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Final
Site-Specific Remedial Investigation Work Plan for Sites 11, 13, 17, 21, and 25 Naval Surface Warfare Center, Indian Head Division Indian Head, Maryland

Prepared for

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

Contract No. N62470-95-D-6007
CTO-0122

July 2000

Prepared by

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Baker
Environmental, Inc.

CDM
Federal Programs Corp.

Final

Site-Specific Remedial Investigation Work Plan for Sites 11, 13, 17, 21, and 25

Naval Surface Warfare Center
Indian Head Division
Indian Head, Maryland

Contract Task Order 0122

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Under the

LANTDIV CLEAN II Program
Contract N62470-95-D-6007

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Abbreviations and Acronyms

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
IR	Installation Restoration
MCL	Maximum Contaminants Levels
MDNR	Maryland Department of Natural Resources
MEK	Methyl Ethyl Ketone (2-Butanone)
NEESA	Naval Energy and Environmental Support Activity
NG	Nitroglycerin
NOAA	National Oceanographic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NOS	Naval Ordnance Station

Abbreviations and Acronyms (Continued)

NPL	National Priorities List
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 (Project Specific Work Plan) for the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), Indian Head, Maryland, was prepared in response to Contract Task Order (CTO) 0122, 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 and planned investigations for five Installation Restoration (IR) sites on IHDIV-NSWC.

The specific 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.

Sampling of various media is planned at all five sites. Overall, the planned field investigations include the installation of 17 monitoring wells and the collection of 23 groundwater samples. In total, between 77 and 113 surface soil samples will be collected from all five sites and between 43 and 79 subsurface soil samples will be collected from four of the five sites. Thirteen sediment and surface water samples are planned for Sites 11 and 17. Between 17 and 53 waste samples will be collected at Site 11.

TABLE ES-1
EXECUTIVE SUMMARY
INDIAN HEAD, MARYLAND

Site Name	Work Plan Summary	Surface Soil Samples	Subsurface Soil Boring Samples	Ground Water Samples	Surface Water Samples	Sediment Samples	Waste Samples	Ecological Risk Assessment	Human Health Risk Assessment
Site 11 - Caffee Road Landfill	Determine thickness and limits of waste. Characterize waste. Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of waste disposal or oil storage. Evaluate potential contaminant transport to Mattawoman Creek with sediment and surface water samples.	30-65	up to 56	11	7	7	18-53	YES	YES
Site 13 - Paint Solvents Disposal Ground	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of paint and solvent disposal.	9	5	3	none	none	none	YES	YES
Site 17 - Disposed Metal Parts along Mattawoman Creek Shoreline	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of drum contents. Determine whether prior metal material disposal on shoreline contaminated nearby Mattawoman Creek sediment.	10	10	3	6	6	none	YES	YES
Site 21 - Bronson Road Landfill	Determine thickness and limits of waste. Conduct a thorough investigation of surface soils and groundwater to determine if contaminated as result of waste disposal.	20	none	4	none	none	none	YES	YES
Site 25 - Hypo Discharges from Bldg. 588	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of hypo discharges.	17	8	2	none	none	none	YES	YES

1. Introduction

This Project Specific Work Plan for the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), Indian Head, Maryland, was prepared in response to CTO- 0122, under the Navy CLEAN contract. The purpose of this Work Plan is to present site-specific information and planned investigations for five IR sites on IHDIV-NSWC (Sites 11, 13, 17, 21, and 25).

This Project Specific Work Plan is a supplement to the following master planning documents:

- Master Work Plan (Master WP), prepared by Brown and 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 five sites in this Project Specific Work Plan. The objective of this Work Plan is to present historical information regarding each site, evaluate that information, 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. There has been minimal previous environmental investigation at these sites; therefore, the site-specific objective is in general to verify the presence or absence of contamination, to define the extent of contamination, and to evaluate the need for remediation. Unless otherwise noted, all SOPs referenced in this Work Plan are contained in the Master WP (B&RE, April 1997).

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 1-1). 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.

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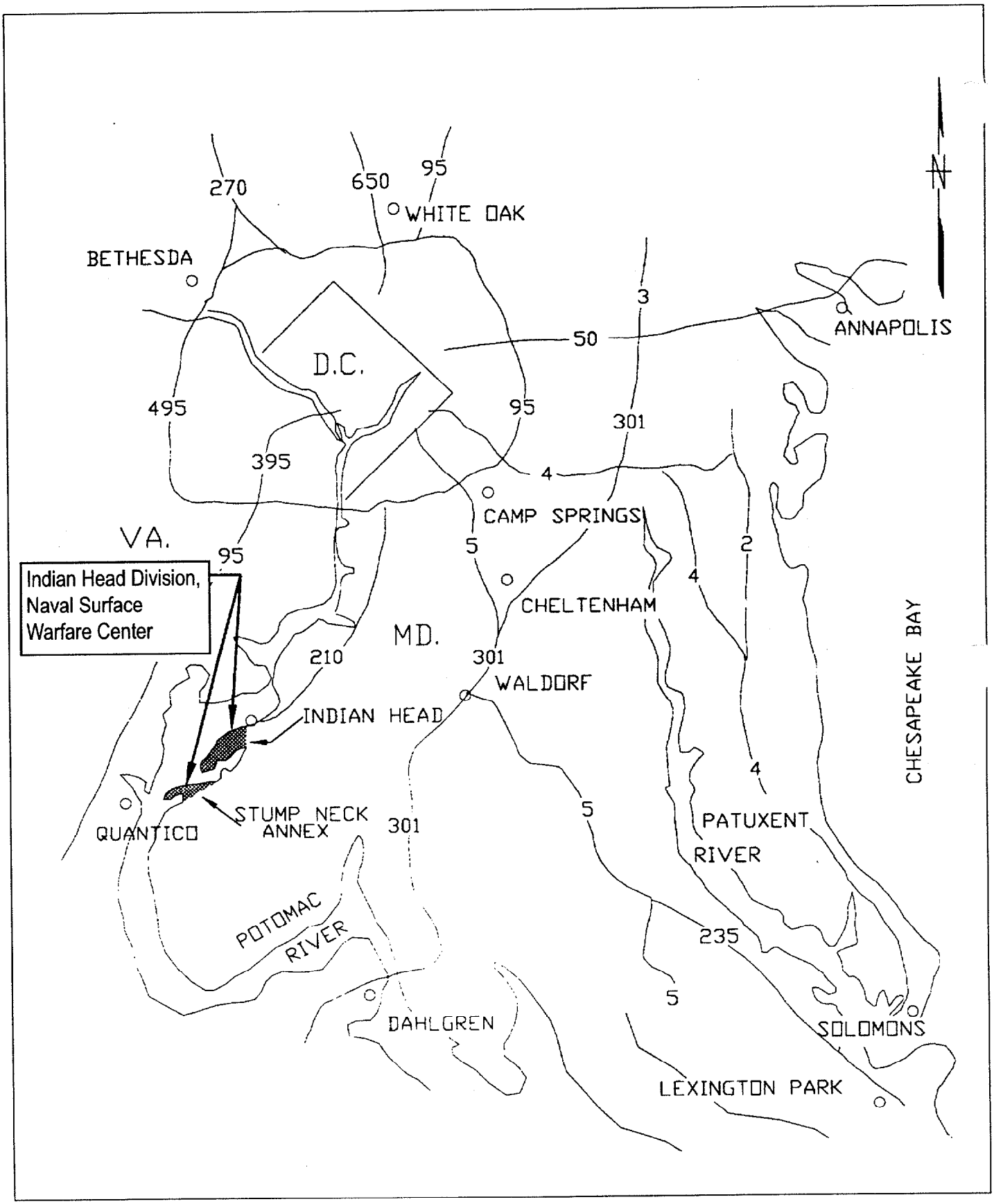

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Figure 1-1
Vicinity Map
Indian Head Division NSWC
Indian Head, Maryland

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 a Resource Conservation and Recovery Act (RCRA) Corrective Action 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 or 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 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

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.

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 concern in the region.

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.

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:
E = Endangered
NS = No status

State Codes:
E = Endangered
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.

1.2 Document Organization

Five sites are addressed in this Project Specific Work Plan. Sections 3 through 7 contain site-specific information on the five specific sites addressed in this work plan. Each site is contained in a separate section and consists of background information and a site description, a summary of previous environmental investigations performed at the site, data assessment, 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 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 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. Site 12 is in need of further investigation.

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 in Site 42, Olson 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.

As required under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the USEPA conducted a Hazard Ranking System (HRS) for IHDIV-NSWC. The Activity scored a 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.

Very limited previous data could be located for these five sites. Thus no initial data screening was performed. Three USEPA Region III screening criteria will be used once results are obtained: Risk-Based Concentrations (RBCs), Soil Screening Levels (SSLs), and modified Biological Technical Assistance Group (BTAG) ecological criteria. Tables 1-3 and 1-4 show human health and ecological screening concentrations, respectively, for analytes that will be analyzed during the investigation.

1.4 Work Plan Summary

The locations of the five sites addressed by this Work Plan are shown on Figure 1-2 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 all five sites.

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	1.1[illegible]
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	--	--	--	--	--
B[illegible](a)pyrene	780	87	0.019	0.2	0.0092
B[illegible]ic 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	--	--	--	--	--
Di[illegible]lphthalate	1,000,000,000	63,000,000	23	--	29,000
p[illegible]ethylaminoazobenzene	--	--	--	--	--
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	--	0.09
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	--	0.00
n-Nitrosomethylethylamine	260	29	--	--	0.0
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
[illegible]-Trichlorophenol	520,000	58,000	--	--	6.1
[illegible]-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	--	--	--	--	--
[illegible]one	--	--	--	--	--
[illegible]oxychlor	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	50	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 (T)	1,500
Cyanide	41,000,000	1,600,000	7.4	200	730
Iron	610,000,000	23,000,000	--	--	11,000
Lead	--	--	--	15 (T)	--
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
[illegible]	10,000,000	390,000	1.6	--	180
[illegible]um	--	--	--	--	--
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 the 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.

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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.

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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.

