy ERA guidance (CNO 1999). This section of the work plan presents Step 1 of the 8-step ERA process. Step 1 (screening-level problem formulation) involves: (1) compiling and reviewing existing data on the nature and extent of contamination and on the habitats and biota potentially present on the site; (2) developing a preliminary conceptual model that includes a qualitative evaluation of potential sources, fate and transport mechanisms, mechanisms of toxicity, potential receptors, and exposure pathways; and (3) developing preliminary assessment endpoints, measurement endpoints, and risk questions.

The two major products of the screening-level problem formulation are the preliminary conceptual model and the preliminary endpoints/hypotheses. The preliminary conceptual model provides the basic framework for the screening ERA and will be revised, as appropriate, during any of the subsequent risk assessment steps. Further details on the ERA process and the screening-level problem formulation can be found in Section 4 of the Master Work Plan.

The general objectives of a screening ERA are: (1) to screen individual sites to determine if additional ecological risk assessment is warranted (beyond Steps 1 and 2); and (2) to identify any data gaps that may require the collection of additional data. The screening-level problem formulation (Step 1) is intended to answer two main questions: (1) do complete exposure pathways exist at the site?; and if so (2) are sufficient data available to conduct Step 2 of the screening ERA?

4.4.1 Environmental Setting

The Laboratory Area covers about 14 acres. The majority of the area is maintained, containing grass and trees (oaks are common). A small emergent wetland (<0.5 acres) with cattails, rushes, and several trees receives local runoff and blow-off water from the steam system. It appears that the blow-off from the steam system is an important source of water, responsible for artificially supporting part of the wetland. Precipitation also plays an important role in the hydrology of the wetland.

TABLE 4-7
POTENTIAL EXPOSURE PATHWAYS
SITES 50, 54, and 55 - MERCURY CONTAMINATED SURFACE SOIL IN LABORATORY AREA
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current/Future					Future		
		Industrial Worker	Trespasser/Visitor		Recreational User		Resident		Construction Worker
			Adult	Adolescent	Adult	Child	Adult	Child	
Surface Soil									
	Ingestion	X	X	X			X	X	X
	Dermal	X	X	X			X	X	X
	Inhalation	X	X	X			X	X	X
Sediment									
	Ingestion				X	X			
	Dermal				X	X			
	Inhalation								
Surface Water									
	Ingestion				X	X			
	Dermal				X	X			
	Inhalation				X	X			

X Quantitative evaluation.

The wetland is bisected northeast to southwest by a small channel and northwest to southeast by a walkway. A culvert carries water under the walkway. The channel, which originates in the wetland, is the only area of the wetland with significant standing water. During a September 23, 1999 site visit by a CH2M HILL ecologist, most of the channel was 1 to 2 feet wide with a few inches of water. The channel is widest (3 to 4 feet) and deepest (4 to 5 inches) near the culvert. In some locations, the channel banks flatten out and the water moves through multiple secondary channels. Water was not flowing in the channel during the site visit.

The channel supports insects, other invertebrates, and amphibian larvae, but not fish. Adult frogs were observed during the site visit. Overflow from the wetland area drains into the storm drain system. At the northern end of the wetland, there are sloped areas vegetated with grass that is not mowed on a frequent basis.

4.4.2 Summary of Available Analytical Data

Analytical data for the soil in the Laboratory Area are discussed in previous sections. No chemical data have been collected from the emergent wetland. As it was used extensively in the Laboratory Area, mercury is one of the focal contaminants that will be evaluated in the ecological risk assessment.

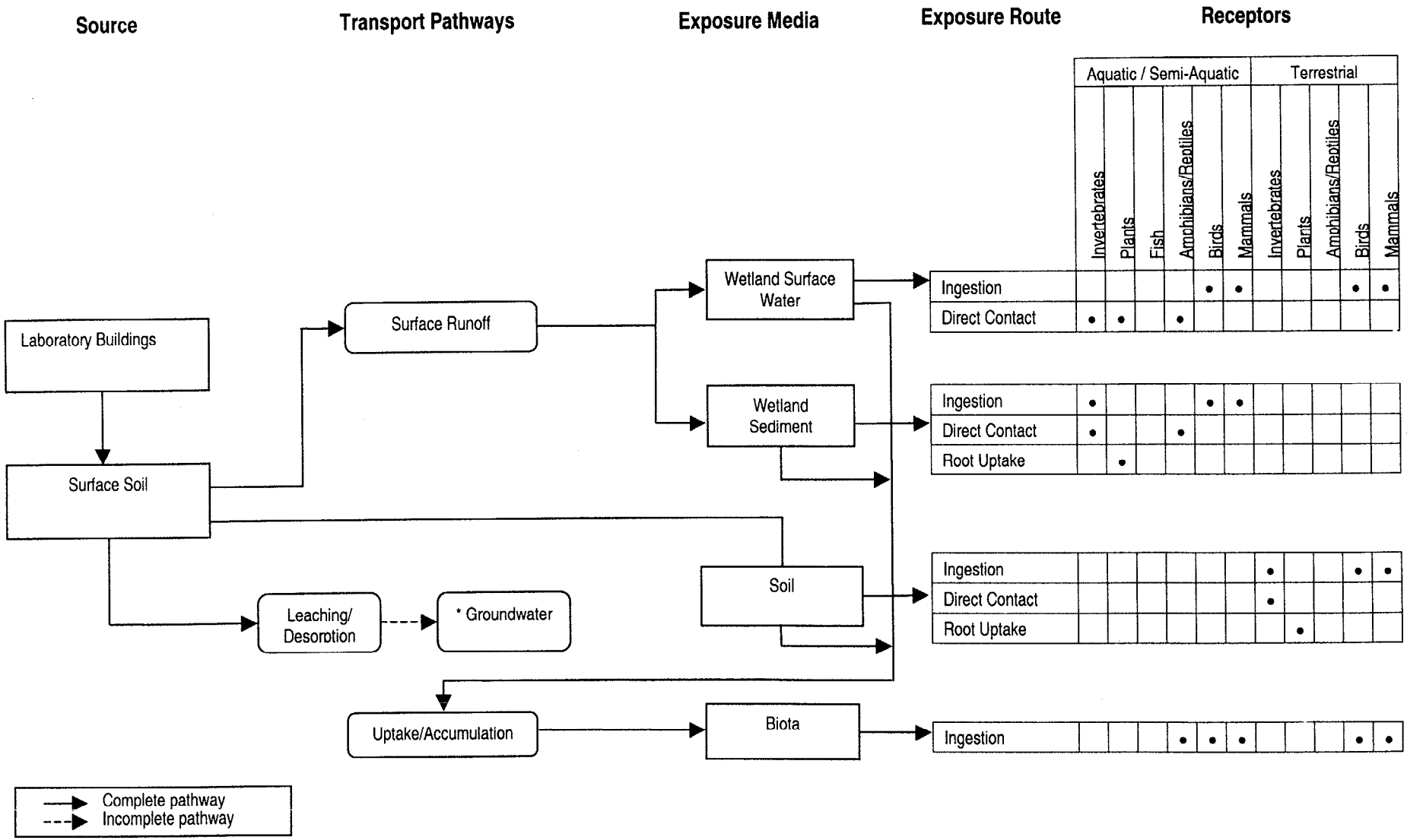
4.4.3 Preliminary Conceptual Model

Figure 4-2 illustrates the preliminary conceptual model for the Laboratory Area. Important components of the preliminary conceptual model are the identification of potential sources of contaminants, transport pathways, exposure media, potential exposure routes, and potential receptor groups.

Exposure Pathways. An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure route. For the Laboratory Area, the source of contamination is historic disposal of laboratory waste in the vicinity of the laboratory buildings. Once disposed on the ground, contaminants could be transported via runoff to other areas of the site or to the emergent wetland which is situated downgradient of the laboratory buildings. Receptors may include terrestrial species that have contact with the soil (e.g., plants, soil invertebrates, American robin, white-footed mouse) or consume organisms that have direct contact with the soil (e.g., red fox, red-tailed hawk), semi-aquatic species that forage in upland and wetland areas (e.g., raccoon), and aquatic/wetland species (e.g., plants, frogs, and benthic invertebrates) present in the wetland.

Groundwater discharge into the wetland is not likely to be an important transport pathway. Depth to groundwater is greater than 30 feet. Because it is so deep, it is unlikely that contaminants would leach to the water table. Contaminants disposed of on-site could enter the storm drain system. From that point, they could eventually reach Mattawoman Creek.

FIGURE 4-2
PRELIMINARY CONCEPTUAL MODEL LABORATORY BUILDINGS



* Depth to groundwater is greater than 30 feet at the Laboratory

Endpoints and Risk Hypotheses. The conclusion of the screening-level problem formulation includes the selection of ecological endpoints. Table 4-8 presents the preliminary assessment endpoints, reasons for their selection, risk questions, surrogate organisms (i.e., organisms that will be used to represent the assessment endpoint), and measurement endpoints.

4.4.4 Conclusion

Potentially complete exposure pathways exist and the assessment should continue to Step 2. As available data are insufficient to prepare screening-level risk calculations, a sampling program has been proposed (see Sections 4 5.2 and 4.5.3).

4.5 Work Plan

4.5.1 Surface Soil

The only surface soil samples collected as part of the SI in the lab area were located in the crawl space of Building 103 (Site 50). These were collected in the vicinity of known sink drain outlets and drainage features beneath the building, but no samples were taken on the ground surface outside of the building. The detection of contamination within the crawl space and the nature of the drainage paths under and outside of Building 103 warrants the sampling of the surface soil around the building.

Previous sampling at Buildings 101 and 102 was limited to the structures themselves. However, it is outside the scope of the IR program to remediate structures. Therefore, sampling in the lab area will focus on these and other buildings as sources of contamination in the surface soil. Contaminants may have been transported by runoff from crawl spaces, spills, or inappropriate disposal practices.

An estimated 78 surface soil samples will be collected in the lab area and submitted for analysis by a contract laboratory (see Figure 4-3). Of these, 64 samples will be collected from areas adjacent to each of the buildings in the lab area. These samples will be biased to locations of doorways, drain outlets, and topographic drainage features where contaminants may have been disposed of, drained into, or accumulated. Six samples will be collected in the general area between the southern boundary of the buildings and the northern edge of the wetlands area (numbers 65 – 70 on Figure 4-3). Another 6 samples will be available to be

Table 4-8
Assessment and Measurement Endpoints for the Laboratory Area

Assessment Endpoint	Reason for Selection	Risk Question	Surrogate Organism	Measurement Endpoint
Survival and reproduction of benthic invertebrate communities	Benthic invertebrates decompose organic matter and are an important prey base for many other organisms	Are chemicals in surface water and/or sediment causing a reduction in the survival and/or reproduction of the benthic invertebrate community?	Benthic Invertebrates	Comparison of the ratio of maximum medium-specific site concentrations and ecological screening values for benthic invertebrates to a reference hazard quotient of 1.
Survival and reproduction of aquatic/wetland plant community	Aquatic/wetland plants provide cover and are a food source for many animals	Are chemicals in surface water and/or sediment causing a reduction in the survival and/or reproduction of the aquatic/wetland plant community?	Aquatic/Wetland Plants	Comparison of the ratio of maximum chemical concentrations in surface water and/or sediment and medium-specific screening values to a reference hazard quotient of 1.
Survival and reproduction of amphibian community	Aquatic habitat on the site supports the development of larval amphibians.	Are chemicals in surface water and/or sediment causing a reduction in the survival and/or reproduction of the amphibian community?	Amphibians	Comparison of the ratio of maximum chemical concentrations in surface water and/or sediment and medium-specific screening values to a reference hazard quotient of 1.
Survival and reproduction of soil invertebrate communities	Soil invertebrates play an important role in the processing of organic matter and serve as a prey base for higher order animals.	Are chemicals in soil causing a reduction in the survival and/or reproduction of the soil invertebrate community?	Soil Invertebrates (primarily earthworms)	Comparison of the ratio of maximum soil concentrations and soil screening values to a reference hazard quotient of 1.
Survival and reproduction of terrestrial plant communities	Terrestrial plants provided cover, nesting sites, and food to a variety of animals.	Are chemicals in soil causing a reduction in the survival and/or reproduction of the terrestrial plant community?	Terrestrial plants	Comparison of the ratio of maximum soil concentrations and soil screening values to a reference hazard quotient of 1.

Table 4-8
Assessment and Measurement Endpoints for the Laboratory Area

Assessment Endpoint	Reason for Selection	Risk Question	Surrogate Organism	Measurement Endpoint
Survival and reproduction of avian vermivores	Avian vermivores are second order consumers that may be highly exposed to chemicals that biomagnify. They may also be at greater risk due to their small body size, high metabolic rate, and contact with soils.	Are chemicals in prey causing a reduction in the survival and/or reproduction of avian vermivores?	American robin	Comparison of the ratio of maximum exposure dose and reference toxicity value to a reference hazard quotient of 1.
Survival and reproduction of semi-aquatic omnivores	Semi-aquatic omnivores often have significant contact with sediment while foraging.	Are chemicals in food, sediment, soil, or surface water causing a reduction in the survival and/or reproduction of semi-aquatic omnivores?	Raccoon	Comparison of the ratio of maximum exposure dose and reference toxicity value to a reference hazard quotient of 1.
Survival and reproduction of terrestrial, mammalian carnivores	Terrestrial, mammalian carnivores are second or third order consumers that may be highly exposed to contaminants that biomagnify.	Are chemicals in food, sediment, soil, or surface water causing a reduction in the survival and/or reproduction of terrestrial, mammalian carnivores?	Red Fox	Comparison of the ratio of maximum exposure dose and reference toxicity value to a reference hazard quotient of 1.
Survival and reproduction of avian terrestrial carnivores	Avian terrestrial carnivores are top-level predators. They may be highly exposed to contaminants that biomagnify through the food chain.	Are chemicals in prey causing a reduction in the survival and/or reproduction of avian terrestrial carnivores?	Red-tailed Hawk	Comparison of the ratio of maximum exposure dose and reference toxicity value to a reference hazard quotient of 1.
Survival and reproduction of terrestrial omnivores	Many terrestrial omnivores are a prey base for top level predators.	Are chemicals in prey causing a reduction in the survival and/or reproduction of semi-aquatic omnivores?	White-footed mouse	Comparison of the ratio of maximum exposure dose and reference toxicity value to a reference hazard quotient of 1.

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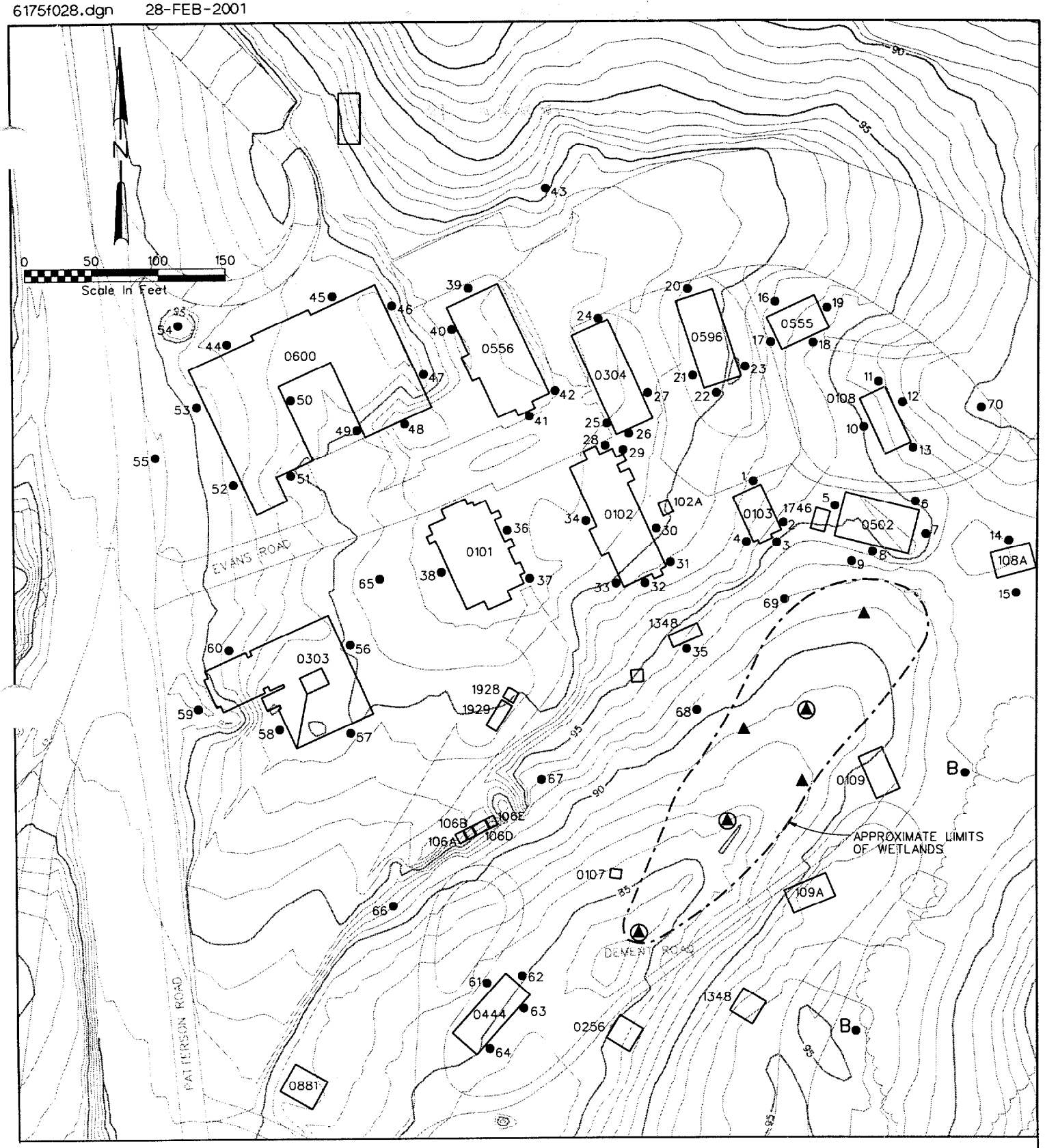

LEGEND

- ● PROPOSED SURFACE SOIL SAMPLE LOCATION
- B BACKGROUND SURFACE SOIL SAMPLE LOCATION
- ▲ SEDIMENT SAMPLE LOCATION
- SEDIMENT AND SURFACE WATER SAMPLE LOCATION

NOTES:
1. REFER TO TABLE 4-8 FOR FULL SAMPLE ID'S AND EXACT LOCATIONS.
2. UP TO SIX ADDITIONAL SAMPLES TO BE LOCATED AT FIELD TEAM'S DISCRETION NOT SHOWN ON FIGURE.

Figure 4-3
LAB AREA PROPOSED
SURFACE SOIL SAMPLE LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

used by the field team at their discretion in areas of distressed vegetation or ponding water (water other than the wetlands area). Finally, two surface soil samples will be collected near the woods uphill from Buildings 109 and 109A to be used as background samples. The samples will be collected from a depth of 0 to 6 inches using clean disposable stainless steel trowels to transfer the soil to the sampling containers. Tables 4-9, 4-10, and 4-11 describe the sampling and analysis program, bottleware, preservation, and holding time requirements.

All soil samples will be analyzed for TAL inorganics and explosives (including PETN, nitroglycerine, and nitroguanidine) by a contract laboratory. Seventeen samples (about 20 percent) also will be analyzed for TCL VOCs , and TCL SVOCs. Up to 10 samples will be selected for analysis of TOC and pH. The ten samples will be spread throughout the site, covering all the major soil types.

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates, will be analyzed in addition to laboratory QA/QC samples, including matrix spike and matrix spike duplicate samples (MS/MSDs). Analysis of the soil samples will be performed in accordance with the Navy guidance for Level D.

4.5.2 Sediment

Six sediment samples will be collected from the wetlands area to the southeast of the lab area (see Figure 4-3). The samples will be collected using sampling scoops, using CH2M HILL standard sampling procedures. Tables 4-9 through 4-11 describe the sampling and analysis program, bottleware, preservation, and holding time requirements.

The sediment samples will be analyzed for TAL inorganics, ammonium perchlorate, explosives (including PETN, nitroglycerine, and nitroguanidine), TOC, and pH by a contract laboratory. Two samples also will be analyzed for TCL SVOCs. The same two samples, one collected within the channel and one outside of the channel, will be analyzed for grain size (sieve).

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates, will be analyzed in addition to laboratory QA/QC samples, including matrix spike and matrix spike duplicate samples (MS/MSDs). Analysis of the sediment samples will be performed in accordance with the Navy guidance for Level D.

4.5.3 Surface Water

Surface water samples will be collected at three of the sediment sample locations in the wetlands area as shown on Figure 4-3. Tables 4-9 through 4-11 describe the sampling and analysis program, bottleware, preservation, and holding time requirements.

The surface water samples will be analyzed for TAL inorganics (dissolved and total), ammonium perchlorate, explosives (PETN, nitroglycerine, and nitroguanidine), and hardness by a contract laboratory. One sample will also be analyzed for TCL SVOCs.

In the field, surface water at the same locations will be analyzed for salinity, pH, conductivity, and dissolved oxygen. Depth of water and flow rate will also be measured and notes will be taken on the physical character of the wetland (e.g., depth, width, bank type, surrounding vegetation, sediment type).

TABLE 4-9

SITE SPECIFIC WORK PLAN
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis
Surface Soil	Lab Area - Sites 15, 16, 50, 53, 54, 55, Buildings 556, 304, 596, 555, 303, 101, 102, 108, 108A, 444	Determine extent of surface soil mercury contamination throughout the Lab Area.	Collect surface soil samples using stainless steel trowels.	Throughout the Lab Area. See Figure 4-3.	78	TAL inorganics, and explosives. 17 samples will also be analyzed for TCL VOCs, and TCL SVOCs. 10 samples will also be analyzed for TOC and pH.
Sediment	Wetlands Area	Determine whether sediment collected in wetlands area is contaminated.	Collect sediment samples from wetlands area using a scoop.	Wetlands Area. See Figure 4-3.	6	TAL inorganics, ammonium perchlorate, and explosives. Two samples will also be analyzed for TCL SVOCs and grain size.
Surface Water	Wetlands Area	Determine whether surface water collected in wetlands area is contaminated.	Collect surface water samples using CH2M HILL standard operating procedure.	Wetlands Area. See Figure 4-3.	3	TAL inorganics, ammonium perchlorate, explosives, and hardness. One sample will also be analyzed for TCL SVOCs.

TABLE 4-10
SUMMARY OF SAMPLING PROGRAM
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Sample Media	Sample ID Number	Sample Depth/Location	Analysis								
			TCL VOCs	TCL SVOCs	TAL Inorganics	Explosives	Ammonium Perchlorate	TOC	pH	Hardness	Grain Size
Surface Soil	IS53SS010001	Bldg 103: outside door on north side*	X	X	X	X		X	X		
	IS53SS020001	Bldg 103: off SE corner*			X	X					
	IS53SS030001	Bldg 103: outside door on south side*			X	X					
	IS53SS040001	Bldg 103: off SW corner*			X	X					
	IS53SS050001	Bldg 502: outside doors on west side*	X	X	X	X					
	IS53SS060001	Bldg 502: off NE corner*			X	X					
	IS53SS070001	Bldg 502: outside doors on east side*			X	X					
	IS53SS080001	Bldg 502: off south side*			X	X					
	IS53SS090001	Bldg 502: off south side in wet area*			X	X					
	IS53SS100001	Bldg 108: outside door on west side*	X	X	X	X		X	X		
	IS53SS110001	Bldg 108: off NE corner*			X	X					
	IS53SS120001	Bldg 108: between crawl space doors on east side*			X	X					
	IS53SS130001	Bldg 108: off SE corner*			X	X					
	IS53SS140001	Bldg 108A: outside door on north side*	X	X	X	X					
	IS53SS150001	Bldg 108A: at 4" cast iron pipe outlet on south side*			X	X					
	IS53SS160001	Bldg 555: outside door on north side*	X	X	X	X		X	X		
	IS53SS170001	Bldg 555: outside door on west side*			X	X					
	IS53SS180001	Bldg 555: outside door on south side*			X	X					
	IS53SS190001	Bldg 555: outside door on east side*			X	X					
	IS53SS200001	Bldg 596: outside door on north side*	X	X	X	X					
	IS53SS210001	Bldg 596: off SW corner*			X	X					
	IS53SS220001	Bldg 596: outside door on south side*			X	X					
	IS53SS230001	Bldg 596: off SE corner by drain outlet*			X	X					
	IS53SS240001	Bldg 304: outside door on north side*	X	X	X	X		X	X		
	IS53SS250001	Bldg 304: off SW side*			X	X					
	IS53SS260001	Bldg 304: off SW side of patio*			X	X					
	IS53SS270001	Bldg 304: off SE side*			X	X					
	IS53SS280001	Bldg 102: outside door on north side*	X	X	X	X					
	IS53SS290001	Bldg 102: outside door on NE corner*			X	X					
	IS53SS300001	Bldg 102: off SE side by A/C equip.*			X	X					
	IS53SS310001	Bldg 102: off SE corner*			X	X					
	IS53SS320001	Bldg 102: outside door on south side*			X	X					
	IS53SS330001	Bldg 102: off SW corner*			X	X					
	IS53SS340001	Bldg 102: off west side between door and drain outlets*			X	X					
	IS53SS350001	Bldg 1348: off south side*	X	X	X	X		X	X		
	IS53SS360001	Bldg 101: outside door on NE corner*	X	X	X	X					
	IS53SS370001	Bldg 101: outside door on SE corner*			X	X					
	IS53SS380001	Bldg 101: off west side*			X	X					

TABLE 4-10
SUMMARY OF SAMPLING PROGRAM
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Sample Media	Sample ID Number	Sample Depth/Location	Analysis								
			TCL VOCs	TCL SVOCs	TAL Inorganics	Explosives	Ammonium Perchlorate	TOC	pH	Hardness	Grain Size
Surface Soil	IS53SS390001	Bldg 556: outside door on north side*	X	X	X	X		X	X		
	IS53SS400001	Bldg 556: off NW side by drain outlet*			X	X					
	IS53SS410001	Bldg 556: outside door on south side*			X	X					
	IS53SS420001	Bldg 556: off SE corner in drainage swale*			X	X					
	IS53SS430001	Bldg 556: at drain outlet across street to the north*			X	X					
	IS53SS440001	Bldg 600: outside door on north side*	X	X	X	X					
	IS53SS450001	Bldg 600: outside door on north side*			X	X					
	IS53SS460001	Bldg 600: in drainage swale on east side*			X	X					
	IS53SS470001	Bldg 600: in drainage swale on east side*			X	X					
	IS53SS480001	Bldg 600: outside door on south side*			X	X					
	IS53SS490001	Bldg 600: outside door off concrete*	X	X	X	X		X	X		
	IS53SS500001	Bldg 600: next to stairwell in grass*			X	X					
	IS53SS510001	Bldg 600: outside door on south side*			X	X					
	IS53SS520001	Bldg 600: off SW side*			X	X					
	IS53SS530001	Bldg 600: off NW side*			X	X					
	IS53SS540001	Bldg 600: in pond sediment*			X	X					
	IS53SS550001	Bldg 600: in storm sewer grate sediment*			X	X					
	IS53SS560001	Bldg 303: between door and drain outlet on east side*	X	X	X	X					
	IS53SS570001	Bldg 303: off south side*			X	X					
	IS53SS580001	Bldg 303: off west side*			X	X					
	IS53SS590001	Bldg 303: in storm sewer grate sediment*			X	X					
	IS53SS600001	Bldg 303: off NE side*			X	X					
	IS53SS610001	Bldg 444: outside door on NW side*	X	X	X	X					
	IS53SS620001	Bldg 444: near drain outlets on NE side*			X	X		X	X		
	IS53SS630001	Bldg 444: outside door on SE side*			X	X					
	IS53SS640001	Bldg 444: outside door on SE side*			X	X					
	IS53SS650001	Between lab area bldgs and wetlands*	X	X	X	X					
	IS53SS660001	Between lab area bldgs and wetlands*			X	X					
	IS53SS670001	Between lab area bldgs and wetlands*			X	X					
	IS53SS680001	Between lab area bldgs and wetlands*			X	X					
	IS53SS690001	Between lab area bldgs and wetlands*			X	X					
	IS53SS700001	Between lab area bldgs and wetlands*			X	X					
	IS53SS710001	Located at field team's discretion	X	X	X	X		X	X		
	IS53SS720001	Located at field team's discretion			X	X					
	IS53SS730001	Located at field team's discretion			X	X					
	IS53SS740001	Located at field team's discretion			X	X					
	IS53SS750001	Located at field team's discretion			X	X					
	IS53SS760001	Located at field team's discretion			X	X					
	IS53SS770001	Background sample*			X	X					
	IS53SS780001	Background sample*			X	X		X	X		
Sediment	IS53SD14*BDED*	Wetlands Area		X	X	X	X	X	X		X
	IS53SD15*BDED*	Wetlands Area			X	X	X	X	X		
	IS53SD16*BDED*	Wetlands Area			X	X	X	X	X		
	IS53SD17*BDED*	Wetlands Area			X	X	X	X	X		
	IS53SD18*BDED*	Wetlands Area		X	X	X	X	X	X		X
	IS53SD19*BDED*	Wetlands Area			X	X	X	X	X		
Surface Water	IS53SW01	Wetlands Area		X	X	X	X			X	
	IS53SW02	Wetlands Area			X	X	X			X	
	IS53SW03	Wetlands Area			X	X	X			X	

* Refer to Figure 4-X for proposed surface soil, sediment, and surface water sample locations.

BDED - Refers to sample beginning depth (BD) and ending depth (ED) (for example 0405 = 4 to 5 feet below ground surface)

TABLE 4-11

BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
Lab Area - Mercury Contamination
INDIAN HEAD, MARYLAND

Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Soil	TCL VOCs - CLP OLM04.0	17	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	17	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	78	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	78	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	Total Organic Carbon (TOC)	10	1	8 oz. Glass with teflon cap	Cool to 4 degrees C	24 hours
	pH	10	1	250 ml plastic	Cool to 4 degrees C	6 months
Sediment	Grain Size	2	1	250 ml CWM glass	Cool to 4 degrees C	6 months
	TCL SVOCs - CLP OLM04.0	2	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	6	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	6	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	6	1	4 oz. glass	Cool to 4 degrees C	14 days to analysis
Surface Water	Hardness	3	1	250 ml plastic	HNO3 to pH<2; Cool to 4 degrees C	6 months
	TCL SVOCs - CLP OLM04.0	1	2	1 liter glass	Cool to 4 degrees C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	3	1	1 liter glass	Cool to 4 degrees C	14 days to analysis
	Explosives - Modified SW-846-8330*	3	1	1 liter glass	Cool to 4 degrees C	14 days to analysis
	Ammonium Perchlorate	3	1	1 liter glass	Cool to 4 degrees C	14 days to analysis

CWM - Clear Wide Mouth
* - Includes analysis for nitrate esters (nitroglycerine, nitrocellulose, nitroguanidine) and pentaerythritol tetranitrate (PETN) in Modified SW-846-8330.

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates, will be analyzed in addition to laboratory QA/QC samples, including matrix spike and matrix spike duplicate samples (MS/MSDs). Analysis of the surface water samples will be performed in accordance with the Navy guidance for Level D.

5.0 Site 49 – Chemical Disposal Pit

5.1 Background Information and Site Description

Site 49 – Chemical Disposal Pit is located in the northeast part of NSWC in the laboratory area. The site consists of a circular concrete pit, approximately 2.5 feet in diameter and 3 feet deep, northwest of building 444 as shown in Figure 5-1. The pit was designed to dispose of laboratory containers without exposing personnel to the contents. To dispose of laboratory waste in laboratory containers, the containers were placed on a steel grate in the pit. A metal plate was dropped on the containers. The fragments of shattered glass were caught in a wire basket below the steel grate, and the contents of the containers collected in the bottom of the pit and drained from the pit via a drain line to the sanitary sewer system. Reportedly, the pit received limited use until the early 1970's. The concrete pit is still structurally sound with no visible fractures. The container crushing hardware has since been removed.

According to the Supplemental Preliminary Assessment (NEESA, 1992), a drain line exits on the south side of the pit and connects the pit to the sanitary sewer manhole 473 as shown on a drawing (Bureau of Yards and Docks, Dwg. No. 670,579) in that report. This is shown in Figure 5-1. However, during a visual inspection of Site 49 in 1996, another drain line entering the pit from the north was discovered. This line may connect to sanitary sewer manhole 472, as shown on a drawing (Bureau of Yards and Docks, Dwg. No. 15,699, 1964), which was reviewed by NEESA during the Supplemental Preliminary Assessment (1992). This is also shown in Figure 5-1.

5.2 Previous Environmental Investigation

Sampling was conducted by Ensafe/Allen & Hoshall in 1994 to determine if contamination was present in the solids in the bottom of the pit or in the shallow soil zone adjacent to the pit from past disposal methods. A summary of the sampling conducted during the SI (E/A &H, 1994), is provided in Table 5-1. Sampling results are shown in Table 5-2. The sample locations and analytical results which exceed the EPA Region III RBC screening levels are provided in Figure 5-1.

Elevated levels of tetrachloroethene were detected at 90.0 µg/kg in the pit solids sample. Six semivolatile organic compounds were detected in this sample at varying concentrations.