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

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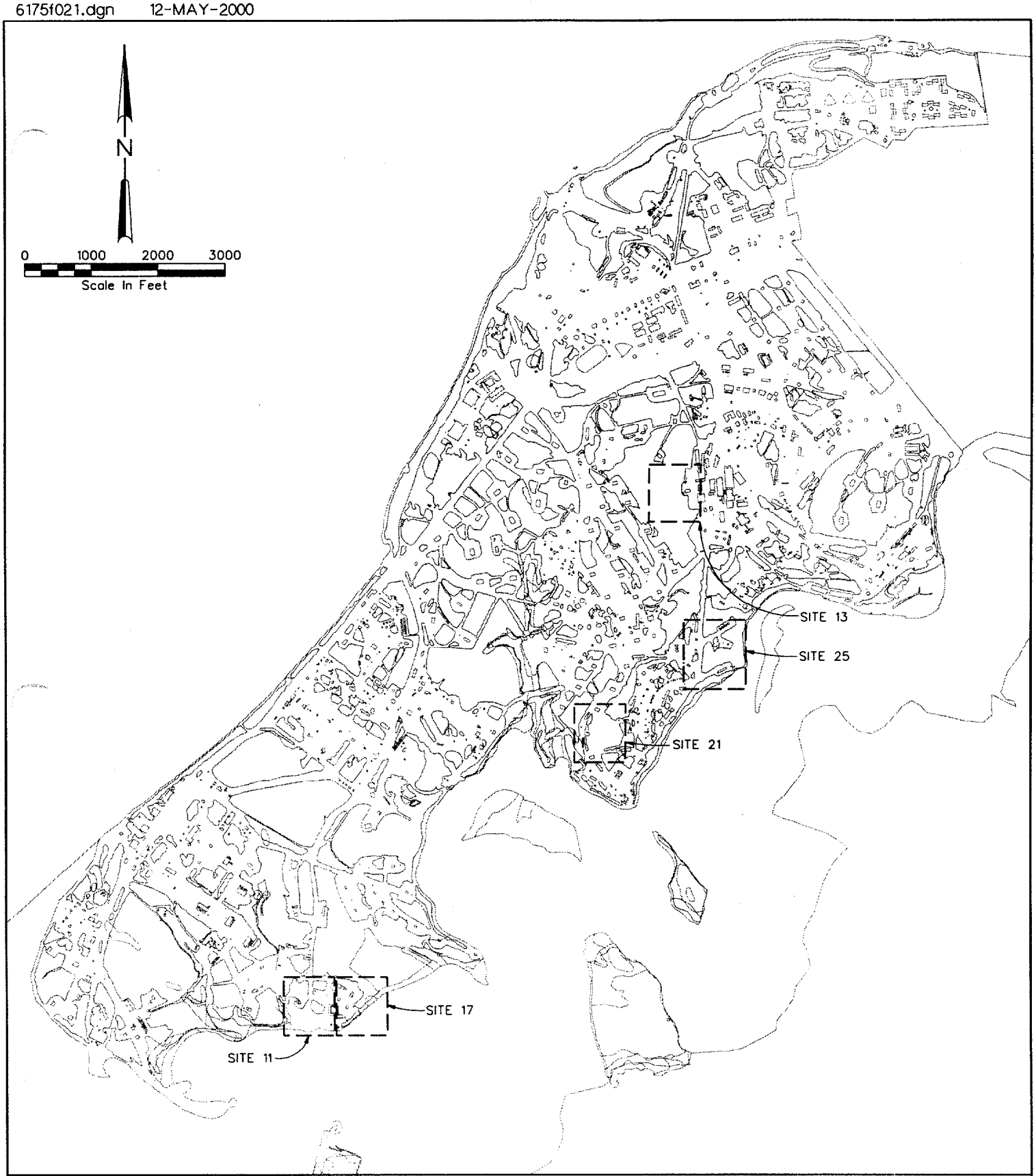

Figure 1-2
LOCATIONS OF SITES IN WORKPLAN
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

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
11	3	Caffee Road Landfill	Limited Investigation	Determine extent of waste; waste, soil, groundwater, surface water, and sediment sampling
13	4	Paint Solvents Disposal Ground	Limited Investigation	Soil and groundwater sampling
17	5	Disposed Metal Parts Along Mattawoman Creek Shoreline	Limited Investigation	Sediment, soil, and groundwater sampling
21	6	Bronson Road Landfill	Limited Investigation	Determine extent of waste; soil and groundwater sampling
25	7	Hypo Discharges from Building 588	Limited Investigation; adjacent storm water outfall IW-46 sampled	Soil and groundwater sampling

1.5 Data Quality Level

Data will be analyzed in accordance with the specifications identified in the Master QAPP and Addendum.

1.6 Project Organization

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

Mr. Rob Sadorra, Code 1811
Department of the Navy
Engineering Field Activity Chesapeake
Naval Facilities Engineering Command
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Mr. Shawn Jorgensen will be the primary contact at IHDIV-NSWC.

Mr. Shawn Jorgensen, Code 046C
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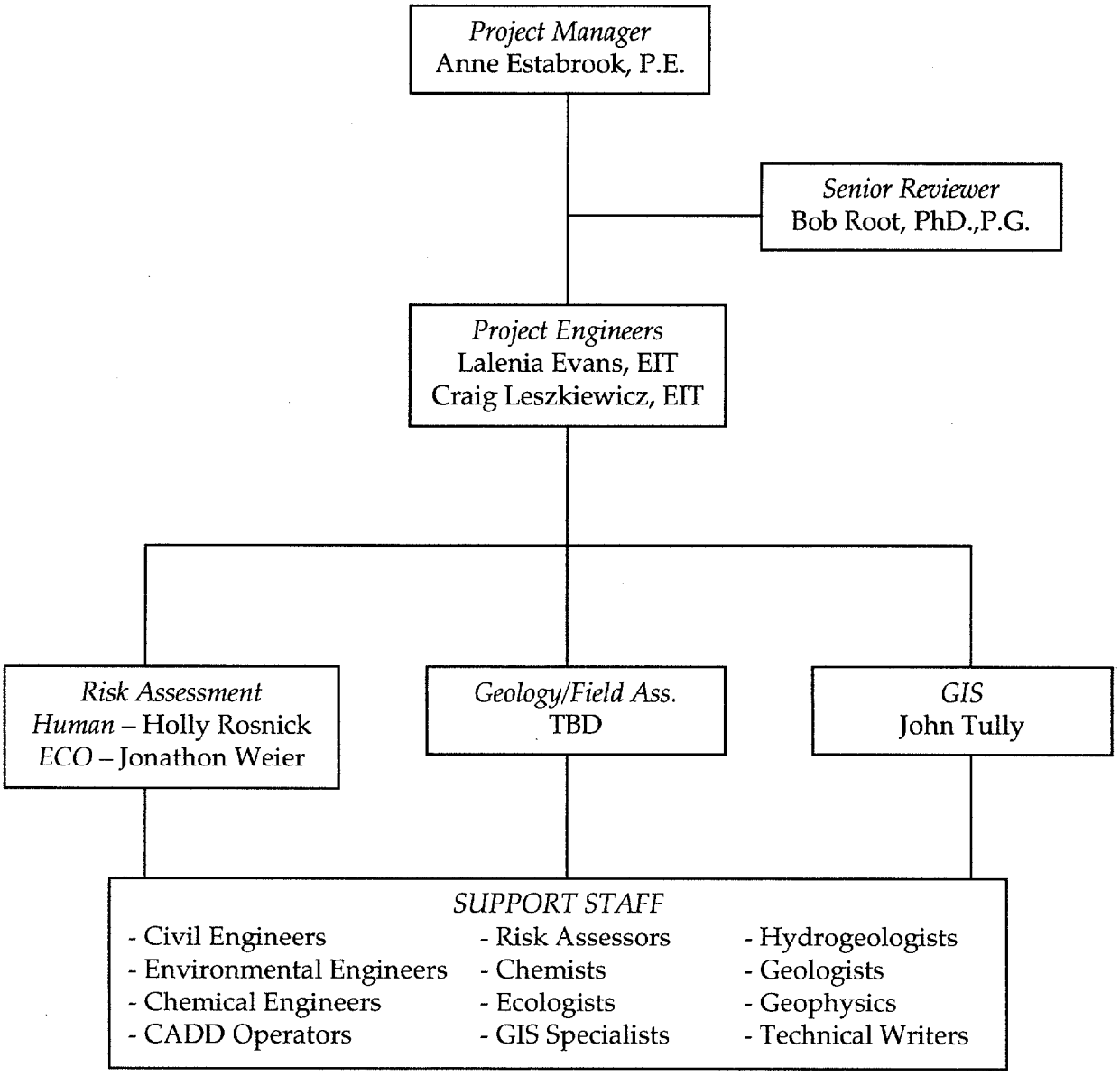
Email: jorgensensa@ih.navy.mil

The CH2M HILL Project Organization is shown on Figure 1-3.

Figure 1-3

Project Organization Chart



2. 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 through 7.0).

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 CH2M HILL Health and Safety Plan provided in the Addendum.

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 are 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 will be based on the evaluation of historical site data and conditions observed during an initial site visit. The field team will consider the following factors in selecting sample locations:

TABLE 2-1
WORK PLAN SUMMARY TABLE
INDIAN HEAD, MARYLAND

Site Name	Work Plan Summary	Soil Sampling			Groundwater Sampling			Surface Water Samples	Sediment Samples	Waste Samples
		Number of Surface Soil Samples	Number of Soil Borings	Number of Soil Boring Samples	Number of Grab Groundwater Samples	Number of New Wells	Number of Wells to Sample			
Site 11 - Caffee Road Landfill	Determine thickness and limits of waste. Characterize waste. Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of waste disposal or oil storage. Evaluate potential contaminant transport to Mattawoman Creek with sediment and surface water samples.	30-65	up to 65	up to 65	6	5	5	7	7	18-53
Site 13 - Paint Solvents Disposal Ground	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of paint and solvent disposal.	9	5	5	--	3	3	--	--	--
Site 17 - Disposed Metal Parts along Mattawoman Creek Shoreline	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of drum contents. Determine whether prior metal material disposal on shoreline contaminated nearby Mattawoman Creek sediment.	10	10	10	--	3	3	6	6	--
Site 21 - Bronson Road Landfill	Determine thickness and limits of waste. Conduct a thorough investigation of surface soils and groundwater to determine if contaminated as result of waste disposal.	20	5	--	--	4	4	--	--	--
Site 25 - Hypo Discharges from Bldg. 588	Conduct a thorough investigation of surface soils, subsurface soils, and groundwater to determine if contaminated as result of hypo discharges.	17	6	8[A]	--	2	2	--	--	--

[A] - two subsurface soil samples will be collected from two depths while installing the monitoring well.

- Historical use/cause of potential contamination
- Site layout, topography, and drainage characteristics
- Type of contamination
- Mobility 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
- Groundwater Sampling; IHDIV-NSWC SOP SA-01
- 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(A)

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. S11 = Site 11)

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)
WW	=	Waste (water)
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)
P	=	Duplicate sample
DDYY	=	QC Samples – 2-digit day and 2-digit year of sampling event

Examples of this numbering approach are:

IS11SS040001	The 4th surface soil sample collected at Site 11, from 0 to 1 feet below ground surface
IS11GW020800P	The 2nd grab GW sample collected at Site 11 in August 2000 (a duplicate sample)
IS17WS01	The 1st IDW sample collected from drums at Site 17

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

IS11FB100196	Field blank collected at Site 11 on October 1, 1996
IS13TB07299701	First trip blank collected at Site 13 on July 29, 1997
IS21EB080198	Equipment blank collected at Site 21 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 samples shall be tightly packed in a cooler with bubble wrap or Vermiculite packaging material and ice as a preservative. The Field Operations Leader (FOL) is responsible for completion of the following forms:

- Sample labels and Chain-of-Custody (COC) 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. Site 11 – Caffee Road Landfill

3.1 Background Information and Site Description

The Caffee Road Landfill is situated at the end of Caffee Road extending about 200 feet on either side of the road to the edge of Unnamed Creek on the West and to Mattawoman Creek on the South. Review of historical aerial photos indicated that filling activities have extended the shoreline into Mattawoman Creek as much as 150 feet from its original position. Site reconnaissance verified that the majority of the Mattawoman Creek shoreline next to Site 11 consists of concrete, debris, and fill. One-quarter of the site, the area adjacent to Unnamed Creek, is classified as a wetland (see Figure 3-1).

The landfill was used until the early 1960s (Kearney, 1988) for the disposal of bulk metal items and trash, rocket motor casings, exploded building debris, rifles, demilitarized ordnance, propellant grains residue and open burning residues. There is no information concerning the date the landfill was first used. Table 3-1 lists some of the items deposited at the Caffee Road site with an estimate of their quantities. In 1980, IHDIV-NSWC reportedly removed 5,000 to 6,000 cubic yards of flashed metal parts from this wetland area. Flashed metal refers to metal debris that was burned to remove trace amounts of explosives residue.

The surface above the landfill is now used as the Decontamination Burn Point and a large collection of flashed metal parts are located atop the unit. A contractor periodically removes the metal parts for sale off-site. The eastern area of the site is now used for drum storage and waste segregation. This site was never permitted as a landfill so there were no organized cover material application procedures to secure deposited or stored waste materials. The IAS indicated that various materials were dumped or left uncovered for extended periods. Surface runoff, site leachate, and air emissions present potential site hazards. The nearest potable water wells are Well 16A, 1,400 feet north-northwest, and Well 17, 1,600 feet north-northeast of the site.

On recent site visits additional debris was observed in the wooded swale northwest of the site, towards the nitramine fine grind facility (see Figure 3-1). The debris consisted of bricks, metal parts, a washing machine, and the end of a fiberglass tank, and appeared to be deposited on the surface only (i.e. not buried). It is unclear whether this debris is associated with disposal activities at Site 11; however, given the proximity to the site, some investigation of the area is warranted.

3.2 Previous Environmental Investigations

The IAS was conducted by NEESA in 1983. The Phase II RCRA Facility Assessment was completed in 1988. No samples were collected at this site during these studies and there is no known analytical data for the site.

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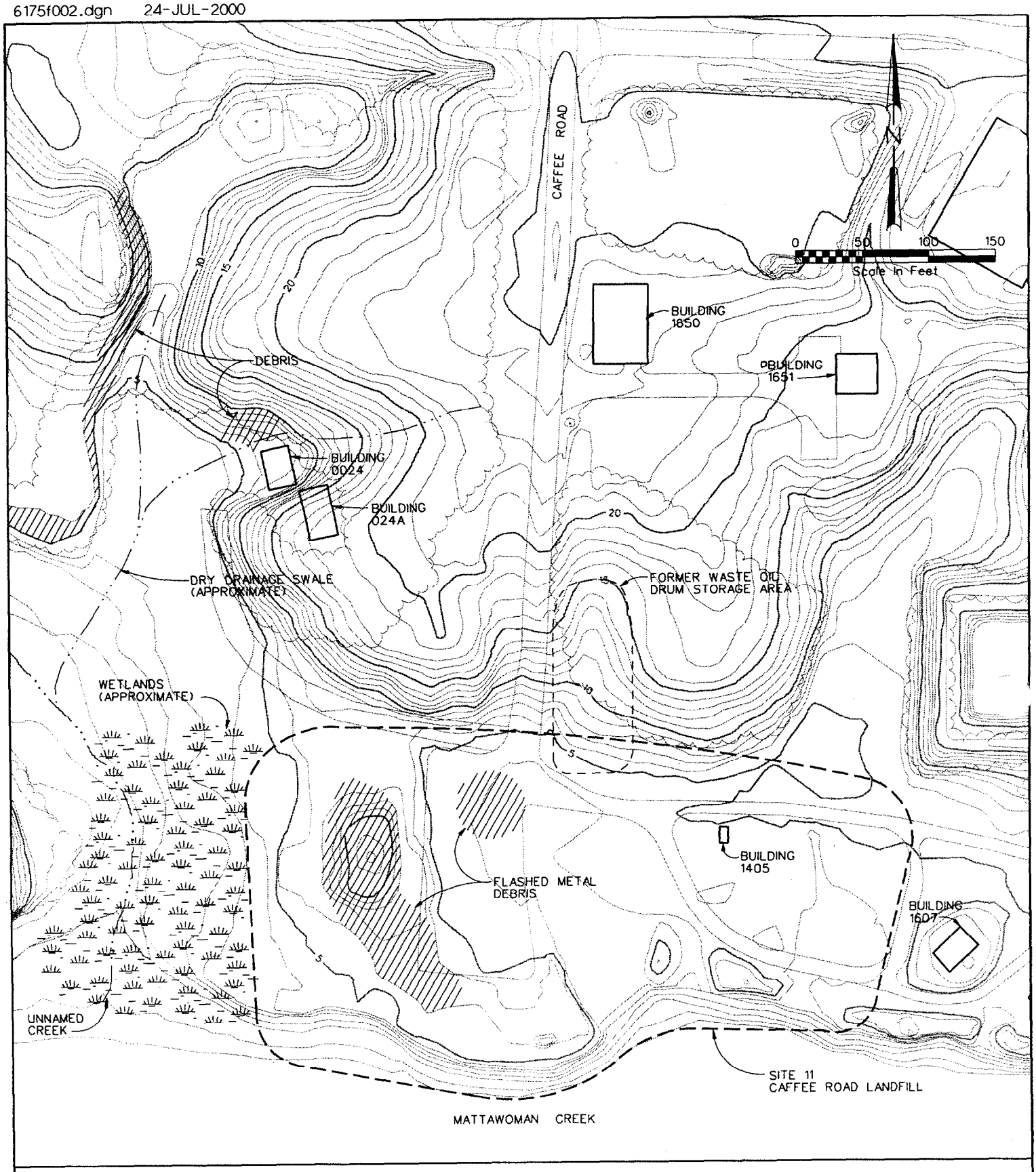

Figure 3-1
SITE 11 EXISTING CONDITION
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER,
INDIAN HEAD DIVISION

NOTE:
NEAREST POTABLE WATER WELLS ARE WELL 16A (1,400 FEET NNW) AND WELL 17 (1,600 FEET NNE).

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TABLE 3-1
Site 11
Material Deposited at Caffee Road Landfill

Material Description	Estimated Quantity	Origin of Material
Flashed bulk waste	5-6,000 cubic yards [1]	Ordnance Activities
Demilitarized ordnance material, propellant grains residue	5,000 pounds/yr [2]	Pyrotechnics Burning Point
Open-burning residues	26,000 pounds/yr [3]	Decontamination Burning Point
Trash dunnage	2,000 cubic yards [4]	Unknown
Pyrolock slurry	6 drums [5]	Unknown
Rifles Model M-1	Unknown	Unknown

NOTES:

[1] Material excavated by NOS in 1980.

[2] Estimated Residue Generation 100 pounds/week.

[3] Q = (Total Quantity of Material Flashed Annually) x (Estimated Combustible Fraction By Net Weight) x (Estimated Residue Fraction) = 517,000 (0.25) (0.20) = 25,850 ~ 26,000 pounds/year

[4] Material observed during team site reconnaissance survey June 17, 1982.

[5] Team site reconnaissance survey June 17, 1982 observed bags contaminated with phenol-type organic chemical compounds and Pyrolock spillage from 2 drums.

SOURCE: Fred C. Hart Associates, 1983.

3.3 Human Health Risk Assessment

A human health risk assessment for Site 11 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 contaminant concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 11 human health risk assessment including the screening methods for determination of chemicals of potential concern (COPCs) and exposure scenarios to be evaluated.

Site 11 is a former landfill/burn area that is not anticipated for residential use in the future. However, Navy policy is to evaluate a hypothetical conservative scenario of future residential use. Therefore, the Region III soil risk-based concentrations (RBCs) for the resident and soil screening levels (SSLs) for transfer from soil to air will be used for screening soil levels at Site 11. The sediment data from the site will be screened against an RBC that is ten times the residential soil value. The Region III RBCs for tap water will be used to screen the groundwater data and ten times the tap water RBC will be used to screen the surface water data. 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 3-2 summarizes the potential receptors that will be evaluated in the human health risk assessment for Site 11. The trespasser adult and adolescent are included in the evaluation because access to the site from Mattawoman Creek is restricted by signs, but not by a fence. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. The site is not anticipated to be used for residential purposes in the future, however, the future residential user is conservatively included in this evaluation.

3.4 Ecological Risk Assessment

An assessment of the potential ecological risks associated with Site 11 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 ecological risk assessment (ERA) process for Site 11. 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 hypotheses.

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 steps deemed necessary at Site 11. Further details on the ERA process and the screening-level problem formulation can be found in Section 4 of the Master Work Plan.

3.4.1 Objectives

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?

3.4.2 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the screening ERA. As described above, in the screening-level problem formulation:

- The environmental setting of a site is characterized in terms of the habitats and biota known or likely to be present
- The types and concentrations of chemicals that are present in ecologically relevant media are characterized

Table 3-2
POTENTIAL EXPOSURE PATHWAYS
SITE 11 - CAFFEE ROAD LANDFILL
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current					Future							
		Industrial Worker	Trespasser/Visitor		Recreational User		Onsite 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										
Surface Water	Ingestion				X*	X*							X*	X*
	Dermal				X*	X*							X*	X*
	Inhalation													
Sediment	Ingestion				X*	X*							X*	X*
	Dermal				X*	X*							X*	X*
	Inhalation													
Fish	Ingestion				X*	X*							X*	X*
	Dermal													
	Inhalation													
Groundwater	Ingestion						X	X						
	Dermal						X	X	X					
	Inhalation						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		

X Quantitative evaluation.

* Current and Future are the same.

A conceptual model is developed for the site that describes potential sources, potential transport pathways, potential exposure pathways and routes, and potential receptors

- Assessment endpoints, measurement endpoints, and risk hypotheses are selected to evaluate those receptors for which complete and potentially significant exposure pathways are likely to exist

These components of the problem formulation are developed for Site 11 in this section. In addition, the fate, transport, and toxicological properties of the chemicals present at a site are also considered during the problem formulation process (as discussed below).

3.4.2.1 Environmental Setting

Habitats and Biota. Habitats within the vicinity of Site 11 include mixed hardwood and pine forest, tidal freshwater marsh, intermittent stream (Unnamed Creek), and tidal river (Mattawoman Creek). The western Cornwallis Neck Marsh Protection Area, which supports the state endangered tickseed sunflower (*Bidens coronata*), is located approximately 750 feet downstream of the site. However, this area is not hydrologically connected to the tidal freshwater marsh at the site.