Eight metal compounds were detected in the pit solids sample at concentrations exceeding the average background concentration for these soils (E/A & H, 1994). Mercury and cobalt were two of the compounds reported at these elevated concentrations. HMX, the only explosive derivative compound detected, was reported at 2.25 µg/g (E/A & H, 1994).

The data was compared against the EPA Region III RBC levels which indicated arsenic exceeded the screening levels in the pit solids sample and the boring sample at the 4 foot depth. Mercury also exceeded the screening levels for the pit sediment sample.

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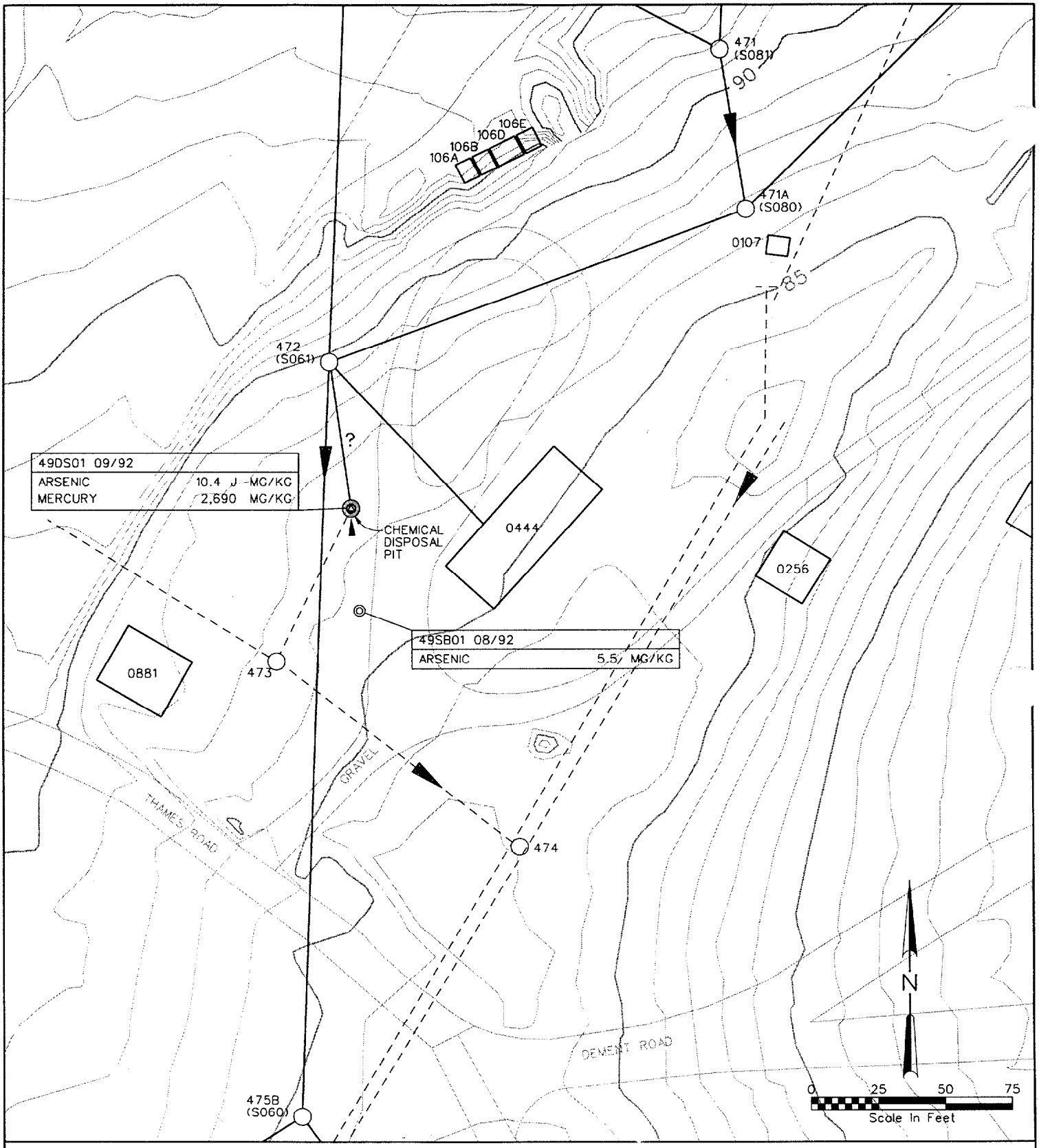

LEGEND

- ◎ SOIL BORING SAMPLE LOCATION
- ◎ SEDIMENT SAMPLE LOCATION
- ○ MANHOLE
- ? EXISTENCE OF SEWER LINE NOT CONFIRMED
- — — — STORM SEWER
- ——— SANITARY SEWER

NOTES:

1. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
2. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO. 670,579 AND 15,699.

Figure 5-1
SITE 49 - LOCATIONS OF SOIL BORING AND SEDIMENT SAMPLE AND EPA REGION III RBC EXCEEDANCES FROM E/A&H SI (1994)
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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TABLE 5-1

PREVIOUS INVESTIGATION
SITE 49 - Chemical Disposal Pit
INDIAN HEAD, MARYLAND

Sample Media:	Shallow soil zone (0-6 feet) Sediment in pit			
Sampling Performed:	**Type**	**Number**	**Sample/Location**	**Total**
	Soil boring (2', 4', & 6' depths)	1	3	3
	Sediment Sample (Surface sample)	1	1	1
Analyses Performed:	**Media**	**Analyses**		
	Soil	VOC, BNA, TAL, Nitrate Esters		
	Sediment	VOC, BNA, TAL, Nitrate Esters		

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

TABLE 5-2

PREVIOUS INVESTIGATION
SITE 49 - Chemical Disposal Pit
INDIAN HEAD, MARYLAND

Parameter	Average	Minimum	Maximum	Frequency
VOCs (ug/kg)				
Tetrachloroethene	90.00	90.00	90.00	
BNAs (ug/kg)				
Pyrene	235.00	235.00	235.00	
Fluoranthene	69.00	69.00	69.00	
Chrysene	89.50	89.50	89.50	
Benzo(a)anthracene	58.00	58.00	58.00	
Phenanthrene	78.00	78.00	78.00	
N-Nitrosodiphenylamine (1)	265.00	265.00	265.00	
TALs (mg/kg)				
Aluminum	6950.00	6950.00	6950.00	
Arsenic	10.40	10.40	10.40	
Barium	393.00	393.00	393.00	
Cadmium	4.50	4.50	4.50	
Calcium	6760.00	6760.00	6760.00	
Chromium	131.00	131.00	131.00	
Cobalt	462.00	462.00	462.00	
Copper	298.00	298.00	298.00	
Iron	23100.00	23100.00	23100.00	
Lead	110.00	110.00	110.00	
Manganese	1120.00	1120.00	1120.00	
Magnesium	938.00	938.00	938.00	
Nickel	44.50	44.50	44.50	
Potassium	507.00	507.00	507.00	
Mercury	2690.00	2690.00	2690.00	
Sodium	299.00	299.00	299.00	
Silver	16.40	16.40	16.40	
Zinc	195.00	195.00	195.00	

Note: From Site Inspection (SI) performed by Ensafe, Allen, & Hoshall (E/A&H), 1994

5.3 Human Health Risk Assessment

A human health risk assessment for Site 49 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance with Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate whether site concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 49 human health risk assessment including the screening methods for determination of COPCs and exposure scenarios to be evaluated.

Site 49, the Chemical Disposal Pit is located in the northeast part of NSWC in the laboratory area. It is not anticipated that Site 49 will be used for residential development in the future. However, Navy policy is to evaluate a hypothetical conservative scenario of future residential use. Therefore, the Region III soil RBCs for the resident will be used for screening the soil data. The sediment samples collected from chemical pit outfall locations will be screened against ten times the residential soil RBC. The constituents with maximum detected concentrations exceeding the screening value will be retained as COPCs and will be evaluated quantitatively in the risk assessment.

Table 5-3 summarizes the potential receptors that will be evaluated in the human health risk assessment. The trespasser adult and adolescent are included in the evaluation because although the site is posted to restrict access, and is partially fenced, the fence is not continuous along the river and people could access the site. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. For the future exposure scenarios, it is assumed that the current subsurface soil may be disturbed during construction activities and placed on the surface as surface soil.

5.4 Ecological Risk Assessment

Due to the proximity of Site 49 to the lab area soils discussed in Section 4 of this report, the environmental setting, summary of available analytical data, and preliminary conceptual model presented in Section 4.4 will also apply to Site 49.

5.5 Work Plan

Analytical results from the previous investigation indicate some elevated levels of mercury and arsenic above the screening levels established to address human health risk. The elevated levels were detected in a sample taken from the chemical pit sediment and a subsurface sample taken adjacent to the chemical pit area. The Navy has decided to remove the chemical disposal pit in conjunction with the next phase of the remedial investigation at the site.

The proposed scope for the field investigation is summarized in Table 5-4. Table 5-5 summarizes the sampling and analysis program, and Table 5-6 provides the sample bottleware, preservation, and holding time requirements. Location of the samples to be collected are provided on Figure 5-2.

Table 5-3
POTENTIAL EXPOSURE PATHWAYS
SITE 49 - CHEMICAL DISPOSAL PIT
INDIAN HEAD, MARYLANC

Media	Exposure Route	Current					Future							
		Industrial Worker	Trespasser/Visitor		Recreational User		Resident		Construction Worker	Industrial Worker	Trespasser/Visitor		Recreational User	
			Adult	Adolescent	Adult	Child	Adult	Child			Adult	Adolescent	Adult	Child
Surface Soil	Ingestion	X	X	X										
	Dermal	X	X	X										
	Inhalation	X	X	X										
Subsurface and Surface Soil Combined	Ingestion						X	X	X	X	X	X		
	Dermal						X	X	X	X	X	X		
	Inhalation						X	X	X	X	X	X		
Sediment	Ingestion	X*								X*				
	Dermal	X*								X*				
	Inhalation													

X Quantitative evaluation.

* Current and Future are the same.

Note:

For future scenarios, assumed subsurface soil could be accessible as surface soil, after site disturbance.

TABLE 5-4

SITE SPECIFIC WORK PLAN
Site 49 - Chemical Disposal Pit
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis
Sediment	Site 49 (in manhole outfall structure)	Determine whether discharges from the chemical disposal pit have contaminated sediments downstream.	Collect sediment samples from identified outfall.	See Figure 5-2	0 - If manhole 473 is identified as the outfall. 1 - If manhole 472 is identified as the outfall.	TCL VOCs and SVOCs, TAL inorganics, explosives, and ammonium perchlorate
Surface Soil	Site 49 (soil outside of excavated area)	Determine whether runoff from the chemical disposal pit has contaminated surrounding surface soils and whether surface soils pose any residual human health or ecological risk after pit removal.	Collect surface soil samples using hand tools outside backfilled area.	See Figure 5-2	2	TCL VOCs and SVOCs, TAL inorganics, and explosives
Subsurface Soil	Site 49 (bottom of excavation)	Determine whether additional excavation is required after removal of chemical disposal pit.	Collect subsurface soil samples in bottom of excavation after chemical disposal pit has been removed	Bottom of excavation.	1	TCL VOCs and SVOCs, TAL inorganics, and explosives
Subsurface Soil	Site 49 (adjacent to pipe leading to outfall manhole)	Determine whether additional excavation is required adjacent to pipe section, or if pipe can be abandoned in place.	Collect direct-push soil samples adjacent to pipe at manhole outfall structure.	See Figure 5-2	2	TCL VOCs and SVOCs, TAL inorganics, and explosives
Rubble	Site 49	Determine whether rubble resulting from chemical disposal pit removal is characterized as hazardous for purposes of disposal.	Collect composite sample of soil and concrete rubble.	Rolloff container of soil and rubble.	1	TCLP

TABLE 5-5

SUMMARY OF SAMPLING PROGRAM
Site 49 - Chemical Disposal Pit
INDIAN HEAD, MARYLAND

Sample Media	Sample ID Number	Sample Depth/Location	Analysis					
			TCL VOCs	TCL SVOCs	TAL Inorganics	Explosives	Ammonium Perchlorate	TCLP
Sediment	IS49SD01*BDED*	At pipe network drainage outfall*	X	X	X	X	X	
Surface Soil	IS49SS010001	0-6" deep outside area of pit removal	X	X	X	X		
	IS49SS020001	0-6" deep outside area of pit removal	X	X	X	X		
Subsurface Soil	IS49SB01*BDED*	0-6" deep in base of excavation pit	X	X	X	X		
	IS49SB02*BDED*	Adjacent to pipe and manhole outfall	X	X	X	X		
	IS49SB03*BDED*	Adjacent to pipe and manhole outfall	X	X	X	X		
Concrete/Soil Rubble	IS49CO01*BDED*	Composite from concrete/soil rubble pile						X

* Excavation will be used to locate pipe network drainage outfall

BDED - Refers to sample beginning depth (BD) and ending depth (ED) (for example 0405 = 4 to 5 feet below ground surface)

TABLE 5-6

BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
Site 49 - Chemical Disposal Pit
INDIAN HEAD, MARYLANC

Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Sediment	TCL VOCs - CLP OLM04.0	0-1**	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	0-1**	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	0-1**	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	0-1**	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	0-1**	1	4 oz. Glass	Cool to 4 degrees C	14 days to analysis
Surface Soil	TCL VOCs - CLP OLM04.0	2	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	2	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	2	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	2	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
Subsurface Soil	TCL VOCs - CLP OLM04.0	3	1	250 ml CWM glass	Cool to 4 degrees C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	3	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	3	1	250 ml CWM glass	Cool to 4 degrees C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330*	3	1	250 ml CWM glass	Cool to 4 degrees C	14 days to extract; 40 days to analysis
Concrete/Soil Rubble	TCLP (full)	1	5	1-4oz.glass (volatiles); 4-8oz. glass	Cool to 4 degrees C	7 days to extractiojn

CWM - Clear Wide Mouth

* Includes analysis for nitrate esters (nitroglycerine, nitroguanidine) and pentaerythritol tetranitrate (PETN) in Modified SW-846-8330.

** Number of sediment samples depends on whether manhole 473 is identified as the outfall (no sample) or manhole 472 is identified as the outfall (1 sample).

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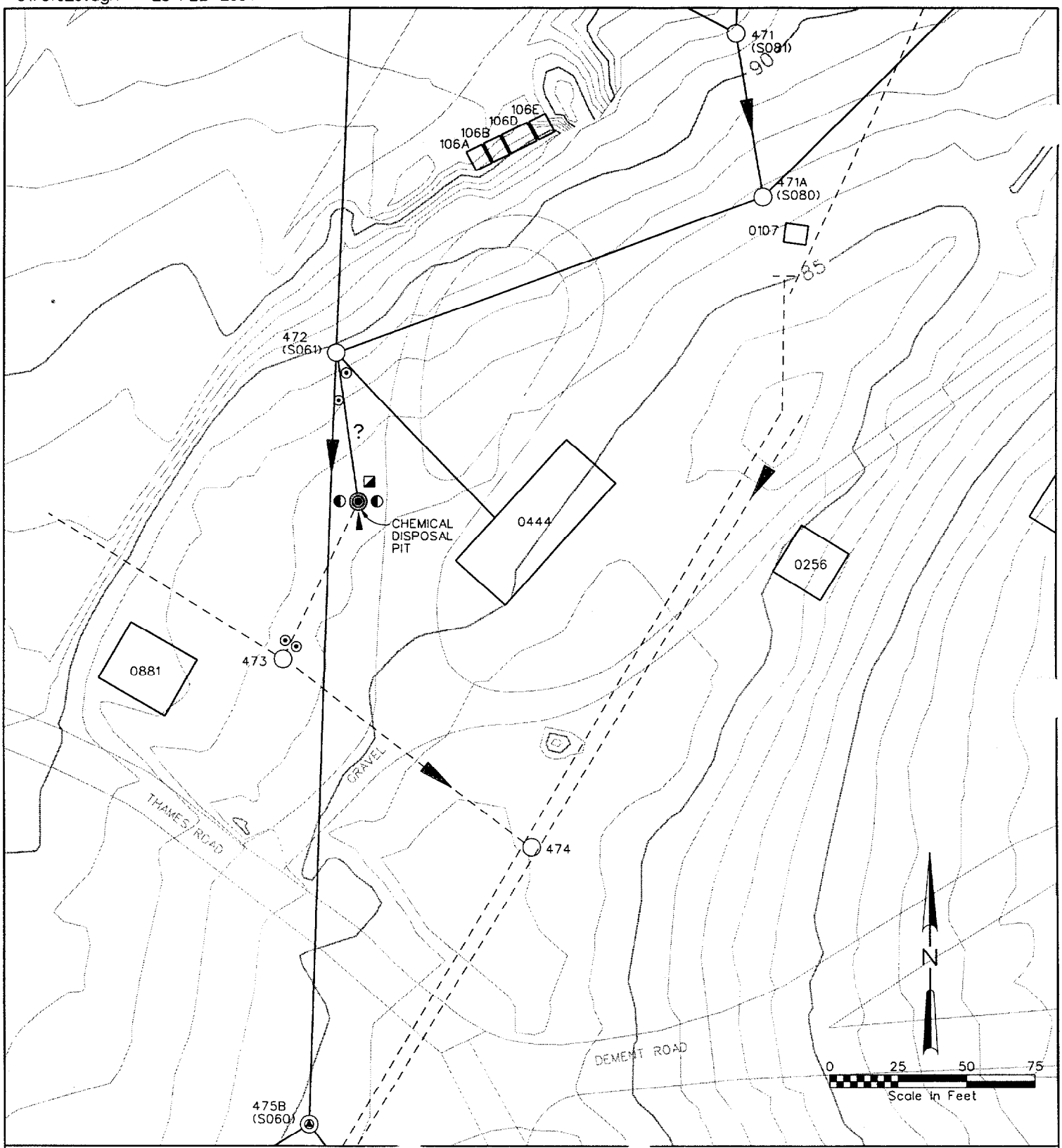


LEGEND

- PROPOSED SEDIMENT SAMPLE LOCATION
- PROPOSED SUBSURFACE SOIL SAMPLE LOCATION
- PROPOSED SURFACE SOIL SAMPLE LOCATION
- PROPOSED DIRECT-PUSH SOIL SAMPLE LOCATION
- PROPOSED CONCRETE RUBBLE SAMPLE LOCATION (TAKEN FROM RUBBLE PILE)
- ? EXISTENCE OF SEWER LINE NOT CONFIRMED
- O MANHOLE
- - - - STORM SEWER
- ——— SANITARY SEWER

NOTES:

1. REFER TO TABLE 5-4 FOR SAMPLE ID'S.
2. SEVERAL MANHOLES HAVE MULTIPLE DESIGNATIONS AS ASSIGNED IN PAST INVESTIGATIONS.
3. FIGURE DEVELOPED FROM BUREAU OF YARDS AND DOCKS, DRAWINGS NO.670,579 AND 15,699.