Mixed hardwood and pine forest is located on the hillsides north of the landfill and west of the marsh (Figure 3-1). The forests are second or third growth and are dominated by several species of oaks (*Quercus* spp.) with red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), and Virginia pine (*Pinus virginiana*). The forest understory is dominated by American holly (*Ilex opaca*). The understory appears heavily browsed by white-tailed deer (*Odocoileus virginianus*).

The tidal freshwater marsh is located at the confluence of Unnamed Creek and Mattawoman Creek. The marsh is approximately 0.75 acres in size with exposed mudflats at low tide. The low marsh is dominated by cattail (*Typha* spp.) and the high marsh is dominated by rose-mallow (*Hibiscus palustris*), wool grass (*Scirpus cyperinus*), and soft rush (*Juncus effusus*). A sparse mixture of immature trees has established in the marsh including sycamore (*Platanus occidentalis*) and black willow (*Salix nigra*). The marsh edge abutting the landfill is dominated by clumps of wild rye (*Elymus villosus*) and black locust (*Robinia pseudoacacia*).

The Unnamed Creek begins north of Olsen Road, flows south under the nitramine fine grind facility, emerges approximately 200 feet south of Olsen Road and broadens into a tidal freshwater marsh at the confluence with Mattawoman Creek. A drainage ditch upgradient of the landfill is located north of Buildings 0024 and 024A and flows southwest joining the Unnamed Creek northwest of the marsh (Figure 3-1). The shoreline of Mattawoman Creek adjacent to the site consists of concrete, debris, and fill. Large sycamores have grown between the debris in some areas. No submerged aquatic vegetation was observed in Mattawoman Creek during a March 2000 site visit.

The fauna observed in these habitats during the March 2000 site visit included marsh wren (*Cistothorus palustris*), northern flicker (*Colaptes auratus*), American crow (*Corvus brachyrhynchos*), gulls (*Larus* spp.), and gray squirrel (*Sciurus carolinensis*). White-tailed deer (*o. virginianus*) tracks were also observed.

Surrounding Land Uses. The surrounding land west of the Caffee Road Landfill is primarily forested. A nitramine fine grind facility and a PCB storage facility are located to the north of the landfill along Olsen Road. Site 17 lies to the east of the landfill along the shoreline of Mattawoman Creek. A propellant disposal facility (including a storm water detention pond), which never went into operation, is located northeast of the landfill.

3.4.2.2 Summary of Available Analytical Data

There are no known analytical data currently available for the site.

3.4.2.3 Preliminary Conceptual Model

Figure 3-2 illustrates the preliminary diagrammatic conceptual model for Sites 11 and 17 (these two sites are evaluated together since they are adjacent to one another). 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. Potential source areas are the landfill at Site 11.

Exposure Pathways. An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure routes. Exposure, and thus potential risk, can only occur if complete exposure pathways exist. Based on the preliminary conceptual model for Site 11 (illustrated on Figure 3-2), complete exposure pathways in terrestrial habitats exist to surface soils located on and adjacent to the landfill. Although no surface water bodies occur on Site 11, Mattawoman Creek (a tidal fresh to brackish water body) borders the landfill to the south and a freshwater wetland borders the landfill to the west (Figure 3-1). Potentially complete transport pathways via surface runoff and groundwater link the landfill (source) to these two water bodies, based on topography and proximity. Thus, complete exposure pathways exist to the surface water and sediments in the creek and wetland located adjacent to Site 11. Complete exposure pathways also exist to upper trophic level receptors that may feed on prey items in these terrestrial, wetland, and aquatic habitats.

Endpoints and Risk Hypotheses. The conclusion of the screening-level problem formulation includes the selection of ecological endpoints, which are based on the conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process, as are risk hypotheses or risk questions. Preliminary assessment endpoints, risk hypotheses, and measurement endpoints (Table 3-3) are developed for Site 11 based on the preliminary conceptual model (illustrated on Figure 3-2) and the complete exposure pathways it identifies. Table 3-3 also identifies specific receptor species or groups associated with each endpoint.

3.5 Work Plan

The objectives of the remedial investigation at Site 11 are to determine the lateral extent and depth of waste disposed of at the site and to determine whether the waste is a source of contamination in the underlying soils or the groundwater at the site. Other objectives include determining whether surface soils have been contaminated by past activities and whether this contamination has spread to the adjacent creeks by surface runoff.

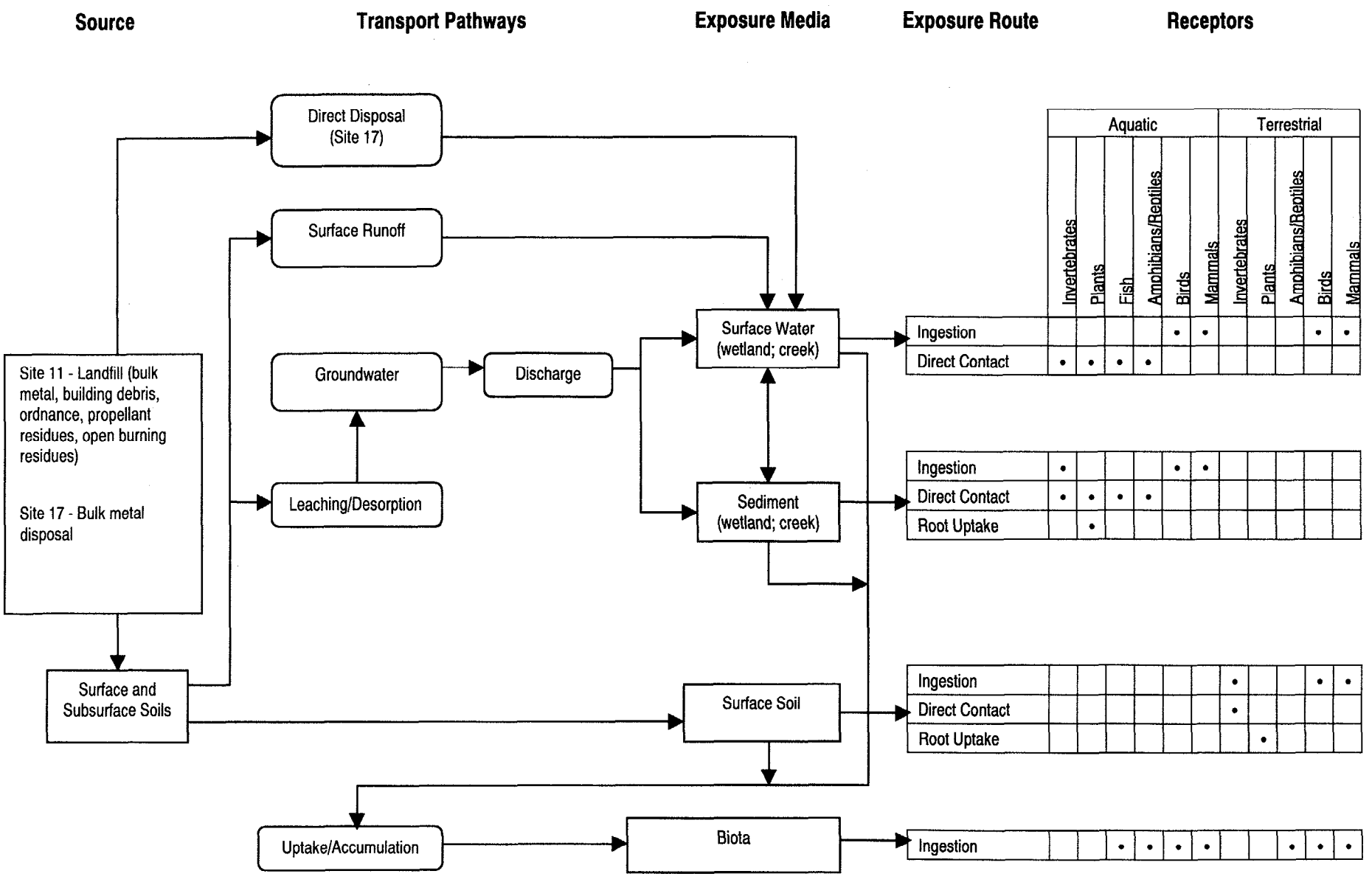

FIGURE 3-2 PRELIMINARY CONCEPTUAL MODEL
NSWC INDIAN HEAD - SITES 11 AND 17

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Table 3-3
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Sites 11 and 17
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Terrestrial Habitats			
Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related surface soil concentrations sufficient to adversely effect soil invertebrate communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Soil Invertebrates (earthworms)
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related surface soil concentrations sufficient to adversely effect terrestrial plant communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American robin
Survival, growth, and reproduction of avian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American kestrel
Survival, growth, and reproduction of mammalian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Short-tailed shrew
Survival, growth, and reproduction of mammalian terrestrial herbivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Meadow vole
Survival, growth, and reproduction of mammalian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Red fox

Table 3-3
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Sites 11 and 17
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Wetland and Aquatic Habitats			
Survival, growth, and reproduction of benthic invertebrate communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect benthic invertebrate communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Benthic invertebrates
Survival, growth, and reproduction of aquatic and wetland plant communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect aquatic or wetland plant communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Aquatic/wetland plants
Survival, growth, and reproduction of fish communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect fish communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Fish
Survival, growth, and reproduction of avian aquatic/wetland insectivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume aquatic invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Marsh wren
Survival, growth, and reproduction of avian aquatic/wetland piscivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume fish from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Great blue heron
Survival, growth, and reproduction of mammalian aquatic/wetland omnivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume aquatic prey from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Raccoon

Since historical information indicates a wide variety of materials may have been disposed of at the site and no previous analytical data is available, samples collected will be analyzed for a full suite of analytes including the target compound list (TCL) of volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), the target analyte list (TAL) of inorganics, and explosives. Explosive analysis at this site will include in addition to the analyte list for EPA Method 8330A, the nitrate esters nitroguanidine and nitroglycerin, pentaerythritol tetranitrate (PETN), and ammonium perchlorate (AP). Because petroleum products were stored and used onsite to ignite fires, samples will also be analyzed for diesel and gasoline range organics (DRO/GRO). Unless otherwise specified samples will be submitted for analysis in a standard 28-day turnaround time (TAT).

Background samples will be collected in areas that are physically upgradient of the site and not expected to be affected by any potential contamination originating at Site 11. Background samples will be used as reference for comparison of analytical results from site samples.