Figure 5-2
SITE 49 -
PROPOSED SAMPLING LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

5.5.1 Sewer Lines

Upon excavation of the chemical pit, all possible outfall areas will be identified. Of particular interest are the outfalls at manholes 472 and 473, as these have been previously identified as being potentially connected to the chemical disposal pit. The location and number of samples to be collected at Site 49 is contingent on which manholes are connected to the chemical pit.

5.5.2 Sediment

No sediment samples were taken at possible outfalls from the chemical disposal pit during the previous investigation. Sediment sampling is proposed at chemical pit outfall locations identified following the excavation of the pit structure. This sampling will determine whether discharges from the chemical disposal pit have contaminated sediments downstream.

Sediment samples will be collected from manholes in the vicinity of the chemical disposal pit to confirm the results of the SI and to define the extent of sediment contamination at Site 49. Samples will be collected from outfalls identified from review of utility drawings, and identified as a result of excavation.

If it is found that the chemical pit connects to the sanitary sewer line (manhole 472), then the sediment in manhole 475B (the next downstream manhole) will be sampled. The sediment in manhole 472 will not be sampled as part of the Site 49 sampling plan, as it is included in the sampling plan for the lab area sewers and storm drains (Section 4.0).

If it is found that the chemical pit connects to manhole 473 on the storm drain line, no additional sediment samples will be collected as both manhole 473 and 474 are included in the sampling plan for the lab area sewers and storm drains (Section 4.0).

Sediment samples will be collected from sediment within the pipes or manholes using sampling scoops attached to poles, using CH2M HILL standard sampling procedures. Sediment samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives. Explosives analysis will include nitroglycerine, nitroguanidine, PETN, and ammonium perchlorate, in addition to the analyte list for EPA Method 8330A. The appropriate number of field quality assurance/quality control (QA/QC) samples, including field blanks, rinsate blanks, and duplicates will be analyzed in addition to laboratory QA/QC samples, including matrix spike and matrix spike duplicate (MS/MSD) samples.

5.5.3 Pit Removal, Pipe Abandonment, and Subsurface Soil Sampling

CH2M HILL will oversee a subcontractor who will remove the concrete chemical disposal pit, along with approximately one foot of soil around the perimeter of the pit and one foot under the bottom. Pipes connecting the chemical disposal pit to either the sanitary sewer system or the storm sewer system will be identified and abandoned in place or removed, if warranted.

Previous sampling was conducted to evaluate subsurface soils in an area adjacent to the chemical pit only. Subsurface soils indicated arsenic as being elevated over the screening level in this area. Cracks and fissures in the chemical pit are considered potential pathways for contamination. Therefore, the soil in bottom of the chemical pit excavation will be

sampled following the chemical pit demolition and removal. This will also serve to determine whether additional excavation is required after removal of the chemical disposal pit.

A sample will be collected from the bottom of the excavation and analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives. The results will be compared to EPA Region III RBCs for industrial sites as an initial screen to determine whether further excavation is required. If industrial RBCs are exceeded, additional excavation and subsequent testing will be performed until remaining soils are below the industrial RBCs.

A single composite sample of the soil and concrete rubble removed will be collected and analyzed for TCLP to verify that it does not constitute a hazardous waste, then disposed of offsite at a permitted landfill.

Additionally, two direct-push soil samples will be collected on the upstream side of the manhole identified as the outfall from the chemical disposal pit (either manhole 472 or 473). The samples will be collected adjacent to the line connecting the chemical disposal pit to the manhole at its lowest point where it enters the manhole structure. The samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives. The results will be compared to EPA Region III RBCs for industrial sites as an initial screen to determine whether the pipe can be abandoned in place. If the industrial RBCs are not exceeded, the pipe segment between the chemical disposal pit and manhole will be abandoned in place. If the industrial RBCs are exceeded, additional sampling and subsequent testing will be performed to identify the extent of contamination along the pipe segment.

After the excavation is complete and analytical results have been received and verified, the excavation will be backfilled with clean, imported soil placed and compacted to form a stable mass. The surface of the backfilled area will be graded to match the surrounding ground surface and reseeded.

Removal of the pit, abandonment of the pipes, and transport and disposal of the excavated materials will be done by a qualified subcontractor. CH2M HILL will oversee the removal and collect confirmatory samples.

5.5.4 Surface Soil

No surface soil samples were collected in the previous investigation. Surface soil sampling is proposed in areas adjacent to the chemical pit after it has been removed and backfilled. This will determine whether runoff from the chemical disposal pit has contaminated surrounding surface soils and whether surface soils pose any residual human health or ecological risk following pit removal.

Two surface soil samples will be collected in the vicinity of the chemical disposal pit at Site 49. The soil samples will be collected outside the limits of removal, after the pit has been removed and the area backfilled. The purpose of this sampling is to define the extent of any surface soil contamination at the site and to provide data on residual risk at the site for use in human health and ecological risk assessments. Surface soil samples will be collected from a depth of 0 to 6 inches using clean disposable stainless steel trowels to transfer the soil to the sampling containers. Figure 5-2 shows proposed sample locations.

All soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives (including nitroglycerine, and nitroguanidine) by a contract laboratory.

The appropriate number of field QA/QC samples, including field blanks, rinsate blanks, and duplicates will be analyzed in addition to laboratory QA/QC samples, including MS/MSD samples.

5.5.5 Groundwater

The SI Report described the soils in the Site 49 area as stiff to hard, brown and green, silty clay with little moisture. Blow counts averaged 40 blows per foot. Hydraulic conductivity test results for these soils varied between 7.1×10^{-8} cm/sec and 1×10^{-6} cm/sec. According to the SI migration of metals deposited into these soils would be very limited. For this reason, no groundwater samples are planned for this investigation. Contaminant concentrations will be identified first in the overlying sediments and soils prior to determining if groundwater wells and groundwater samples will be necessary.

6.0 References

Brown & Root Environmental, April 1997. *Master Work Plan for Remedial Investigations at Indian Head Division,* Naval Surface Warfare Center, Indian Head, Maryland.

Brown & Root Environmental, April 1997. *Master Field Sampling Plan for Remedial Investigations at Indian Head Division,* Naval Surface Warfare Center, Indian Head, Maryland.

Brown & Root Environmental, April 1997. *Master Quality Assurance Project Plan for Remedial Investigations at Indian Head Division,* Naval Surface Warfare Center, Indian Head, Maryland.

Brown & Root Environmental, April 1997. *Health and Safety Plan Guidance Document for Remedial Investigations at Indian Head Division,* Naval Surface Warfare Center, Indian Head, Maryland.

Brown & Root Environmental, April 1997. *Standard Operating Procedures for Remedial Investigations at Indian Head Division,* Naval Surface Warfare Center, Indian Head, Maryland.

CH2M HILL, March 2000. *Draft Addendum to Master Plans for Remedial Investigations Prepared by Brown & Root Environmental,* Naval Surface Warfare Center, Indian Head Division, Indian Head, Maryland.

Chief of Naval Operations (CNO). 1999. *Navy policy for conducting ecological risk assessments.* Memorandum from Chief of Naval Operations to Commander, Naval Facilities Engineering Command. Ser N453E/9U595355. April 5, 1999.

Hart, Fred C. Associates, Inc., May 1983. *Initial Assessment Study of Naval Ordnance Station,* Indian Head, Maryland.

Kearney, A.T., Inc., August 1988. *Phase II RCRA Facility Assessment of the Naval Ordnance Station,* Indian Head, Maryland.

Maryland Department of Natural Resources (MDNR) Natural Heritage Program. 1992. *Rare, threatened and endangered species and natural area survey for the Naval Surface Warfare Center, Indian Head Division 1991 – 1992.*

Parsons Engineering Science, Inc. (Parsons). 2000. *Draft integrated natural resources management plan (DINRMP), Naval Surface Warfare Center Indian Head Division.* Draft. February 2000.

United States Department of Agriculture, Soil Conservation Service (USDA SCS). 1974. *Soil survey of Charles County, Maryland.*

U.S. Environmental Protection Agency (USEPA). 1997. *Ecological risk assessment guidance for Superfund: process for designing and conducting ecological risk assessments.* Interim Final. EPA/540/R-97/006.

Appendix A
Lists of Fauna Observed at NSWC Indian Head Division

Reptilian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Northern copperhead	*Agkistrodon contortrix*
Eastern worm snake	*Carphophis amoenus*
Snapping turtle	*Chelydra serpentina*
Eastern painted turtle	*Chrysemys picta*
Spotted turtle	*Clemmys guttata*
Black racer	*Coluber constrictor*
Ringneck snake	*Diadophis punctatus*
Black rat snake	*Elaphe obsoleta*
Five-lined skink	*Eumeces fasciatus*
Eastern hognose snake	*Heterodon platirhinos*
Eastern mud turtle	*Kinosternon subrubrum*
Eastern king snake	*Lampropeltis getula*
Northern water snake	*Nerodia sipedon*
Rough green snake	*Opheodrys aestivus*
Redbelly turtle	*Pseudemys rubiventris*
Queen snake	*Regina septemvittata*
Eastern fence lizard	*Sceloporus undulatus*
Ground skink	*Scincella lateralis*
Northern brown snake	*Storeria dekayi*
Eastern box turtle	*Terrapene caronlina*
Eastern ribbon snake	*Thamnophis sauritus*
Eastern garter snake	*Thamnophis sirtalis*
Six-lined racerunner	*Cnemidophorus sexlineatus sexlineatus*

Source: MDNR 1992; Parsons 2000.

Amphibian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Northern cricket frog	*Acris crepitans crepitans*
Southern cricket frog	*Acris gryllus*
Spotted salamander	*Ambystoma maculatum*
Marbled salamander	*Ambystoma opacum*
American toad	*Bufo americanus*
Fowler's toad	*Bufo woodhousii fowleri*
Northern dusky salamander	*Desmognathus fuscus fuscus*
Northern two-lined salamander	*Eurycea bislineata*
Four-toed salamander	*Hemidactylium scutatum*
Gray treefrog	*Hyla chrysoscelis*
Green treefrog	*Hyla cinerea*
Gray treefrog	*Hyla versicolor*
Red-backed salamander	*Plethodon cinereus*
Northern spring peeper	*Pseaudacris crucifer crucifer*
Spring peeper	*Pseudacris crucifer*
Upland chorus frog	*Pseudacris triserata feriarum*
Northern red salamander	*Pseudotriton ruber ruber*
Bullfrog	*Rana catesbeiana*
Green frog	*Rana clamitans*
Pickerel frog	*Rana palustris*
Wood frog	*Rana sylvatica*
Southern leopard frog	*Rana utricularia*

Source: MDNR 1992; Parsons 2000.

Avian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Red-winged blackbird	*Agelaius phoeniceus*
Wood duck	*Aix sponsa*
Northern pintail	*Anas acuta*
American wigeon	*Anas americana*
Northern shoveler	*Anas clypeata*
Green-winged teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
American black duck	*Anas rubripes*
Gadwall	*Anas Strepera*
Ruby-throated hummingbird	*Archilochus colubris*
Great blue heron	*Ardea herodias*
Scaup	*Aythya sp.*
Ringed-necked duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Cedar waxwing	*Bombycilla cedrorum*
Canada goose	*Branta canadensis*
Bufflehead	*Bucephala albeola*
Common goldeneye	*Bucephala clangula*
Red-tailed hawk	*Buteo jamaicensis*
Red-shouldered hawk	*Buteo lineatus*
Green-backed heron	*Butorides striatus*
Common snipe	*Capella gallinago*
Whip-poor will	*Caprimulgus vociferus*
Great egret	*Casmerodius albus*
Northern cardinal	*Cardinalis cardinalis*
American goldfinch	*Carduelis tristis*
House finch	*Carpodacus mexicanus*
Turkey vulture	*Cathartes aura*
Brown creeper	*Certhia familiaris*
Belted kingfisher	*Ceryle alcyon*
Chimney swift	*Chaetura pelagica*
Killdeer	*Charadrius vociferus*

Avian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Yellow-billed cuckoo	*Coccyzus americanus*
Common flicker	*Colaptes auratus*
Northern flicker	*Colaptes auratus*
Bobwhite quail	*Colinus virginianus*
Eastern wood peewee	*Contopus virens*
Carolina parakeet	*Conuropsis carolinensis*
American crow	*Corvus brachyrhynchos*
Fish crow	*Corvus ossifragus*
Bluejay	*Cyanocitta cristata*
Tundra swan	*Cygnus columbianus*
Yellow-rumped warbler	*Dendroica caronata*
Prairie warbler	*Dendroica discolor*
Yellow-throated warbler	*Dendroica dominica*
Yellow warbler	*Dendroica pinus*
Pileated woodpecker	*Dryocopus pileatus*
Gray catbird	*Dumetella carolinensis*
Acadian flycatcher	*Empidonax virenscens*
American kestrel	*Falco sparverius*
American Coot	*Fulica americana*
Common loon	*Gavia immer*
Common yellowthroat	*Geothlypis trichas*
Blue grosbeak	*Guiraca caerulea*
Bald eagle	*Haliaeetus leucocephalus*
Worm-eating warbler	*Helmitheros vermivorus*
Barn swallow	*Hirundo rustica*
Wood thrush	*Hylocichla mustelina*
Yellow-breasted chat	*Icteria virens*
Northern oriole	*Icterus galbula*
Orchard oriole	*Icterus spurius*
Tree sw. ow	*Iridoprocne bicolor*
Laughing gull	*Larus atricilla*
Herring gull	*Larus californicus*
Ring-billed gull	*Larus delawarenis*

Avian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Red-bellied woodpecker	*Melanerpes carolinus*
Wild turkey	*Meleagris gallopavo*
Song sparrow	*Melospiza melodia*
Common merganser	*Mergus merganser*
Hooded merganser	*Lophodytes cucullatus*
Mockingbird	*Mimus polyglotis*
Brown-headed cowbird	*Molothrus ater*
Great crested flycatcher	*Myiarchus crinitus*
Whistling swan	*Olor columbianus*
Kentucky warbler	*Oporonis formosus*
Ruddy duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
Northern parula	*Parula americana*
Tufted titmouse	*Parus bicolor*
Carolina chickadee	*Parus carolinensis*
House sparrow	*Passer domesticus*
Indigo bunting	*Passerina cyanea*
Great cormorant	*Phalacrocorax carbo*
Double-crested cormorant	*Phalacrocorax auritus*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Rufous-sided towhee	*Pililo erythrophthalmus*
Scarlet tanager	*Piranga olivacea*
Summer tanager	*Piranga rubra*
Horned grebe	*Podiceps auritus*
Pied-billed grebe	*Podilymbus podiceps*
Blue-gray gnatcatcher	*Polioptila caerulea*
Purple martin	*Progne subis*
Prothonotary warbler	*Protonotaria citrea*
Common grackle	*Quiscalus quiscula*
Ruby-crowned kinglet	*Regulus calendula*
Bank swallow	*Riparia riparia*
Eastern phoebe	*Sayornis phoebe*

Avian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Ovenbird	*Seiurus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*
Eastern bluebird	*Sialia sialis*
White breasted nuthatch	*Sitta caronlinensis*
Chipping sparrow	*Spizella passerina*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Least tern	*Sterna antillarum*
Barred owl	*Strix varia*
Eastern meadowlark	*Sturenlla magna*
European starling	*Sturnus vulgaris*
Carolina wren	*Thryothorus ludovicianus*
Brown thrasher	*Toxostoma rufum*
American robin	*Turdus migratorius*
Eastern kingbird	*Tyrannus tyrannus*
Yellow-throated vireo	*Vireo flavifrons*
White-eyed vireo	*Vireo griseus*
Red-eyed vireo	*Vireo olivaceus*
Hooded warbler	*Wilsonia citrina*
Mourning dove	*Zenaida macroura*
White-throated sparrow	*Zonotrichia albicollis*

Source: MDNR 1992; Parsons 2000.

Mammalian Species Observed at NSWC Indian Head Division

Common Name	Scientific Name
Short-tailed shrew	*Blarina brevicauda*
Beaver	*Castor canadensis*
Star-nosed mole	*Condylura cristata*
Least shrew	*Cryptotis parva*
Opossum	*Didelphis virginiana*
Southern flying squirrel	*Glaucomys volans*
Silver-haired bat	*Lasionycteris noctivagans*
Bobcat	*Lynx rufus*
Woodchuck	*Marmota monax*
Striped skunk	*Mephitis mephitis*
Meadow vole	*Microtus pennsylvanicus*
Pine vole	*Microtus pinetorum*
House mouse	*Mus musculus*
Little brown bat	*Myotis lucifugus*
White-tailed deer	*Odocoileus virginianus*
Muskrat	*Ondatra zibethicus*
White-footed mouse	*Peromyscus leucopus*
Eastern pipistrelle	*Pipistrelle subflavus*
Raccoon	*Procyon lotor*
Norway rat	*Rattus norvegicus*
Eastern mole	*Scalopus aquaticus*
Gray squirrel	*Scirus carolinensis*
Southeastern shrew	*Sorex longirostris*
Eastern cottontail	*Sylvilagus floridanus*
Eastern chipmunk	*Tamias striatus*
Gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
Meadow jumping mouse	*Zapus hudsonius*

Source: MDNR 1992; Parsons 2000.

Appendix B
Animals Sighted at the Naval Surface Warfare Center, Indian Head Division, During the 1991-1992 Rare Species Survey

Odonates Recorded from 23 May – 19 September 1992 at the Stump Neck Annex

Family	Scientific Name	Common Name*
Damselflies		
Calopterygidae – Broad-winged Damselflies		
	Calopteryx maculata	Ebony Jewelwing
Lestidae – Spreadwings		
	Lestes inequalis	Elegant Spreadwing
	Lestes rectangularis	Slender Spreadwing
	Lestes vigilax	Swamp Spreadwing
Coenagrionidae – Pond Damsels		
	Ischnura posita	Fragile Forktail
	Ischnura verticalis	Eastern Forktail
	Amphiagrion saucium	Eastern Red Damsel
	Argia fumipennis	Variable Dancer
	Argia bipunctulata	Seepage Dancer
	Chromagrion conditum	Variegated Damselfly
	Enallagma civile	Familiar Bluet
	Enallagma durum	Big Bluet
	Enallagma basidens	Double-striped Bluet
	Enallagma divagans	Turquoise Bluet
	Enallagma signatum	Orange Bluet
Dragonflies		
Aeshnidae – Darners		
	Aeshna umbrosa	Shadow Darner
	Anax junius	Common Green Darner
	Epiaeschna heros	Swamp Darner
	Nasiaeschna pentacantha	Cyrano Darner
Gomphidae – Clubtails		
	Gomphus exilis	Lancet Clubtail
Cordulegastridae – Spiketails		
	Cordulegaster bilineata	Brown Spiketail
Macromiidae – Cruisers		
	Didymops transyersa	Stream Cruiser
Cordulidae – Emeralds		
	Epitheca princeps	Prince Baskettail

Odonates Recorded from 23 May – 19 September 1992 at the Stump Neck Annex

Family	Scientific Name	Common Name*
	Epitheca cynosura	Common Baskettail
	Somatochlora linearis	Mocha Emerald
	Somatochlora filosa	Five-lined Emerald
	Somatochlora provocans	Treetop Emerald
	Somatochlora tenebrosa	Clamp-tipped Emerald
Libellulidae – Skimmers		
	Libellula lydia	Common Whitetail
	Libellula semifasciata	Painted Skimmer
	Libellula deplanata	Blue Corporal
	Libellula needhami	Needham's Skimmer
	Lebellula vibrans	Great Blue Skimmer
	Libellula incesta	Slaty Skimmer
	Libellula cyanea	Black-faced Skimmer
	Libellula flavida	Yellow-sided Skimmer
	Libellula luctuosa	Pied Skimmer
	Perithemis tenera	Amberwings
	Pachydiplax longipennis	Blue Dasher
	Erythemis simplicicollis	Eastern Pondhawk
	Pantala hymenea	Spot-winged Glider

*Sources used for taxonomic and common name standards: Dunkle 1989, Dunkle 1990, and Carpenter 1991.

Butterflies Recorded from 25 April – 15 October 1992 at the Stump Neck Annex

Family	Scientific Name	Common Name*
Papilionidae – Swallowtails		
	Eurytides marcellus	Zebra Swallowtail
	Papilio glaucus	Tiger Swallowtail
	Papilio troilus	Spicebush Swallowtail
Pieridae – Whites and Sulphurs		
	Anthocharis midea	Falcate Orange Tip
	Colias philodice	Clouded Sulphur
	Colias eurytheme	Alfalfa Butterfly
	Eurema nicippe	Sleepy Orange
	Phoebis sennae	Cloudless Sulphur
	Pieris rapae	Cabbage Butterfly
Lycaenidae – Harvesters, Coppers, Hairstreaks, and Blues		
	Feniseca tarquinius	Harvester
	Incisalia irus	Frosted Elfin
	Calycopis cecrops	Red-banded Hairstreak
	Strymon melinus	Gray Hairstreak
	Everes comyntas	Eastern Tailed Blue
	Celastrina argiolus	Spring Azure
Nymphalidae – Brushfoots		
	Libytheana carinenta	American Snout
	Euptoieta claudia	Variegated Fritillary
	Speyeria cybele	Great Spangled Fritillary
	Phyciodes tharos	Pearl Cresent
	Polygonia interrogationis	Question Mark
	Polygonia comma	Hop Merchant
	Vanessa atalanta	Red Admiral
	Vanessa virginiensis	American Painted Lady
	Vanessa cardui	Painted Lady
	Limenitis arthemis	Red-spotted Purple
	Satyrodes appalachia	Appalachian Eyed Brown
	Hermeuptychia sosybius	Carolina Satyr
	Megisto cymela	Little Wood Satyr
	Cercyonis pegala	Common Wood Nymph
	Danaus plexippus	Monarch

Butterflies Recorded from 25 April – 15 October 1992 at the Stump Neck Annex

Family	Scientific Name	Common Name*
Hesperiidae – Skippers		
	Epargyreus clarus	Silver-spotted Skipper
	Staphylus hayhurstii	Scalloped Sooty Wing
	Erynnis icelus	Dreamy Dusky Wing
	Erynnis juvenalis	Juvenal's Dusky Wing
	Erynnis horatius	Horace's Dusky Wing
	Nastra lherminier	Swarthy Skipper
	Ancyloxypha numitor	Least Skipper
	Polites peckius	Peck's Skipper
	Polites themistocles	Tawny-edged Skipper
	Polites origenes	Crossline Skipper
	Wallengrenia otho	Broken Dash
	Wallengrenia egeremet	Northern Broken Dash
	Pompeius verna	Little Glassy Wing
	Atalopedes campestris	Sachem
	Poanes zabulon	Zabulon Skipper
	Euphyes dion	Sedge Skipper
	Euphyes vestris	Dun Skipper
	Panoquina ocola	Ocola Skipper

* Source used for taxonomic and common name standards: Opler 1992

Appendix C
Sewage Plant Sludge Analysis, 1987-1999

File for Site 22

5090
Ser 0431G/94/mkf
03 Feb 89

MEMORANDUM

From: 0431G
To: 0431

Subj: EVALUATE OFF-STATION WASTE ANALYSIS - ENVIRONMENTAL TASK TEAM CONCERN NUMBER C1

Encl: (1) Details On Sewage Plant Sludge Analyses - Quotes

1. Presently, we are experiencing a mercury contamination problem on the sludge, as described below:

a.

SAMPLE IDENTIFICATION	TOTAL MERCURY (DRY BASIS)
1987 Sludge	25 mg/kg
1988 Sludge	150 mg/kg(CL)
	172 mg/kg(CL)
Soil from 1988 application	90.2 mg/kg(CL)
	101 mg/kg(VL)

NOTE: Abbreviations (CL) and (VL) stand for Chesapeake Laboratory and Versar Laboratory, respectively.

b. Because of high mercury content, the sludge does not qualify as class I sewage sludge, COMAR 10.17.10. The limit on mercury is 10 mg/kg.

2. For safety of personnel handling the sludge (and also from possible legal point of view), we need to document that the sludge is not a hazardous waste. EP-toxicity test is the basis, in this case, to determine the sludge as non-hazardous or hazardous.

3. Once the mercury contamination problem is solved satisfactorily, the next step is to determine if the sludge qualifies as class I sewage sludge. Analyses requirements for this type of sludge are given below. Concentration figures are the maximum allowed. Analyses should be on dry weight basis.

a.

CONSTITUENT	CONCENTRATION (Parts per million)
cadmium	25
copper	1000
mercury	10
nickel	200
lead	1000
zinc	2500
PCB's	10

Subj: EVALUATE OFF-STATION WASTE ANALYSIS - ENVIRONMENTAL TASK TEAM CONCERN NUMBER C1

b. For any off-site disposal of sludge, the above analyses are required. It is a permit requirement (once we decide to have one). In the meantime, next sludge discharge to sand beds is expected around April, 1989.

4. Various analytical laboratories approved for environmental analyses in the general area are contacted. Quotations are obtained regarding costs for various analyses. Quotes for normal turnaround versus five-working-day special are tabulated.

T. K. TUMMALA

Copy to:
043C2

CHESAPEAKE ANALYTICAL LABORATORY, INC.
P.O. Box [illegible] La Plata, Maryland 20646
Phone (301) 934-[illegible]

November 10, 1989

Mr. John Tominack
NAVORDSTA
Indian Head, MD 20640

Dear Mr. Tominack:

Listed below are results of analyses performed on a sample of sludge taken from sanitary waste treatment sludge drying beds at NAVORDSTA.

Sample Identification: SS01 Sewage Sludge (from dumpster)
Sampler's Name: J. Tominack
Sample Date: 10/12/89 Sample Time: 0930
Received in Lab: 10/17/89

PARAMETER	EPA METHOD	ANALYSIS DATE	WET-WGT MG/KG	DRY-WGT MG/KG	ANALYST
pH	150.1	10/23/89	6.7		Knott
% Solids	209F*	10/23/89	93.6 per cent		Knott
NO3-N	353.1	11/08/89	27.6	29.5	Knott
NH3-N	350.1	11/09/89	665	710	Knott
Total N	(353.1 + 351.2)		17600	18800	Knott
Total P	365.1	11/09/89	13200	14100	Knott
Cadmium	213.1	10/23/89	16.2	17.2	Lufriu
Chromium	218.1	N/A			
Copper	220.1	10/23/89	625	665	Lufriu
Mercury	245.1	10/23/89	40	43	Lufriu
Nickel	249.1	10/23/89	35.7	38.0	Lufriu
Lead	239.1	10/23/89	186	197	Lufriu
Zinc	289.1	10/23/89	1400	1480	Lufriu
Potassium	258.1	10/23/89	3200	3410	Lufriu

*Standard Methods, 16th ed.
Sludge was digested for metals, except mercury, using SW-846, Method 3050.

All analyses were performed according to EPA approved procedures. Please feel free to call me if you have any questions about these analyses.

Sincerely,

Ted W. Lufriu
Lab Director

ENCLOSURE(1)

CHESAPEAKE ANALYTICAL LABORATORY, INC.
P.O. Box 2730 La Plata, Maryland 20646
Phone: (301) 934-2639

June 13, 1990

Mr. Thomas Woo
NAVORDSTA, Public Works
Indian Head, MD 20640

Dear Mr. Woo:

Listed below are results of analyses performed on samples of sludge taken from the sanitary waste treatment plant at NAVORDSTA. All results listed as mg/Kg (wet-wt and dry-wt basis) except pH and % Solids. Not all analyses have been completed as of this date. You will receive a complete report as soon as possible. Analyses listed as "greater than" (>) will be retested in order to determine exact concentrations.

Sample Date: 05/30/90 Sample Time: 1100
Received in Lab: 05/30/90

Sample ID:	"Old Bed"		"New Bed"		Thickener		Digestor	
PARAMETER	wet	dry	wet	dry	wet	dry	wet	dry
pH	6.9	---	7.0	---				
% Solids	49.2	---	52.7	---				
NO3-N	392	797	106	201				
NH4-N	448	911	451	856				
Total P	8460	17200	8940	17000				
Cadmium								
Copper								
Mercury	28.5	57.9	42.6	80.8	>0.08	>2	>0.08	>3
Nickel								
Lead								
Zinc								
Potassium								
PCB								

Sludge was digested for metals, except mercury, using SW-846, Method 3050.

All analyses were performed according to EPA approved procedures. Please feel free to call me if you have any questions about these analyses.

Sincerely

Ted W. Lufrlu
Lab Director

ENCLOSURE(2)

CHARLES COUNTY GOVERNMENT
Planning and Growth Management

July 24, 1990

Mr. Peter Ritzcovan
Director, Environmental Protection Division
Naval Ordnance Station
Indian Head, Maryland 20640-5000

Dear Mr. Ritzcovan:

This is in response to your letter of June 19, 1990. After consultation with our contractor regarding your request, this is to advise that Charles County does not wish to jeopardize its land application program. The level of mercury in your sludge is more than four times the allowable limit for sludge to be land applied in Maryland. If after pretreatment, you can get the level down to below 10 ppm on a dry weight basis and meet Department of Agriculture standards for land application of sludge, we could accept your sludge for disposal.

Should you have any questions, please contact me at either of the numbers shown below.

Sincerely,

Susan C. Weber, P.E.
Environmental Resources Director

pc: Mel Bridgett
Roy Hancock
Mike Mudd

SW:mea

Post Office Box 8 La Plata, Maryland 20646 (301) 645-0610 or 870-3935

7-27-90

DEPARTMENT OF THE NAVY
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND 20640-5000

5090
Ser 0964/633
9 Oct 91

Maryland Department of the Environment
Sewage Sludge Division
Attn: Mr. Douglas Proctor
2500 Broening Highway
Baltimore, MD 21224

Gentlemen:

Our annual Sludge Analysis Report for 1991, as required by Code of Maryland Regulations 26.04.13, is provided as enclosure (1). The sludge is from our sewage plant covered under National Pollutant Discharge System (NPDES) permit MD0020885. If you have any questions, please contact Mr. Michael Dunn on (301) 743-6747.