The proposed scope for the field investigation is summarized on Table 3-4. Proposed sample locations are indicated on Figure 3-3. Table 3-5 reviews the sampling program for Site 11, and Table 3-6 provides sample bottleware, preservation, and holding time requirements. A breakdown of the sampling by media is given below:

- *Waste*: The extent of the waste at Site 11 will be determined by drilling in a 100-ft grid pattern and visually logging the boreholes. An all-terrain rig will be used to gain access to the wetland area. In areas where the limits of waste need to be refined further, additional borings will be advanced on a 50-ft grid. In general, the secondary borings will be concentrated towards the presumed limits of the landfill. Each soil boring will be advanced to the depth of groundwater (estimated to be 10 to 15 feet bgs). The total number of soil borings will vary between approximately 18 and 53, based on conditions observed in the field. If the field sampler notices evidence of contamination, a waste sample will be taken – not to exceed one per location. The waste samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, DRO/GRO, explosives, and AP.

- *Surface Soils:* Surface soil contamination presents both a human health and ecological exposure pathway. Contamination in surface soils will be evaluated by collecting samples at each borehole location to a depth of 6 inches. Sample quantities could range from 18 if boreholes are only drilled on a 100-ft grid to about 53 if boreholes are drilled at all secondary 50-ft grid locations. Three additional surface soil samples will be collected near the debris observed in the wooded swale northwest of the site and six additional samples will be collected as shown around Buildings 24 and 24A which were reportedly used as incinerators. Four background surface soil samples will also be collected: one at the background monitoring well location and three others north of Site 11. All surface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, DRO/GRO, explosives, AP, Total Organic Carbon (TOC), and pH.

TABLE 3-4
SITE SPECIFIC WORK PLAN
SITE 11 - CAFFEE ROAD LANDFILL
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis [a,b]
Waste	Site 11	Determine thickness and limits of waste	Use drill rig in 100-ft grid pattern to determine extent of waste - go back and drill in 50-ft grid where necessary. Collect waste samples where there is evidence of contamination (not to exceed one per location).	See Figure 3-3	18-53 [b]	Visual logging of borehole; TCL VOCs and SVOCs, TAL inorganics, explosives, DRO/GRO, AP
Surface Soil	Site 11	Determine whether surface soil is contaminated as result of waste disposal or oil storage.	Collect surface soil samples on 100-ft grid pattern; go back and collect on 50-ft grid where necessary. Collect three additional samples near debris observed in wooded area northwest of site.	See Figure 3-3	27-62 [b]	TCL VOCs and SVOCs, TAL inorganics, explosives, TOC, pH,AP, DRO/GRO
	Background	Determine contaminant levels in background surface soil.	Collect background surface soil samples (0in-6in) at background well location and three other areas north of Site 11.	See Figure 3-3	3	TCL VOCs and SVOCs, TAL inorganics, explosives, DRO/GRO, TOC, pH, AP
Subsurface Soil	Site 11	Determine whether subsurface soil is contaminated as result of waste disposal or oil storage.	Collect subsurface soil samples on 100-ft grid pattern if below waste and above water table; go back and collect on 50-ft grid where necessary.	See Figure 3-3	up to 53 [b]	TCL VOCs and SVOCs, TAL inorganics, explosives, DRO/GRO, AP
	Background	Determine contaminant levels in background subsurface soil.	Collect background subsurface soil samples (2ft-2ft6in) at background well location and three other areas north of Site 11 and 17.	See Figure 3-3 and Figure 5-2	3	TCL VOCs and SVOCs, TAL inorganics, explosives, DRO/GRO, AP
Groundwater	Site 11	Determine whether groundwater is contaminated as result of waste disposal or oil storage.	Collect groundwater grab samples at 6 locations near perimeter of site. 7-day TAT to determine MW locations. Install and sample 4 monitoring wells at chosen locations.	See Figure 3-3	10	TCL VOCs and SVOCs, TAL metals (total and dissolved in MW, dissolved only for grab samples), total cyanide, explosives, DRO/GRO, AP
	Background	Determine contaminant levels in background upgradient groundwater.	Install and sample one monitoring well upgradient from Site 11.	See Figure 3-3	1	TCL VOCs and SVOCs, TAL metals (total and dissolved), total cyanide, explosives, DRO/GRO, AP
Surface Water	Site 11	Determine whether site is a source of contamination to Mattawoman and Unnamed Creeks.	Collect surface water samples from Mattawoman and Unnamed Creek at locations of concentrated surface runoff.	See Figure 3-3	7	TCL VOCs and SVOCs, TAL metals (total and dissolved), total cyanide, explosives, DRO/GRO, hardness, AP
Sediment	Site 11	Determine whether site is a source of contamination to Mattawoman and Unnamed Creeks.	Collect sediment samples from Mattawoman and Unnamed Creek at locations of concentrated surface runoff.	See Figure 3-3	7	TCL VOCs and SVOCs, TAL, explosives, DRO/GRO, TOC, pH, AP

Notes:
a) Explosives analysis will include nitroglycerin, PETN, and nitroguanidine as well as explosives analyzed for by EPA Method 8330A.
b) Number of samples depends on whether intermediate sampling required (i.e.50-foot grid instead of 100-foot grid)

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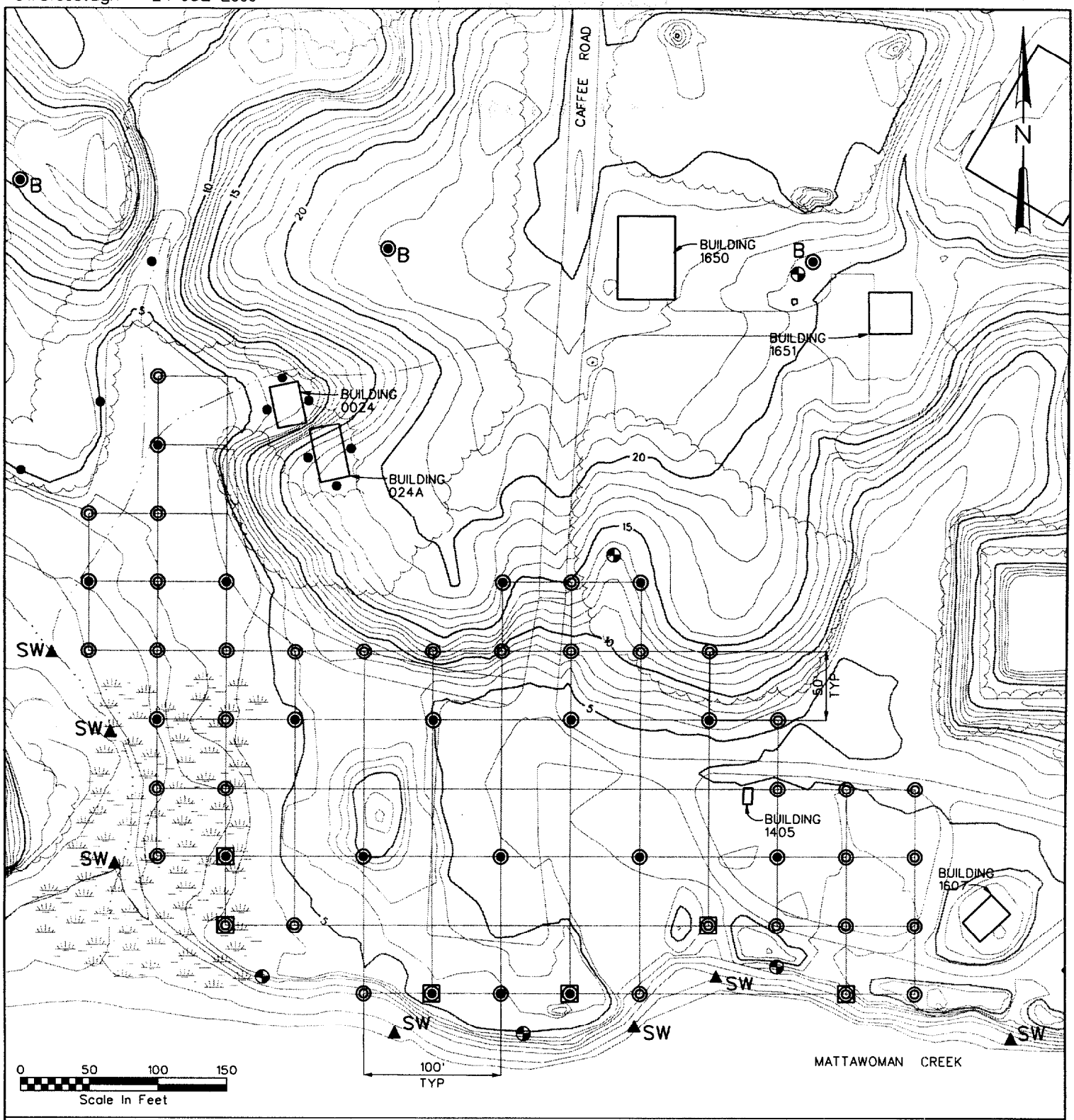

LEGEND

- ▲ SEDIMENT SAMPLE LOCATION
- MONITORING WELL (ACTUAL LOCATIONS TO BE DETERMINED FROM GRAB GROUNDWATER DATA)
- B BACKGROUND SAMPLE
- SW SURFACE WATER SAMPLE
- SURFACE SOIL SAMPLE LOCATION
- SECONDARY SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (AS NEEDED)
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION
- GROUNDWATER GRAB SAMPLE LOCATION

Figure 3-3
SITE 11 PROPOSED SAMPLING LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER, INDIAN HEAD DIVISION

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TABLE 3-5
SAMPLING PROGRAM
SITE 11 - CAFFEE ROAD LANDFILL
INDIAN HEAD, MARYLAND