Sincerely,

KENNETH D. MORIN, P.E.
Director, Utilities/
Environmental Division
By direction of
the Commanding Officer

Encl:
(1) Sludge Analysis Report
For 1991

Sludge Data, Sewage Sludge Regul. Section, Rm. 21224.
(Please read instructions on the back)

Report Submital Date:

)Name of Sludge Generator

NAVAL ORDNANCE STATION, Indian Head, MD

OFFICE USE ONLY
Generator ID:

)Sample Date: 8/14/91

)Sample Type: GRAB or (COMPOSITE)

)Sample Number: SS01 Drying beds

)Moisture Content: 8.5%

Date Received:

)Sludge Type (See Back): 02 Aerobically Digested

)Lab Name Lab Phone

Chesapeake Analytical Laboratory (301) 932-4775

Lab Number:

)Results of Analysis (continue on another page, if necessary)

a)Parameter Analyzed	OFFICE USE Parm Code	b)Value Dry Weight	c)Units	d) < Detection Limit(Y/N)
Cadmium	CD	8.03	mg/kg	N
Copper	CU	382	mg/kg	N
Lead	PB	97.4	mg/kg	N
Mercury	HG	23.5	mg/kg	N
Nickel	NI	44.8	mg/kg	N
Zinc	ZN	831	mg/kg	N
PCBs	PCB	<0.3	mg/kg	Y
Total Kjeldahl N	TKN	20,700	mg/kg	N
Ammonium Nitrogen	NH4	770	mg/kg	N
Nitrate Nitrogen	NO3	28.5	mg/kg	N
Total Phosphorous	TP	1,170	mg/kg	N
Total Potassium	TK	2,880	mg/kg	N
pH	PH	6.4		N/A

)Certification As an authorized representative of the above named sewage sludge generator, I certify that the above information is correct and complete to the best of my knowledge.

a)Name

KENNETH D. MORIN, P.E.

b)Title

Director, Utilities/Environmental Division

c)Signature

Kenneth D. Morin

d)Date 10/3/91

ENCLOSURE(1)

REPORT OF ANALYSIS

Report Date: 08/20/93
Sample Source: NSWC - Indian Head Division
Indian Head, MD 20640
Contact Person: ~~Jim Pinto, (301) 743-4320~~
Sample Identification: WWTP Drying Bed Sludge
Sample Date/Time: ~~07/22/93, 1535~~
Received in Lab: 07/22/93

PARAMETER	EPA METHOD	ANALYSIS DATE	WET-WGT mg/Kg	DRY-WGT mg/Kg	ANALYST
pH	150.1	08/17/93	7.5 pH units		RM
% Solids	2540G	07/22/93	89.0 per cent		CM
% Vol.Solids	160.4	08/12/93	56.0 per cent		RM
TKN	351.2	08/10/93	35600	40000	ES
NH3-N	350.1	08/18/93	861	967	ES
NO3/NO2-N	353.1	07/29/93	56.7	63.7	ES
NO2-N	353.1	08/04/93	9.43	10.6	ES
NO3-N	353.1	07/29/93	47.3	53.1	ES
Total P	365.1	08/06/93	17200	19300	ES
Total N	353.1 & 351.2	CALCULATED	35700	40100	ES
TPH	418.1	08/09/93	650	730	TL
Potassium	258.1	08/06/93	2100	2400	ES
Cadmium	213.1	08/06/93	7.95	8.94	ES
Copper	220.1	08/06/93	564	634	ES
Mercury	245.5	08/19/93	9.9	11	ES
Nickel	249.1	08/06/93	32.5	36.6	ES
Lead	239.1	08/06/93	98.1	110	ES
Zinc	289.1	08/06/93	947	1060	ES
Chromium	218.1	08/03/93	29.4	33.0	ES
Arsenic	206.2	08/12/93	1.49	1.68	ES
PCB*	8080	08/14/93	<0.2	<0.23	TL

*Detection limit is for Arochlor 1254. Analysis was performed by gas chromatography/electron capture detector. Sample was extracted 07/28/93 by extraction method 3510.

Sludge was digested for metals, except mercury, using SW-846, Method 3050.

Laboratory Director: Debra L. Kynett for Ted W. Kaplin Date: 8/20/93

ENCLOSURE(2)

DEPARTMENT OF THE NAVY
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
101 STRAUSS AVE
INDIAN HEAD MD 20640-5035

5090
Ser 045G/209
11 Sept 96

Dr. Hedy V. Alavi
Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway
Baltimore, MD 21224

Dear Dr. Alavi:

We are submitting to you our annual sewage sludge analysis data for calendar year 1996. If you have any questions regarding the data, please contact Mr. Michael Snyder of my staff on (301) 743-4320.

Sincerely,

MICHAEL W. DUNN
Director, Air, Water, & Natural
Resources Management Division
By direction of the Commander

Encl:
(1) Sanitary Sludge Data
Report for 1996
(2) Laboratory Report

Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway, Baltimore, Maryland 21224

Sewage Sludge Analysis Report

1. Name of Sludge Generator: INDIAN HEAD DIVISION NAVAL SURFACE WARFARE CENTER

2. Sample Date: 06/17/96

3. pH 7.4

4. Sample Type: ☐ Grab ☒ Composite

5. Solids Content 94.7%

6. Sludge Type: ☐ Raw, Unstabilized ☒ Aerobically Digested ☒ Air Dried ☐ Composted ☐ Lime Stabilized ☐ Anaerobically Digested ☐ Other (Describe):

7. Laboratory Name: CHESAPEAKE ANALYTICAL LABORATORY, INC.

8. Results of Analysis: * Optional **Lime Amended Sludges

Parameter Analyzed		Value (WET WGT.)	Units	Detection limit
Total Phosphorus	TP	15,600	mg/kg	0.05
Total Potassium	TK	1,986	mg/kg	0.1
Total Kjeldahl Nitrogen	TKN	99.98	%	0.5
Ammonium Nitrogen	NH_4	12.82	%	0.5
Nitrate Nitrogen	$N0_3$	7.59	mg/kg	0.05
Cadmium	Cd	8.28	mg/kg	0.010
Copper	Cu	540	mg/kg	0.050
Nickel	Ni	42.65	mg/kg	0.100
Lead	Pb	124.4	mg/kg	0.100
Zinc	Zn	1120	mg/kg	0.005
Mercury	Hg	5.10	mg/kg	0.0005
*Arsenic	As	9.558	mg/kg	0.005
*Molybdenum	Mo	-----	mg/kg	-----
*Selenium	Se	-----	mg/kg	-----
PCBs	PCB	0.20	mg/kg	0.050
**Calcium Carbonate Equivalent	$CaC0_3$	-----		-----

Certification: As an authorized representative of the above named sewage sludge generator, I certify that the above information is correct and complete to the best of my knowledge.

Name: MICHAEL W. DUNN

Title: DIRECTOR, AIR, WATER AND NATURAL RESOURCES DIVISION

Signature: Michael W. Dunn

Date:

Phone: (301) 743-4320

Attach a copy of Laboratory Report

rev. 3/96

ENCLOSURE(7)

CHESAPEAKE ANALYTICAL LABORATORY, INC.
106A Rockefeller Court, Waldorf, MD 20602
(301) 932-4775

REPORT OF ANALYSIS

Report Date: July 5, 1996
Client Name: NSWC, Indian Head Division
Indian Head, MD 20640-5000
Contact Person: Frank Hannah, (301) 743-4320
Sample Source: Sanitary Sludge
Sample Received: 06/19/96, 1410

SAMPLE INFORMATION:

Sample ID		Date	Time	Preserv.	Type
SS-01-06-96	Sanitary Sludge	06/17/96	1300	4C	Grab

ANALYTICAL RESULTS:

pH: 7.4 units
% Solids: 94.7 per cent
% Volatile Solids: 49.6 per cent

Parameter	mg/kg Wet Weight	mg/kg Dry Weight
TKN	36900	39000
NH3-N	4730	5000
NO3-N	7.59	8.01
Total N	36908	39000
Total P	15600	16500
As	9.558	10.09
Cd	8.28	8.74
Cr3	33.9	35.8
Cu	540	570
Hg	5.10	5.39
Pb	124.4	131.4
Ni	42.65	45.04
K	1986	2097
Ag	50.37	53.19
Zn	1120	1180
TPH	1080	1140
PCB	<0.20	<0.21

ENCLOSURE(2)

ANALYTICAL INFORMATION:

Parameter	Method	Prep Date	Analysis Date	Analyst
pH	150.1		06/20/96	LD
% Solids	160.3		06/24/96	KH
% Volatile Solids	160.4		06/24/96	KH
TKN	351.2	07/02/96	07/02/96	TL/KH
NH3-N	350.1	07/03/96	07/03/96	TL/KH
NO3-N	353.2		06/27/96	TL
Total N	353.2 + 351.2		CALCULATION	
Total P	365.1	06/27/96	06/27/96	TL/KH
As	206.2	06/27/96	06/28/96	DK
Cd	213.1	06/27/96	07/01/96	DK
Cr	218.1	06/27/96	07/03/96	DK
Cu	220.1	06/27/96	07/01/96	DK
Pb	239.1	06/27/96	07/02/96	DK
Hg	245.5	06/28/96	06/28/96	DK
Ni	249.1	06/27/96	07/02/96	DK
K	258.1	06/27/96	07/02/96	DK
Ag	272.1	06/27/96	07/02/96	DK
Zn	289.1	06/27/96	07/01/96	DK
TPH	418.1		06/22/96	DK
PCB	8080	06/24/96	06/26/96	DK

NOTE: Sample was digested for metals, except mercury, using EPA Method 3050.
Sample was extracted for PCB analysis using EPA Method 3510.
All analyses performed using EPA approved procedures.

Reviewed and approved: Ted W [illegible]. Date: 07/05/96.
Lab Director

Filename: R960619.SSS

DEPARTMENT OF THE NAVY
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
101 STRAUSS AVE
INDIAN HEAD MD 20640-5035

5090
Ser 045J/190
18 Sept 97

Dr. Hedy V. Alavi
Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway
Baltimore, MD 21224

Dear Dr. Alavi:

We are submitting to you our annual sewage sludge analysis data for calendar year 1997. If you have any questions regarding the data, please contact Mr. Jim Humphreys of my staff on (301)743-6745.

Sincerely,

MICHAEL W. DUNN
Director, Air, Water, & Natural
Resources Management Division
By direction of the Commander

Encl:
(1) Sanitary Sludge Data
Report for 1997
(2) Laboratory Report

Waste Management Administration
2500 Broening Highway, Baltimore, Maryland 21224

Sewage Sludge Analysis Report

1. Name of Sludge Generator: INDIAN HEAD DIVISION NAVAL SURFACE WARFARE CENTER

2. Sample Date: 08/13/97

3. pH 7.0

4. Sample Type: ☐ Grab ☒ Composite

5. Solids Content 91.6%

6. Sludge Type: ☐ Raw, Unstabilized ☒ Aerobically Digested ☒ Air Dried ☐ Composted ☐ Lime Stabilized ☐ Anaerobically Digested ☐ Other (Describe):

7. Laboratory Name: CHESAPEAKE ANALYTICAL LABORATORY, INC.

8. Results of Analysis: * Optional **Lime Amended Sludges

Parameter Analyzed		Value (WET WGT.)	Units	Detection limit (MG/L)
Total Phosphorus	TP	17,300	mg/kg	0.05
Total Potassium	TK	1,850	mg/kg	0.1
Total Kjeldahl Nitrogen	TKN	3.20	%	0.5
Ammonium Nitrogen	NH_4^+	0.42	%	0.1
Nitrate Nitrogen	NO_3	3.16	mg/kg	0.05
Cadmium	Cd	5.83	mg/kg	0.010
Copper	Cu	454	mg/kg	0.050
Nickel	Ni	34.8	mg/kg	0.100
Lead	Pb	108.2	mg/kg	0.100
Zinc	Zn	1,070	mg/kg	0.005
Mercury	Hg	4.14	mg/kg	0.0005
*Arsenic	As	2.03	mg/kg	0.005
*Molybdenum	Mo	———	mg/kg	———
*Selenium	Se	———	mg/kg	———
PCBs	PCB	0.46	mg/kg	2.0 (MG/KG)
**Calcium Carbonate Equivalent	$CaCO_3$			

Certification: As an authorized representative of the above named sewage sludge generator, I certify that the above information is correct and complete to the best of my knowledge.

Name: MICHAEL W. DUNN

Title: DIRECTOR, AIR, WATER AND NATURAL RESOURCES DIVISION

Signature: Michael W. Dunn

Date: 09/22/97

Phone: (301) 743-4320

Attach a copy of Laboratory Report

rev. 3/96

ENCLOSURE(1)

106A Rockefeller Court, Waldorf, MD 20602
(301) 932-4775

9/24/97

REPORT OF ANALYSIS

Report Date: September 23, 1997
(Revision of report dated September 17, 1997)
Client Name: NSWC, Indian Head Division
Indian Head, MD 20640-5000
Contact Person: Frank Hannah, (301) 743-4320
Sample Source: Sanitary Sludge
Sample Received: 08/13/96, 1320

Revision done as per Mike Snyder to reflect addition of NO3/NO2-N to Total N value.

SAMPLE INFORMATION:

Sample ID	Date	Time	Preserv.	Type
SS-08-13-96 Sanitary Sludge	08/13/97	1100	4C	Grab

ANALYTICAL RESULTS:

pH: 7.0 units
% Solids: 91.6 per cent
% Volatile Solids: 42.3 per cent

Parameter	mg/kg Wet Weight	mg/kg Dry Weight
TKN	32000	35000
NH3-N	4230	4620
NO3/NO2-N	7.40	8.08
NO2-N	4.24	4.63
NO3-N	3.16	3.45
Total N	32007	35008
Total P	17300	18800
As	2.03	2.22
Cd	5.83	6.37
Cr3	36.5	39.9
Cu	454	496
Hg	4.14	4.52
Pb	108.2	118.1
Ni	34.8	38.0
K	1850	2020
Ag	45.54	49.72
Zn	1070	1160
TPH	480	520
PCB	<0.46	<0.50

ENCLOSURE(2)

ANALYTICAL INFORMATION:

Parameter	Method	Prep Date	Analysis Date, Time	Analyst
pH	150.1		08/13/97, 1535	KL
% Solids	160.3		08/14/97	KL
% Volatile Solids	160.4		08/14/97	KL
TKN	351.2	09/02/97	09/02/97	KH
NH3-N	350.1	09/08/97	09/09/97	KH
NO3/NO2-N	353.2		09/03/97	KH
NO2-N	353.2		09/03/97	KH
NO3-N	(NO3/NO2-N)-NO2-N		CALCULATION	
Total N	353.2 + 351.2		CALCULATION	
Total P	365.1	08/19/97	08/19/97	KH
As	206.2	08/28/97	09/12/97	DK
Cd	213.1	08/28/97	09/16/97	DK
Cr	218.1	08/28/97	09/16/97	DK
Cu	220.1	08/28/97	09/16/97	DK
Pb	239.1	08/28/97	09/16/97	DK
Hg	245.5	08/19/97	08/19/97	DK
Ni	249.1	08/28/97	09/16/97	DK
K	258.1	08/28/97	09/16/97	DK
Ag	272.1	08/28/97	09/16/97	DK
Zn	289.1	08/28/97	09/16/97	DK
TPH	418.1		09/10/97	KH
PCB	8080	08/20/97	09/02/97	TL

NOTE: Sample was digested for metals, except mercury, using EPA Method 3050.
Sample was extracted for PCB analysis using EPA Method 3510.
All analyses performed using EPA approved procedures.

Reviewed and approved: Debra L. Scott. Date: 09/23/97.
Lab Supervisor

Filename: R970813.SSS

DEPARTMENT OF THE NAVY
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
101 STRAUSS AVE
INDIAN HEAD MD 20640-5035

5090
Ser 045J/237
23 Dec 98

Ms. Elaine Nolen
Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway
Baltimore, MD 21224

Dear Ms. Nolen,

We are submitting to you our annual sewage sludge analysis data for calendar year 1998. The Sewage Sludge Utilization Permit number for this activity is S-98-30-3483-E.

If you have any questions regarding the data, please contact Mr. Jim Humphreys of my staff on (301)744-6745.

Sincerely,

MICHAEL W. DUNN
Director, Air, Water, & Natural
Resources Management Division
By direction of the Commander

Encl:
(1) Sanitary Sludge Data
Report for 1998
(2) Laboratory Reports

Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway, Baltimore, Maryland 21224

Sewage Sludge Analysis Report

1. Name of Sludge Generator: INDIAN HEAD DIVISION NAVAL SURFACE WARFARE CENTER

2. Sample Date: 09/02/98 09/23/98 12/14/98

3. pH 6.1

4. Sample Type: ☒ Grab ☐ Composite

5. Solids Content 86.9 %

6. Sludge Type: ☐ Raw, Unstabilized ☒ Aerobically Digested ☒ Air Dried ☐ Composted ☐ Lime Stabilized ☐ Anaerobically Digested ☐ Other (Describe):

7. Laboratory Name: CHESAPEAKE ANALYTICAL LABORATORY, INC. IHD, NSWC TEST AND EVALUATION DEPT.

8. Results of Analysis: * Optional **Lime Amended Sludges

Parameter Analyzed		Value	Units	Detection limit (MG/L)
Total Phosphorus	TP	10,100 (MG/KG)	mg/kg	0.05
Total Potassium	TK	710 (MG/KG)	mg/kg	0.1
Total Kjeldahl Nitrogen	TKN	11,800 (MG/KG)	%	0.5
Ammonium Nitrogen	NH_4	1,700 (MG/KG)	%	0.1
Nitrate Nitrogen	NO_3	10.7 (MG/KG)	mg/kg	0.05
Cadmium	Cd	0.0206	mg/kg	0.010
Copper	Cu	0.535	mg/kg	0.050
Nickel	Ni	0.133	mg/kg	0.100
Lead	Pb	<0.060	mg/kg	0.100
Zinc	Zn	3.09	mg/kg	0.005
Mercury	Hg	<0.00030	mg/kg	0.0005
*Arsenic	As	0.0514	mg/kg	0.005
*Molybdenum	Mo	———	mg/kg	———
*Selenium	Se	———	mg/kg	———
PCBs	PCB	<5 (MG/KG)	mg/kg	5.0 (MG/KG)
**Calcium Carbonate Equivalent	$CaCO_3$	———		———

Certification: As an authorized representative of the above named sewage sludge generator, I certify that the above information is correct and complete to the best of my knowledge.

Name: MICHAEL W. DUNN

Title: DIRECTOR, AIR, WATER & ~~NATURAL RESOURCES DIVISION~~

Signature: Michael W. Dunn

Date: 12/22/98

Phone: (301) 744-4320

Attach a copy of Laboratory Report

rev. 3/96

CHESAPEAKE ANALYTICAL LABORATORY, INC.

106A Rockefeller Court Waldorf, Maryland 20602
Phone: (301) 932-4776

NSWC-Indian Head Division
Indian Head, MD 20640
Attn: Alex Bryan

REPORT OF ANALYSIS
October 6, 1998

RECEIVED: 09/02/98, 1445 SOURCE: SS01 Sludge Analysis

COLLECTION INFORMATION:

SAMPLE ID	DATE & TIME	PERSERVATIVE	SAMPLE TYPE
SS01 Sludge	09/02/98 @ 0950	4 C	GRAB

ANALYTICAL INFORMATION:

Physical Parameter	Result
% Solids	*86.9*
pH	*6.1*

SAMPLE ID	TPH, mg/kg Wet Weight	TPH, mg/kg Dry Weight
SS01 Sludge	280	320

ANALYTICAL INFORMATION:

PARAMETER	METHOD	PREP DATE	ANALYSIS DATE	ANALYST
TPH	418.1	09/30/98	10/06/98	JM
%Solids	160.3		09/04/98	SH
pH	150.1		09/04/98, 1510	SH

Reviewed and Approved by: Debra Knott

Debra Knott
Laboratory Supervisor

****
** CHEMICAL AND PHYSICAL ANALYSIS REPORT SSIC 8010 **
****

RECEIVED: 09/02/98
SAMPLE NUMBER: 200016994
SPEC NUMBER:
SAMPLE DESCRIPTION: IHD, NSWC Sludge (TCLP Extract)
CONTRACT NUMBER:
QATIP:
MANUFACTURER:
OTHER SPEC:
LOT #:
CUSTOMER SAMPLE #: SS01/STP

REQUESTED ANALYSIS	UNIT	RESULTS	MIN.	MAX.
TCLP Elements				
Ag : Silver Content	Milligrams/L	< 0.030	-	5.0
As : Arsenic Content	Milligrams/L	0.0514	-	5.0
Ba : Barium Content	Milligrams/L	0.0354	-	100.
Cd : Cadmium Content	Milligrams/L	0.0206	-	1.0
Cr : Chromium Content	Milligrams/L	< 0.0085	-	5.0
Hg : Mercury Content	Milligrams/L	< 0.00030	-	0.20
Pb : Lead Content	Milligrams/L	< 0.060	-	5.0
Se : Selenium Content	Milligrams/L	< 0.0030	-	1.0
Miscellaneous Elements				
Co : Cobalt Content	Milligrams/L	0.139	-	-
Cu : Copper Content	Milligrams/L	0.535	-	-
Fe : Iron Content	Milligrams/L	0.211	-	-
Mg : Magnesium Content	Milligrams/L	33.1	-	-
Mn : Manganese Content	Milligrams/L	7.95	-	-
Ni : Nickel Content	Milligrams/L	0.133	-	-
Sb : Antimony Content	Milligrams/L	< 0.055	-	-
V : Vanadium Content	Milligrams/L	< 0.0052	-	-
Zn : Zinc Content	Milligrams/L	3.09	-	-

COMMENT: The sample was tested in accordance with the Toxicity Characteristic Leaching Procedure (Method 1311, SW-846) described in the Federal Register, Part II, EPA, 40 CFR Part 261 et al., "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristic Revisions", June 29, 1990. Those results which are preceded by a less than symbol indicate that the analytes could not be detected at or above the detection limit of the analytical instrument. The number appearing to the right of the less than symbol is the detection limit of the analytical instrument for this particular analysis. An analysis was not requested on analytes reported as "NR". An asterisk "*" indicates analyte concentrations which exceed the regulatory level.

Rob DeMarr RSD, for

ANALYSTS: Robert DeMarr, Nievo Namata DATE: 09/25/98

LABORATORY MANAGER: _____
Bruce Thomas

CC: 045J (J. Humphreys)

10/07/98

CHESAPEAKE ANALYTICAL LABORATORY, INC.

106A Rockefeller Court Waldorf, Maryland 20602
Phone: (301) 932-4775

NSWC-Indian Head Division
Indian Head, MD 20640
Attn: Alex Bryan

REPORT OF ANALYSIS
October 6, 1998

RECEIVED: 09/23/98, 1410 SOURCE: SS01 Sludge Analysis

COLLECTION INFORMATION:

SAMPLE ID	DATE & TIME	PERSERVATIVE	SAMPLE TYPE
SS01 Sludge	09/23/98 @ 1150	4 C	GRAB

SAMPLE ID	PCB, mg/kg Wet Weight	PCB, mg/kg Dry Weight
SS01 Sludge	< 5	< 6

ANALYTICAL INFORMATION:

PARAMETER	METHOD	PREP DATE	ANALYSIS DATE	ANALYST
PCB	8082	09/24/98	09/30/98	PSS

Reviewed and Approved by: Debra Knott
Debra Knott
Laboratory Supervisor

12/30/98

CHESAPEAKE ANALYTICAL LABORATORY, INC.

106A Rockefeller Court Waldorf, Maryland 20602
Phone: (301) 932-4775

IHDIVNAVSURFWARCEN
101 Strauss Avenue
Indian Head, MD 20640
Attn: Jim Humphreys

REPORT OF ANALYSIS

December 22, 1998

SAMPLE INFORMATION:
RECEIVED:12/16/98@ 1220

SOURCE: IHDIVNAVSURFWARCEN WWTP Sludge

COLLECTION INFORMATION:

SAMPLE ID	DATE	TIME	PRESERVATIVE	SAMPLE TYPE
SS01/Sludge 8188	12/14/98	0930	4 c	GRAB

ANALYTICAL INFORMATION:

Chemical Parameters

Sample ID	*EPA Method*	*mg/kg Wet Weight*	*Prep Date*	*Analysis Date*	*Analyst*
TKN	351.2	11800	12/18/98	12/18/98	JM
NH3-N	350.1	1170	12/22/98	12/22/98	JM
NO2/NO3-N	353.2	10.7	12/21/98	12/21/98	JM
Total Phosphorus	365.1	10100	12/21/98	12/22/98	JM
Total Potassium (K)	258.1	710	12/21/98	12/22/98	DK

NOTE: All results reported as mg/Kg, wet-weight basis. Samples digested for potassium using EPA method 3050. All analyses performed by EPA approved procedures.

Reviewed and Approved by: Debra Knott

Debra Knott
Laboratory Supervisor

DEPARTMENT OF THE NAVY
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
101 STRAUSS AVE
INDIAN HEAD MD 20640-5035

5090
Ser 045J/192
23 Nov 99

Ms. Kelly Robison
Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway
Baltimore, MD 21224

Dear Ms. Robison,

We are submitting to you our annual sewage sludge analysis data for calendar year 1999. The Sewage Sludge Utilization Permit number for this activity is S-99-30-3483-T.

If you have any questions regarding the data, please contact Mr. Jim Humphreys of my staff on (301)744-6745.

Sincerely,

MICHAEL W. DUNN
Director, Air, Water, & Natural
Resources Management Division
By direction of the Commander

Encl:
(1) Sanitary Sludge Data
Report for 1999
(2) Laboratory Reports

Maryland Department of the Environment
Waste Management Administration
2500 Broening Highway, Baltimore, Maryland 21224

Sewage Sludge Analysis Report

1. Name of Sludge Generator: Indian Head Division
Naval Surface Warfare Center

2. Sample Date: 09/07/99 & 10/29/99

3. pH . 6.7

4. Sample Type: ☒ Grab ☐ Composite

5. Solids Content 90.9 %

6. Sludge Type: ☐ Raw, Unstabilized ☒ Aerobically Digested
☒ Air Dried ☐ Composted ☐ Lime Stabilized ☐ Anaerobically Digested
☐ Other (Describe):

7. Laboratory Name: Chesapeake Analytical Laboratory, Inc.
IHD, NSWC Test And Evaluation Dept.

8. Results of Analysis: * Optional **Lime Amended Sludges

Parameter Analyzed		Value	Units	Detection limit (mg/L)
Total Phosphorus	TP	11400	mg/kg	0.05
Total Potassium	TK	1300	mg/kg	0.1
Total Kjeldahl Nitrogen	TKN	26400	(mg/kg) %	0.5
Ammonium Nitrogen	NH_4	2540	(mg/kg) %	0.1
Nitrate Nitrogen	$N0_3$	3.11	mg/kg	0.05
Cadmium	Cd	0.0157 (mg/L)	mg/kg	1.0 (MAX)
Copper	Cu	0.414 (mg/L)	mg/kg	0.050
Nickel	Ni	0.132 (mg/L)	mg/kg	0.100
Lead	Pb	< 0.11 (mg/L)	mg/kg	5.0 (MAX)
Zinc	Zn	2.94 (mg/L)	mg/kg	0.005
Mercury	Hg	< 0.18 (mg/L)	mg/kg	0.20 (MAX)
*Arsenic	As	< 0.45 (mg/L)	mg/kg	5.0 (MAX)
*Molybdenum	Mo	----------	mg/kg	----------
*Selenium	Se	< 0.14 (mg/L)	mg/kg	1.0 (MAX)
PCBs	PCB	< 0.5	mg/kg	5.0 (mg/kg)
**Calcium Carbonate Equivalent	$CaC0_3$	----------		----------

Certification: As an authorized representative of the above named sewage sludge generator, I certify that the above information is correct and complete to the best of my knowledge.

Name: Michael W. Dunn

Title: Director, Air, Water, & Natural Resources MGMT Division

Signature:

Date: 11/23/99

Phone: (301) 744-4320

Attach a copy of Laboratory Report

rev. 3/96

9/29/99

CHESAPEAKE ANALYTICAL LABORATORY, INC.

106A Rockefeller Court Waldorf, Maryland 20602
Phone: (301) 932-4775

NSWC-Indian Head Division
101 Strauss Avenue
Bldg. No. D-327
Indian Head, MD 20640-5000
Attn: Jim Humphreys

REPORT OF ANALYSIS

September 23, 1999

RECEIVED: 09/08/99 @ 1410

SOURCE: Wastewater Treatment Plant Samples
COLLECTOR: Jim Humphreys

SAMPLE INFORMATION:

SAMPLE ID	DATE/TIME	PERSERVATIVE	SAMPLE TYPE
SS01 Sludge/9122	09/07/99 @ 0900	4 C	GRAB

ANALYTICAL RESULTS:

SAMPLE ID	%SOLIDS	pH	PCB mg/Kg	TPH mg/Kg
SS01 Sludge	90.9	6.7	< 0.5	295

ANALYTICAL INFORMATION:

PARAMETER	METHOD	PREP DATE	ANALYSIS DATE	ANALYST
% Solids	160.3		09/14/99	CM
pH	150.1		09/14/99 @ 0910	CM
PCB	8082	09/20/99	09/21/99	PSS
TPH	418.1	09/16/99	09/21/99	SH

Reviewed and Approved by: Debra Knott

Debra Knott
Laboratory Supervisor

****

CHEMICAL AND PHYSICAL ANALYSIS REPORT: SSIC 8010

****

LAB NUMBER: 200022219
SAMPLE DESCIPTION: SS01 Sludge / 9122 (TCLP Extract)
CUSTOMER SAMPLE NUMBER: 9122
ANALYSIS DATE: 10/01/99

DATE RECEIVED: 09/07/99
DATE SAMPLED: 09/07/99
SUBMITTER: J. Humphreys
SAMPLER: J. Humphreys

	REQUESTED ANALYSIS	UNITS	RESULTS	LIMITS MIN	LIMITS MAX
	TCLP Elements				
Ag:	Silver Content	milligrams/L	< 0.050	-	5.0
As:	Arsenic Content	milligrams/L	< 0.45	-	5.0
Ba:	Barium Content	milligrams/L	0.105	-	100.
Cd:	Cadmium Content	milligrams/L	0.0157	-	1.0
Cr:	Chromium Content	milligrams/L	< 0.014	-	5.0
Hg:	Mercury Content	milligrams/L	< 0.18	-	0.20
Pb:	Lead Content	milligrams/L	< 0.11	-	5.0
Se:	Selenium Content	milligrams/L	< 0.14	-	1.0
	Miscellaneous Elements				
Al:	Aluminum Content	milligrams/L	< 0.050	-	-
B :	Boron Content	milligrams/L	0.210	-	-
Ca:	Calcium Content	milligrams/L	128.	-	-
Cu:	Copper Content	milligrams/L	0.414	-	-
Fe:	Iron Content	milligrams/L	< 0.010	-	-
Mg:	Magnesium Content	milligrams/L	35.9	-	-
Mn:	Manganese Content	milligrams/L	5.09	-	-
Ni :	Nickel Content	milligrams/L	0.132	-	-
Sb :	Antimony Content	milligrams/L	< 0.057	-	-
Zn:	Zinc Content	milligrams/L	2.94	-	-

COMMENT: The sample was tested in accordance with the Toxicity Characteristic Leaching Procedure (Method 1311, SW-846) described in the Federal Register, Part II, EPA, 40 CFR Part 261 et al., "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristic Revisions", June 29, 1990. Those results which are preceded by a less than symbol indicate that the analytes could not be detected at or above the detection limit of the analytical instrument. The number appearing to the right of the less than symbol is the detection limit of the analytical instrument for this particular analysis. An analysis was not requested on analytes reported as "NR". An asterisk "*" indicates analyte concentrations which exceed the regulatory level.

ANALYST(S): Robert DeMarr — DATE: 10-6-99

LABORATORY MANAGER: Bruce Thomas — DATE: 10/6/99

CC: 045J (J. Humphreys)

NSWC-Indian Head Division
101 Strauss Avenue
Bldg. No. D-327
Indian Head, MD 20640
Attn: Jim Humphreys

REPORT OF ANALYSIS

November 19, 1999

RECEIVED: 10/29/99 @1305

SOURCE: IHDIVNAVSURWARCEN
COLLECTOR: Jim Humphreys

SAMPLE INFORMATION:

SAMPLE ID	DATE/TIME	PRESERVATIVE	SAMPLE TYPE
SS01 Sludge 1957	10/29/99 @ 1115	4 c	GRAB

ANALYTICAL INFORMATION:

Physical Parameters

Sample ID	EPA Method	Result	Analysis Date	Analyst
% Solids	160.3	88.2	11/05/99	SH

Chemical Parameters

Sample ID	EPA Method	mg/kg Wet Weight	mg/kg Dry Weight	Prep Date	Analysis Date	Analyst
TKN	351.2	26400	29900	11/17/99	11/18/99	DB
NH3-N	350.1	2540	2880	11/18/99	11/18/99	DB
NO2/NO3-N	353.2	3.11	3.53	11/17/99	11/17/99	DB
Total P	365.1	11400	12900	11/06/99	11/06/99	DB
Potassium (K)	258.1	1300	1470	11/05/99	11/19/99	DK/SH

NOTE: All results reported as mg/Kg, wet-weight basis. Samples digested for metals using EPA method 3050. All analyses performed by EPA approved procedures.

Reviewed and Approved by: _____
Debra Knott
Laboratory Supervisor

Appendix D
Memorandum Regarding Mercury Analysis of Soil in the P-Chem Division Area, 25 June 1993

8000
Ser 3330H/196/ckr
25 June 1993

MEMORANDUM

From: 3330H
To: 330
Via: 3330

Subj: MERCURY ANALYSIS OF SOIL IN THE P-CHEM DIVISION AREA

Encl: (1) Table-Analytical Results

1. During recent development work for improvement of our cold vapor atomic absorption (CVAA) system for mercury analysis, several "real world" soil samples were taken for analysis from the ground outside buildings in Physical Chemistry Division area. Results of the analyses are listed in the enclosure (1).

2. The analyses were performed in full compliance with Method 7471 of Test Methods for Evaluating Solid Waste, Third Edition, SW-846, USEPA, Office of Solid Waste, Revision 2, November 1990. All applicable QA/QC procedures were followed.