Sample Media	Sample ID From	Sample ID To	Purpose	Sample Depth/Location	Analysis: VOC	SVOC	Total Metals and Cyanide	Dissolved Metals	Explosives	TPH	Hardness	TOC & pH	Ammonium Perchlorate
Surface Soil	IS11SS010001	IS11SS620001	Site Sample	0" - 6" / Collect surface soil samples in grid pattern (see Figure 3-3 for grid location) and near debris in wooded area northwest of site and around Bldgs. 024 and 024A	x	x	x		x	x		x	x
	IS11SS630001		Background	0" - 6" / Background Sample closest to Unnamed Creek (see Figure 3-3)	x	x	x		x	x		x	x
	IS11SS640001		Background	0" - 6" / Background Sample just west of Caffee Road and north of Bldg. 024A (see Figure 3-3)	x	x	x		x	x		x	x
	IS11SS650001		Background	0" - 6" / Background Sample south of Bldg. 1650 at location of Background Monitoring Well (see Figure 3-3)	x	x	x		x	x		x	x
	IS11SS660001		Background	0" - 6" / Background Sample north of Bldg. 1569 near Site 17 (see Figure 5-2)	x	x	x		x	x		x	x
Subsurface Soil	IS11SB01*BDED*	IS11SB53*BDED*	Site Sample	Depth determined in field (see Figure 3-3 for grid location)	x	x	x		x	x			x
	IS11SB540203		Background	2' - 2' 6" / Background Sample closest to Unnamed Creek (see Figure 3-3)	x	x	x		x	x			x
	IS11SB550203		Background	2' - 2' 6" / Background Sample just west of Caffee Road and north of Bldg. 024A (see Figure 3-3)	x	x	x		x	x			x
	IS11SB560203		Background	2' - 2' 6" / Background Sample south of Bldg. 1650 at location of Background Monitoring Well (see Figure 3-3)	x	x	x		x	x			x
	IS11SB570203		Background	2' - 2' 6" / Background Sample north of Bldg. 1569 near Site 17 (see Figure 5-2)	x	x	x		x	x			x
Waste	IS11WS01*BDED*	IS11WS53*BDED*	Site Sample	Depth determined in field (see Figure 3-3 for grid location)	x	x	x		x	x			x
Groundwater	IS11GW01*MMYY*	IS11GW06*MMYY*	Site Sample	Obtain grab groundwater sample from grid points closest to Mattawoman and Unnamed Creeks - number samples east to west (see Figure 3-3)	x	x		x	x	x			x
	IS11MW01MMYY	IS11MW04*MMYY*	Site Sample	Monitoring Well locations to be decided after grab sample analysis (see Figure 3-3 for temporary location)	x	x	x	x	x	x			x
	IS11MW05*MMYY*		Background	Background Monitoring Well located south of Bldg. 1650 (see Figure 3-3)	x	x	x	x	x	x			x
Surface Water	IS11SW01	IS11SW07	Site Sample	Obtain 4 Surface Water samples from Mattawoman Creek and 2 from Unnamed Creek - number samples east to west (see Figure 3-3)	x	x	x	x	x	x	x		x
Sediment	IS11SD010001	IS11SD070001	Site Sample	0' - 1' / Obtain Sediment Samples from Mattawoman and Unnamed Creeks (upstream to downstream) at Surface Water sample locations - number samples east to west (see Figure 3-3)	x	x	x		x	x		x	x

NOTES:
BDED = ng Depth End Depth as a 4-digit number rounded to the nearest foot (i.e. 2' - 2' 6" = 0203)
MMYY = nd Year as a 4 digit number (i.e. Jan 2001 = 0101)

TABLE 3-6
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITE 11 - CAFFEE ROAD LANDFILL
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Soil	TCL VOCs - CLP OLM04.0	up to 65	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	up to 65	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	up to 65	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	DRO/GRO SW846-8015	up to 65	1	4-oz clear wide-mouth glass	Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	up to 65	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	up to 65	1	4 oz. Glass	Cool to 4°C	14 days to analysis
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	up to 65	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Subsurface Soil	TCL VOCs - CLP OLM04.0	up to 56	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	up to 56	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	up to 56	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	DRO/GRO SW846-8015	up to 56	1	4-oz clear wide-mouth glass	Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	up to 56	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	up to 56	1	4 oz. Glass	Cool to 4°C	14 days to analysis
Waste	TCL VOCs - CLP OLM04.0	up to 53	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	up to 53	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	up to 53	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	DRO/GRO SW846-8015	up to 56	1	4-oz clear wide-mouth glass	Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	up to 53	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	up to 53	1	4 oz. Glass	Cool to 4°C	14 days to analysis
Groundwater	TCL VOCs - CLP OLM04.0	11	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	11	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	11	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	11	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	DRO/GRO SW846-8015	11	1	1 L Polyethylene bottle	H_2SO_4 to pH<2; Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	11	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days
	Ammonium Perchlorate	11	1	250 ml Plastic bottle	Cool to 4°C	14 days to analysis

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

TABLE 3-6
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITE 11 - CAFFEE ROAD LANDFILL
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Water	TCL VOCs - CLP OLM04.0	7	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	7	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	7	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	7	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	DRO/GRO SW846-8015	7	1	1 L Polyethylene bottle	H_2SO_4 to pH<2; Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	7	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days
	Ammonium Perchlorate	7	1	250 ml Plastic bottle	Cool to 4°C	14 days to analysis
	Hardness - EPA Method 130.1	7	1	250 ml glass bottle	HNO_3 to pH<2; Cool to 4°C	6 months
Sediment	TCL VOCs - CLP OLM04.0	7	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	7	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	7	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	DRO/GRO SW846-8015	7	1	4-oz clear wide-mouth glass	Cool to 4°C	14 days to analysis
	Explosives - Modified SW-846-8330 and SW-846-8332*	7	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 4 days to analysis
	Ammonium Perchlorate	7	1	4 oz. Glass	Cool to 4°C	14 days to analysis

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

- *Subsurface Soils*: A subsurface soil sample will be collected at every borehole location where soil exists above the water table and beneath the waste layer to determine whether contaminants have leached from the waste into underlying soils. Sample numbers could range from 0 if no boreholes meet these conditions to approximately 53 if each borehole meets these conditions. Four background subsurface soil samples will also be taken at an interval of 2 feet to 2.5 feet below ground surface (bgs): one at the background monitoring well location and three others north of Site 11. All subsurface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, DPO/GRO, explosives, and AP.

- *Groundwater*: Six groundwater grab samples will be taken at the grid locations closest to Mattawoman and Unnamed Creeks. These samples will be analyzed on a 7-day TAT. The results will be evaluated to determine the best locations to install and sample three monitoring wells that will be located along the downgradient edge of the landfill. One monitoring well will be installed immediately to the east of Caffee Road, near the entrance to the site and in the area where fuel drums were historically stored. One additional monitoring well will be installed upgradient from Site 11 to determine contaminant levels in background groundwater. All groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, TAL total and dissolved metals, cyanide, DRO/GRO, explosives, and AP.

- *Surface Water*: In order to determine whether surface runoff from Site 11 is a source of contamination to the adjacent creeks, four surface water samples will be taken from Mattawoman Creek and three will be taken from Unnamed Creek. Samples will be collected at points where concentrated surface flow discharges from the site. All surface water samples will be analyzed for TCL VOCs, TCL SVOCs, TAL total and dissolved metals, cyanide, DRO/GRO, explosives, AP, and hardness. Field measurements of water temperature, pH, conductivity, dissolved oxygen (DO) and salinity will also be collected at each location.

- *Sediment*: Sediment samples will be taken from the two adjacent creeks at the same seven locations as the surface water samples. All sediment samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, DRO/GRO, explosives, AP, and TOC.

4. Site 13 – Paint Solvents Disposal Ground

4.1 Background Information and Site Description

Site 13 is the Paint Shop (Bldg. 870) which was constructed in 1953 and operated until 1999. Approximately 50 feet to the south and west of the building the terrain slopes down into a wooded area. Two drainage swales radiate from the foot of this slope to the northwest and southwest of Bldg. 870. The drainage swales contain water only during storm-runoff events. The nearest potable water wells are Well 2, 1,800 feet north, and Well 7, 1,950 feet southeast of the site. An asphalt drive surrounds the Paint Shop. See Figure 4-1 for existing conditions at Site 13.

The Paint Shop was used to paint various items by hand using aerosol sprays or paint spray booths. According to the 1983 IAS, between 1953 and 1979, approximately 115 gallons per year of kerosene, mineral spirits, lacquer thinners, and solvents may have been deposited in a depressed area located in the woods behind the Paint Shop. It is also estimated that approximately one percent of the 3,380 gallons of paint used annually may have been washed off during paint equipment cleaning operations, which took place over bare soil areas behind Bldg. 870. Table 4-1 summarizes the estimated quantity of hazardous materials deposited at Site 13 over a 26-year period, using assumed values for paint and lacquer thinner compositions annotated on the table.

Site reconnaissance during the IAS in May 1983 noted severe vegetation and foliage stress over a 400-square-foot area behind the shop, and a strong solvent odor up to 25 feet from the back of Building 870. However, the area was visited twice during the 1988 Phase II RCRA Facility Assessment and the reconnaissance team could not determine the exact location of this unit. They were unable to locate an area of bare or depressed soil and instead they found trees that appeared to be more than 10 years old. The only evidence of contamination noted in the Site 13 area during this visit was one rusted and empty 55-gallon drum located in the wooded area south of the shop. They also noted a solvent odor near the present waste oil storage pad, and stained soil beneath a wooden pallet used for storage of paint cans. The reconnaissance team interviewed the foreman of the maintenance shops and the paint shop foreman and neither of them knew of the existence of a paint solvents disposal area.

4.2 Previous Environmental Investigations

The IAS was conducted by NEESA in 1983. The Phase II RCRA Facility Assessment was completed in 1988. No samples were collected at this site during these studies and there is no known analytical data for the site.

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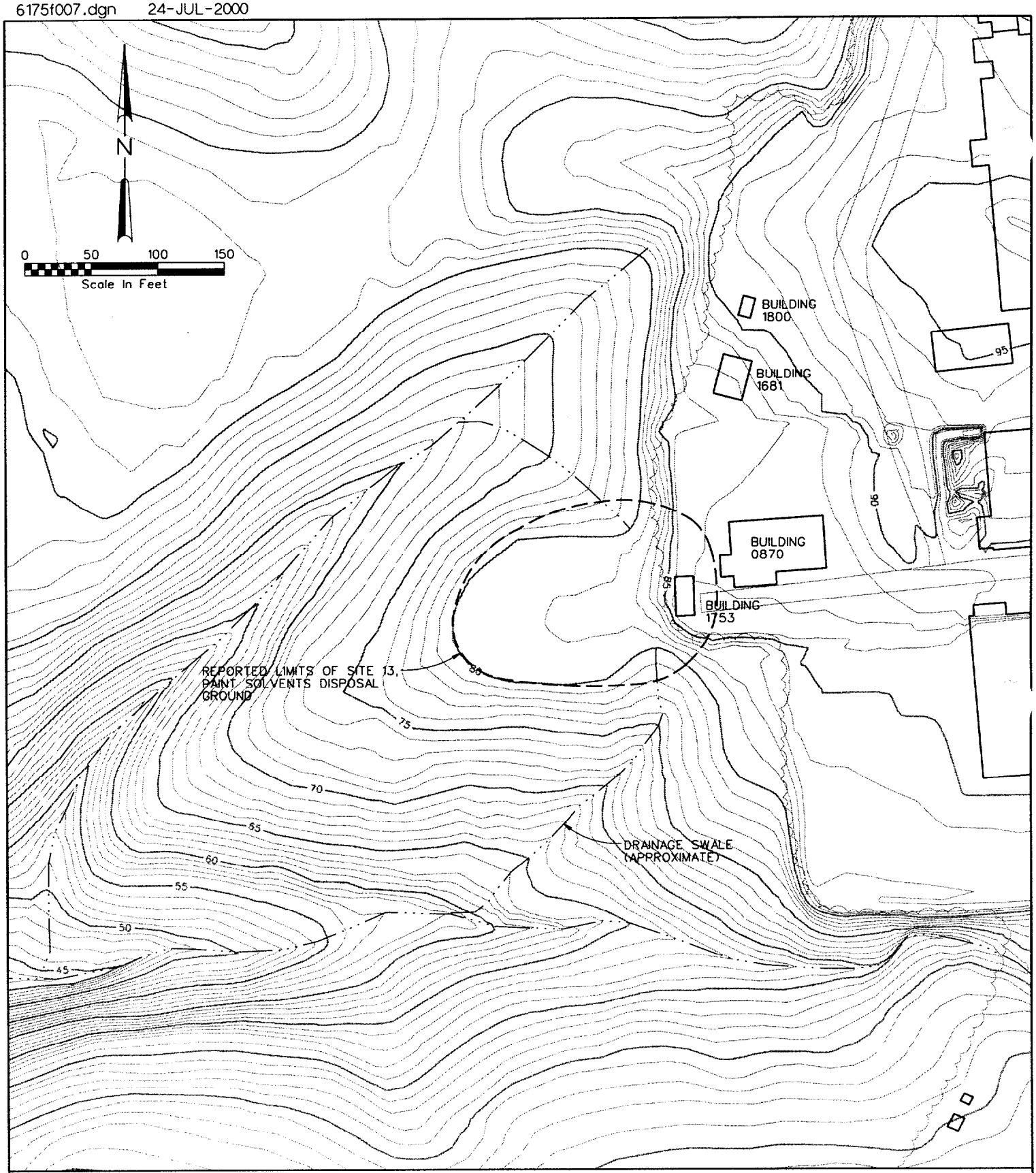

Figure 4-1
SITE 13 EXISTING CONDITION
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

NOTE:
NEAREST POTABLE WATER WELLS ARE WELL 2 (1,800 FEET NORTH) AND WELL 7 (1,950 FEET SOUTHEAST).