3. Mercury in surface soil outside buildings 102, 444, and 108 is present in sufficient quantities to classify the material as TCLP toxic in accordance with 40 Code of Federal Regulations, Part 261, if an appropriate sample of the material fails the TCLP test. The number listed under "Possible TCLP Concentration (mg/l)" in enclosure (1) is calculated assuming all of the mercury present in the sample is extracted into the appropriate TCLP test solution during the TCLP test procedure.

In accordance with Section 1.0 of Appendix II-Method 1311 Toxicity Characteristic Leaching Procedure (TCLP), Federal Register, Volume 55, Number 61, March 29, 1990, page 11863, the TCLP procedure must be used to determine if a sample is TCLP toxic if a total analysis indicates a regulated contaminant is present in quantities which could exceed the regulatory limit. The regulatory TCLP limit for mercury is 0.2 milligrams per liter of TCLP extract; therefore, samples near buildings 102, 444, 108, and possibly 1797 would need TCLP testing as opposed to total mercury analysis.

Further testing will also be needed to determine the extent of mercury contamination, both surface area and depth, in the Physical Chemistry Division area of operation.

04/20/00 THU 14:22 [TX/RX NO 7126]

8000
Ser 3330H/196/
25 June 1993

Subj: MERCURY ANALYSIS

4. Analytical data and exact location of the sample sites can be provided if needed. If there are any further questions, please call on extension 4759 or 1219.

Steve Helberg
STEVE HELBERG

04/20/00 THU 14:22 [TX/RX NO 7126]

ANALYTICAL RESULTS FOR

MERCURY ANALYSIS OF SOIL SAMPLES

IN THE

PHYSICAL CHEMISTRY DIVISION AREA OF OPERATION

Location	Sample Number	MG/KG (wet)	Possible TCLP Concentration (mg/l)
B-102	1	25.2	1.26
B-109A	2	0.216	0.0108
B-444	3	128.	6.40
B-1797	4	2.31	0.116
B-108	5	4.05	0.202
B-556 (parking) (lot)	6	<0.16	N/A

04/20/00 THU 14:22 [TX/RX NO 7126]

Leszkiewicz, Craig/WDC

From: Estabrook, Anne/WDC
Sent: April 25, 2000 3:46 PM
To: Leszkiewicz, Craig/WDC
Subject: FW: MERCURY SAMPLING AT LAB AREA

Craig,
Here's some info from Shawn on the mercury samples mentioned in the memo I gave you. I'll talk to you tomorrow about a sampling approach for these areas after I talk to the team.
Anne

-----Original Message-----
From: Jorgensen Shawn A IHMD [mailto:JorgensenSA@ih.navy.mil]
Sent: April 25, 2000 3:18 PM
To: Estabrook, Anne
Cc: Mcarthur Heidi A IHMD
Subject: MERCURY SAMPLING AT LAB AREA

Anne,

I have spoken to two people already concerning the sampling that was performed in the memo that I sent to you about the lab area (8000, Ser 3330H/196/ckr of 25 Jun 93). I'm not sure what is wrong with these people, but apparently seven years is a long time!?!

The Building 102 sample was taken on the ground outside the back of the building (SSE from the building on your map). Mercury nitrometers were used in the basement and some sort of tank was inside that the mercury/water flowed to or was poured into. Water from this tank was poured on the ground outside the building, right outside the back door.

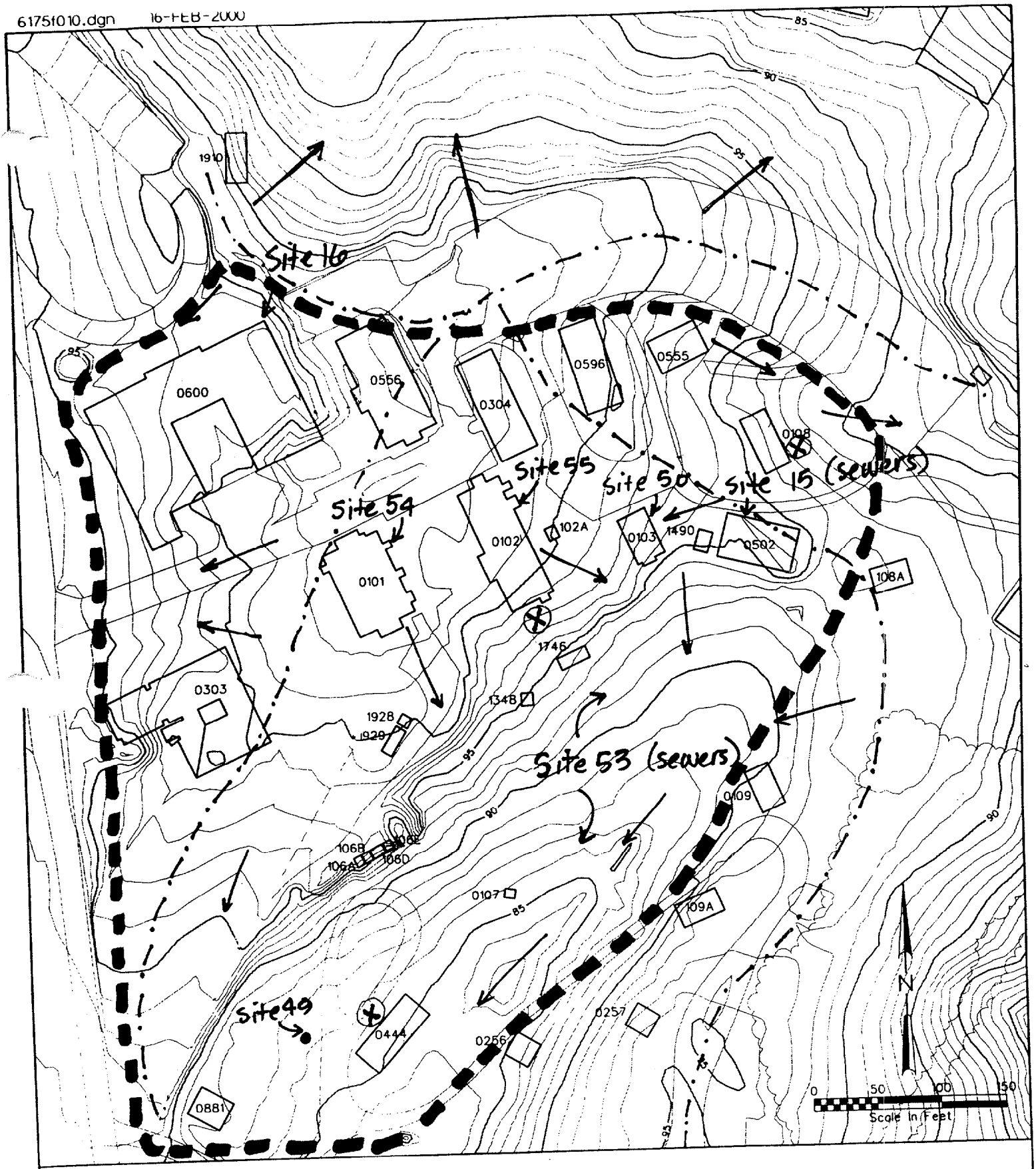
The Building 444 sample, as far as Steve Helberg can remember, was taken in "a natural drainage ditch the came from Building 102 outside of Building 444." I don't particular remember a "natural drainage ditch" right outside of Building 444, but it is worth investigating. I plan to run down there in the near future to check it out.

Steve was not certain about the sample taken around Building 108, as a matter of fact, he was not certain where the building was. I assume that it, too, was near a building exit, where water, possibly containing mercury, was poured. I will look around that building, also, to see what I can see.

I will try to get pictures and email them to you. Also, I will provide my best guess on locations (on your map) after I see the sites.

If you have any questions, please give me a call.

Thanks,
Shawn Jorgensen
Indian Head Division
Naval Surface Warfare Center
ATTN: Code 04SC, Bldg. D-327
101 Strauss Avenue
Indian Head, MD 20640-5035
Phone - (301) 744-6745
Fax - (301) 744-4180
Email - jorgensensa@ih.navy.mil



⊗ = mercury detected in surface soil (6/93)

→ = approximate surface water flow direction

—·— = approximate drainage divide

▬ ▬ ▬ = proposed limits of "lab area"

Figure

SITES 15 AND 53 EXISTING CONDITIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

Appendix E
Summary of Use Report, Buildings 303, 304, 555, and 596

SUMMARY OF USE REPORT
BUILDINGS 303, 304, 555 & 596

NAVAL SURFACE WARFARE CENTER, INDIAN HEAD, MARYLAND

Prepared by:
James E. Dolph
Industrial Historian
Portsmouth Naval Shipyard
Portsmouth, NH

May 27, 2000

BUILDING 303 – SUMMARY OF USE	
Date	**Description**
1918	Building Constructed
1918 – 49	Chemical Laboratory Office Building
1957 – 59	Production & Safety Office Building
1961 – 67	Production Building
1999	Office Building

BUILDING 303 – HISTORIC NOTES	
Date	**Description**
1940	An architectural plan shows two photographic darkrooms and a general workroom in the basement of the building.
1944	An architectural plan shows that all spaces on the first floor are offices.
1956	An architectural plan shows a paper cutting room, paper dipping machine and chemical storage room in the basement.
1978	An architectural plan shows that all spaces in the basement and on the first floor are offices.

BUILDING 304 – SUMMARY OF USE	
Date	**Description**
1918	Building Constructed (additions 1940 & 41)
1918 – 49	Chemical Laboratory Storehouse
1957 – 61	Storehouse
1961	Storehouse & Retail Outlet #4
1999	Storehouse/Wastewater Laboratory

BUILDING 304 – HISTORIC NOTES	
Date	**Description**
1990	A Supply Department architectural plan shows numerous storage shelves in the building.

A 1980 Hazardous Materials survey listed the following chemicals and compounds as being stored in Building 304:

Name	Annual Quantity Stored	Storage Container
Acetic anhydride	72 lbs.	Glass bottles
Acetone	unknown	Glass bottles
Ammonium acetate	9 lbs.	Unknown
Ammonium bichromate	5 lbs.	Unknown
Ammonium carbonate	5 lbs.	Unknown
Ammonium chloride	18 lbs.	Unknown
Ammonium oxalate	10 lbs.	Unknown
Ammonium perchlorate	19 lbs.	Unknown
Ammonium sulfide	20 lbs.	Metal can
Ammonium sulfite (30% solution)	2.25 lbs.	Unknown
Ammonium thiocyanate	9 lbs.	Unknown
Amyl acetate	2.7 lbs.	Unknown
Antimony trioxide	2.5 lbs.	Unknown

1980 Hazardous Materials survey cont:

Name	Annual Quantity Stored	Storage Container
Cadmium (metal)	2 lbs.	Unknown
Cadmium chloride	2.25 lbs.	Unknown
Calcium carbide	2 lbs.	Unknown
Calcium hydroxide	6 lbs.	Unknown
Calcium hypochlorite	24 lbs.	Unknown
Carbon disulfide	4.5 gals.	Unknown
Carbon tetrachloride	11.5 gals.	Unknown
Chloroform	31 gals.	Unknown
Cupric chloride	9 lbs.	Unknown
Cupric sulfate	18 lbs.	Unknown
Dibutyl phthalate	78 lbs.	Unknown
Dimethylamine hydrochloride	4.4 lbs.	Unknown
Ferric chloride	22 lbs.	Unknown
Ferric nitrate	6 lbs.	Unknown
Ferric sulfate	15 lbs.	Unknown
Ferrous ammonium sulfate	5 lbs.	Unknown
Formaldehyde	17 lbs.	Unknown
Formic acid	20 lbs.	Unknown
Hydrofluoric acid (40%)	33 lbs.	Unknown
Hydrogen peroxide (30%)	2.75 gals.	Unknown
Lead acetate	5 lbs.	Unknown
Lead chromate (chrome yellow)	9 lbs.	Unknown
Lead nitrate	3 lbs.	Unknown
Lead sulfate	3.75 lbs.	Unknown
Mercuric sulfate	3.25 lbs.	Unknown
Phenol	9 lbs.	Unknown
Phosphorus pentachloride	1 lb.	Unknown
Phosphorus pentoxide	6 lbs.	Unknown
Potassium bichromate	19 lbs.	Unknown
Potassium chromate	5 lbs.	Unknown
Potassium cyanide	7 lbs.	Unknown
Potassium permanganate	10 lbs.	Unknown
Pyridine	12.9 gals.	Unknown
elenium (powder)	1 lb.	Unknown
Silver nitrate	11 lbs.	Unknown
Sodium azide	8 lbs.	Unknown
Sodium chromate	2 lbs.	Unknown

1980 Hazardous Materials survey cont:

Name	Annual Quantity Stored	Storage Container
Sodium cyanide	3 lbs.	Unknown
Sodium dichromate	263 lbs.	Glass bottles or drums
Sodium fluoride	Unknown	Unknown
Sodium hydroxide	45 lbs.	Bottles
Sodium nitrite	Unknown	Unknown
Sodium phosphate, dibasic	2 lbs.	Unknown
Sulfuric acid	243 lbs.	Unknown
Toulene	Unknown	Unknown
Zinc (metal)	36 lbs.	Unknown
Zinc acetate	11 lbs.	Unknown
Zinc chloride	19.8 lbs.	Unknown
Zinc nitrate	9 lbs.	Unknown
Zinc sulfate	3 lbs.	Unknown

The 1986 NAVORDSTA OIL/HAZARDOUS SUBSTANCE CONTINGENCY PLAN lists the following chemicals and compounds as being in Building 304:

Name	Annual Quantity Stored	Storage Container
Cupric sulfate ($CuSO_4$)	18 lbs.	Bottles
Dibutylphthalate	50 lbs.	Glass bottles
Pyridine	40 lbs.	Glass bottles
Silver Nitrate ($AgNO_3$)	5 lbs.	Glass bottles
Sodium nitrite ($NaNO_2$)	6,531 lbs.	Steel drums

BUILDING 555 SUMMARY OF USE	
Date	**Description**
1944	Building Constructed
1944 – 49	Surveillance Magazine
1957 – 61	Magazine 2Y2
1967 – 76	Explosive Test Laboratory
1999	(Magazine) Explosive Test Laboratory

BUILDING 555 – HISTORIC NOTES	
Date	**Description**
1968	An architectural plan was drawn for a proposal to renovations associated with Mixing and Measuring.
1974	An architectural plan indicates that a Rolling Mill was in the building.

The 1980 Hazardous Materials survey listed the following chemicals and compounds as being stored in Building 555:

Name	Annual Quantity Stored	Storage Container
Acrylonitrile	Unknown	1-gal. glass bottles
Dinitrochlorobenzene	Unknown	Metal drums on concrete floor
2, 4-Dinitrophenoxy ethanol (DNPHE)	685 lbs.	Plastic bags on concrete floor
Ferrous sulfate	Unknown	Unknown
Hydrochloric acid (Muriatic acid)	Unknown	Metal cabinets
Nitric acid (concd)	Unknown	Unknown
Phosphorus trichloride	5 lbs.	Unknown
Sodium hydroxide	400 lbs.	5-gal. cans
Sulfuric acid	Unknown	Unknown

The 1986 NAVORDSTA Oil/Hazardous Substance Contingency Plan lists the following chemicals and compounds as being in Building 555:

Name	Annual Quantity Stored	Storage Container
Acrylonitrile (CH_2CHCN)	Unknown	1-gal. glass bottles

BUILDING 596 - SUMMARY OF USE	
Date	**Description**
1945	Building Constructed
1949	Survellience Magazine #4
1957 – 61	Magazine 2Y1
1976	Stability Test Building
1999	Magazine (Stability Test Building)

References:

US Navy, *Public Works of the Navy Data Book,* Bureau of Yards and Docks, GPO, Washington, DC., July 1927

US Navy , *Public Works of the Navy Data Book,* Bureau of Yards and Docks, GPO, Washington, DC., July 1939

US Navy , P*ublic Works of the Navy Data Book,* Bureau of Yards and Docks, GPO, Washington, DC., July 1945

US Navy, *(NAVCOMP FORM 277) Class II Property Record Card – Building 303*, September 1956

US Navy, *(NAVCOMP FORM 277) Class II Property Record Card – Building 596*, August 1956

US Navy, *(NAVCOMP FORM 277) Class II Property Record Card – Building 304*, July 1954

US Navy, *(NAVCOMP FORM 277) Class II Property Record Card – Building 555*, August 1956

Indian Head General Development Maps, (various years)

Building 303 Architectural Plans (all years)

Building 304 Architectural Plans (all years)

Building 555 Architectural Plans (all years)

Building 596 Architectural Plans (all years)

US Navy, *Hazardous Materials Survey*, Indian Head, Md., 1980

US Navy, *Oil/Hazardous Substance Contingency Plan,* Naval Ordnance Station, Indian Head, Md., 1986

US Navy, *Building and Structure Inventory*, Naval Surface Warfare Center, Indian Head, Maryland, July 1998