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TABLE 4-1
Site 13
Estimate of Quantity of Hazardous Materials Deposited

Contaminant	Estimated Quantity[3] (range in pounds)
Zinc [1], benzene [2], kerosene [2]	1,000 - 10,000
Lead [1], titanium [1], toluene [2], 1,1,1-trichloroethane [2], acetone [1,2], ethyl alcohol [1,2]	100 - 1,000
Ethyl acetate [1], chromium [1], iron [1], benzene, ethyl alcohol, trichloroethane [1]	10 - 100

NOTES:

[1] Estimated Quantity of Paint Washed From Rollers & Brushes Onto Site - assume one percent of total quantity consumed is washed out onto site = (13 lbs/gal) x (3380 gal/yr) x (0.01) x (26 yrs) = *11,424 lbs*

[2] Estimate of Quantity of Material Disposed of on Site – assume composition of thinner to be 1/3 acetone, 1/3 ethyl alcohol, and 1/3 ether alcohol

Kerosene & benzene = (7 lbs/gal) x (55 gal/yr) x (26 yrs) = *18,010 lbs*

Toluene & 1,1,1-trichloroethane = (7 lbs/gal) x (1 gal/yr) x (26 yrs) = *182 lbs*

Lacquer thinner = (7 lbs/gal) x (2 gals/yr) x (26 yrs) = *364 lbs*

[3] Quantity of each contaminant listed is estimated to fall within the range shown.

SOURCE: Fred C. Hart Associates, 1983.

4.3 Human Health Risk Assessment

A human health risk assessment for Site 13 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate whether site contaminant concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 13 human health risk assessment, including the screening methods for determination of COPCs and exposure scenarios to be evaluated.

Site 13 is a wooded area behind Building 870. Currently, there are no development plans for the site and surrounding area. However, it is Navy policy to evaluate a hypothetical conservative scenario of future residential use. Therefore, the Region III soil RBCs for the residential scenario and SSLs for transfer from soil to air will be used for screening soil levels at Site 13. The Region III RBCs for tap water will be used to screen the groundwater data. 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 4-2 summarizes the potential receptors that will be evaluated in the human health risk assessment for Site 13. The trespasser adult and adolescent are included in the evaluation because access to the site is not entirely restricted (though a fence does exist along Mattawoman Creek in the vicinity of the site). The adolescent trespasser is considered to be

TABLE 4-2
POTENTIAL EXPOSURE PATHWAYS
SITE 13 - PAINT SOLVENTS DISPOSAL GROUND
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current		Future					
		Trespasser/Visitor		Onsite Resident		Construction Worker	Industrial Worker	Trespasser/Visitor	
		Adult	Adolescent	Adult	Child			Adult	Adolescent
Surface Soil	Ingestion	X	X						
	Dermal	X	X						
	Inhalation	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
Groundwater*	Ingestion			X	X				
	Dermal			X	X	X			
	Inhalation			X		X			

X Quantitative evaluation.

* Groundwater data will only be collected if the soil investigation determines contamination.

an individual between the ages of 6 and 16 years. The site is not anticipated to be used for residential purposes, in the future, however, the future resident is conservatively included in this evaluation.

4.4 Ecological Risk Assessment

An assessment of the potential ecological risks associated with Site 13 will be conducted following the Navy-Tier II 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), as previously described in Section 3.4. This section of the work plan presents Step 1 of the 8-step ecological risk assessment (ERA) process for Site 13.

4.4.1 Objectives

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?

4.4.2 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the screening ERA. These components of the problem formulation are developed for Site 13 in this section. In addition, the fate, transport, and toxicological properties of the chemicals present at a site are also considered.

4.4.2.1 Environmental Setting

Habitats and Biota. Site 13 is bordered to the west and south by a mixed hardwood and pine forest. The forest is dominated by white oak (*Quercus alba*) and tulip tree (*Liriodendron tulipifera*). The understory is dominated by red maple (*A. rubrum*) and American holly (*I. opaca*). Mature white oaks (*Q. alba*) measure up to 24 inches diameter at breast height (dbh).

The two drainage swales are forested and do not appear to direct significant runoff from the parking lot. The remainder of the site is developed with no natural habitat.

Surrounding Land Uses. As described in the previous section, Site 13 is bordered by forest to the west and south. The land east and north of the site is heavily developed with military buildings and other structures.

4.4.2.2 Summary of Available Analytical Data

There are no known analytical data currently available for the site.

4.4.2.3 Preliminary Conceptual Model

Figure 4-2 illustrates the preliminary diagrammatic conceptual model for Site 13. The potential source area is the area near Building 870 where paints and solvents were disposed of.

Exposure Pathways. Based on the preliminary conceptual model for Site 13 (illustrated on Figure 4-2), potentially complete exposure pathways in terrestrial habitats exist to surface soils located in the forested areas on and adjacent to the site as well as the soils in the two drainage swales. No surface water bodies occur on or in the immediate vicinity of Site 13. Thus, complete transport pathways via surface runoff (via the swales) and groundwater to surface water bodies are not likely for this site, but this would need to be confirmed. Complete exposure pathways also exist to upper trophic level receptors that may feed on prey items in the terrestrial habitats.

Endpoints and Risk Hypotheses. Preliminary assessment endpoints, risk hypotheses, and measurement endpoints (Table 4-3) are developed for Site 13 based on the preliminary conceptual model (illustrated on Figure 4-2) and the complete exposure pathways it identifies. Table 4-3 also identifies specific receptor species or groups associated with each endpoint.

4.5 Work Plan

The objective of the remedial investigation at Site 13 is to determine whether surface and subsurface soils have been contaminated by solvent disposal. The subsurface soils are being tested since solvents migrate downward. The groundwater under Site 13 will be examined in Phase 2 only if evidence of contamination is found in the soils.

Since there is no historical evidence of explosives in the area, collected samples will only be analyzed for paint-related contaminants: TCL VOCs, TCL SVOCs, and TAL metals (no cyanide). All samples will be submitted for analysis with a standard 28-day TAT.

Background samples will be collected in areas that are physically upgradient of the site and not expected to be affected by any potential contamination originating at Site 13. Background samples will be used as reference for comparison of analytical results from site samples.

The proposed scope for the field investigation is summarized on Table 4-4. Proposed sample locations are indicated on Figure 4-3. Table 4-5 reviews the sampling program for Site 13, and Table 4-6 provides sample bottleware, preservation, and holding time requirements. A breakdown of the sampling by media is given below:

- *Surface Soils*: Five surface soil samples will be collected from the likely disposal area at the foot of the grassy slope to the west and south of Bldg. 870 and four additional samples will be collected from the two drainage swales that radiate from Bldg. 870 to the northwest and southwest. Surface soil will be collected from 0 to 6 inches bgs. All surface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL metals, TOC and pH.

- *Subsurface Soils*: Five subsurface soil samples will be collected with an all-terrain direct push rig from the likely disposal area at the foot of the grassy slope to the west and south of Bldg. 870. Subsurface soil will be collected from varying depths. Field personnel will examine the soil cores visually and with the aid of a photoionization detector (PID) to determine the most contaminated 1-ft interval to sample. If the PID readings are consistent or if there are no PID detections then the sample will be taken at the soil/groundwater interface. However, if groundwater was not encountered then the field personnel will rely on visual evidence to decide where to sample. All subsurface soil samples will be analyzed for TCL VOCs, TCL SVOCs, and TAL metals.
- *Groundwater*: If the surface and subsurface soils are found to be contaminated, three monitoring wells will be installed in Phase 2: One at the foot of the western slope, one at the foot of the southern slope, and one upgradient of Bldg. 870 to determine background levels. Groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, and TAL total and dissolved metals. One or more of the analyses may be eliminated if none of the analytes are detected in Phase 1 soil samples.

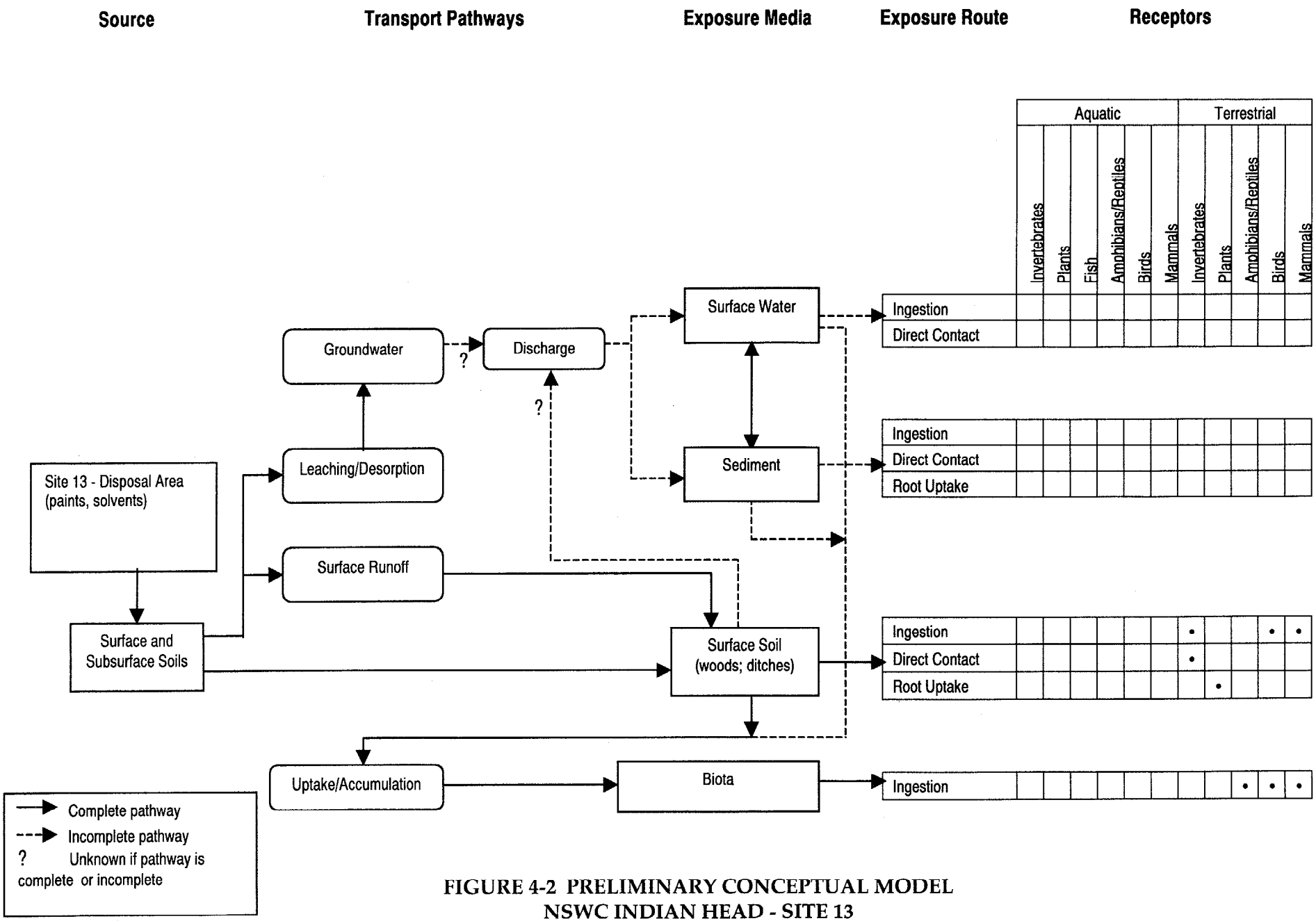

FIGURE 4-2 PRELIMINARY CONCEPTUAL MODEL
NSWC INDIAN HEAD - SITE 13

Table 4-3
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Site 13
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Terrestrial Habitats			
Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related surface soil concentrations sufficient to adversely effect soil invertebrate communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Soil Invertebrates (earthworms)
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related surface soil concentrations sufficient to adversely effect terrestrial plant communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American robin
Survival, growth, and reproduction of avian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Red-tailed hawk
Survival, growth, and reproduction of mammalian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Short-tailed shrew
Survival, growth, and reproduction of mammalian terrestrial omnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume terrestrial plants and invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	White-footed mouse
Survival, growth, and reproduction of mammalian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Gray fox

TABLE 4-4
SITE SPECIFIC WORK PLAN
SITE 13 - PAINT SOLVENTS DISPOSAL GROUND
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis
Phase 1						
Surface Soils	Site 13	Determine whether past disposal of paint and solvents has contaminated surface soils.	Collect surface soil samples (0in-6in) A) in likely disposal area at foot of slope west and south of Bldg. 870 approximately every 40ft, and B) in drainage swales every 100ft where surface flow is concentrated.	See Figure 4-3	9	TCL VOCs and SVOCs, TAL metals (no cyanide), TOC, pH
Subsurface Soils	Site 13	Determine whether past disposal of paint and solvents has contaminated subsurface soils.	Collect subsurface soil samples with all-terrain direct push rig in likely disposal area at foot of slope west and south of Bldg. 870.	See Figure 4-3	5	TCL VOCs and SVOCs, TAL metals
Phase 2 [a]						
Groundwater	Site 13	Determine whether groundwater is contaminated as result of contaminated surface or subsurface soils.	Install and sample monitoring wells to the west and south of Bldg. 870.	See Figure 4-3	2	TCL VOCs and SVOCs, TAL metals (total and dissolved)
	Background	Determine contaminant levels of groundwater upgradient of Site 13.	Install and sample one background monitoring well east of Bldg. 870.	See Figure 4-3	1	TCL VOCs and SVOCs, TAL metals (total and dissolved)

Notes:
a) Phase 2 groundwater sampling will only be performed if soils are determined to be contaminated in Phase I. Analyte list may be reduced if analytes are not detected in Phase 1 sampling.

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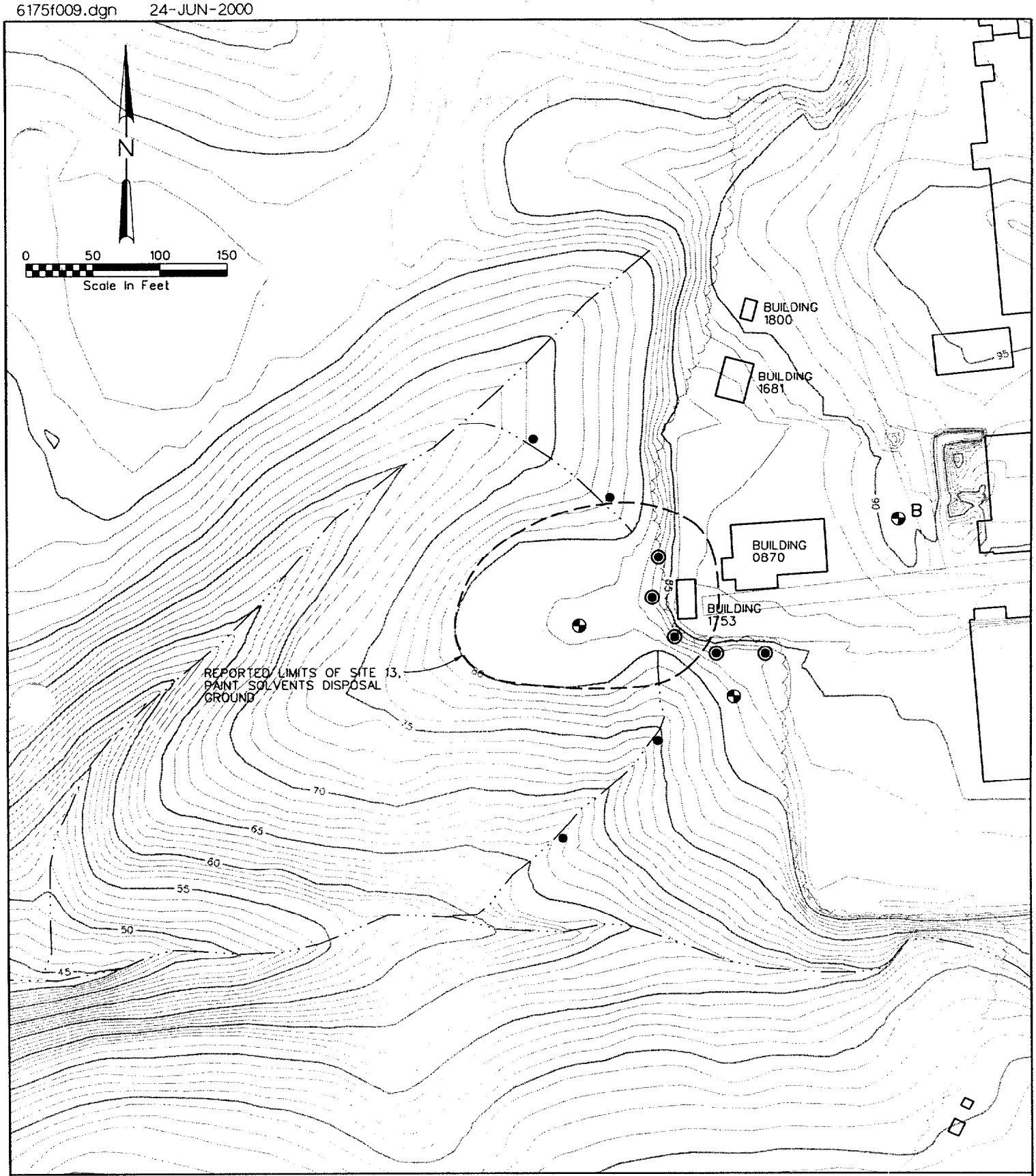

LEGEND

- MONITORING WELL LOCATION
- BACKGROUND SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

Figure 4-3
SITE 13 PROPOSED SAMPLING LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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TABLE 4-5
SAMPLING PROGRAM
SITE 13 - PAINT SOLVENTS DISPOSAL GROUND
INDIAN HEAD, MARYLAND

Sample Media	Sample ID		Purpose	Sample Depth/Location	Analysis				
	From	To			VOC	SVOC	Total Metals	Dissolved Metals	TOC and pH
Surface Soil	IS13SS010001	IS13SS030001	Site Sample	0" - 6" / Collect 3 surface soil samples at the foot of the slope west of Bldg. 870 (see Figure 4-2)	x	x	x		x
	IS13SS040001	IS13SS050001	Site Sample	0" - 6" / Collect 2 surface soil samples at the foot of the slope south of Bldg. 870 (see Figure 4-2)	x	x	x		
	IS13SS060001	IS13SS090001	Site Sample	0" - 6" / Collect 2 surface soil samples on each of the two drainage swales that radiate from Bldg. 870 (see Figure 4-2)	x	x	x		
Subsurface Soil	IS13SB010203	IS13SB030203	Site Sample	2' - 2' 6" / Collect 3 subsurface soil samples at the foot of the slope west of Bldg. 870 (see Figure 4-2)	x	x	x		
	IS13SB040203	IS13SB050203	Site Sample	2' - 2' 6" / Collect 2 subsurface soil samples at the foot of the slope south of Bldg. 870 (see Figure 4-2)	x	x	x		
Groundwater *	IS13MW01*MMYY*		Site Sample	Monitoring Well located west of Bldg. 870 (see Figure 4-2)	x	x	x	x	
	IS13MW02*MMYY*		Site Sample	Monitoring Well located south of Bldg. 870 (see Figure 4-2)	x	x	x	x	
	IS13MW03*MMYY*		Background	Background Monitoring Well located east of Bldg. 870 (see Figure 4-2)	x	x	x	x	

* Groundwater analytical list may be reduced if analyte is not detected in any samples collected in Phase 1.

NOTES:
BDED = Beginning Depth End Depth as a 4-digit number rounded to the nearest foot (i.e. 2' - 2' 6" = 0203)
MMYY = Month and Year as a 4
digit number (i.e. Jan 2001 = 0101)

TABLE 4-6
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITES 13 - PAINT SOLVENTS DISPOSAL GROUND
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Soil	TCL VOCs - CLP OLM04.0	9	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	9	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Metals - CLP ILM04.0	9	1	250 ml Clear wide-mouth glass	Cool to 4oC	6 months; Hg 28 days
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	9	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Subsurface Soil	TCL VOCs - CLP OLM04.0	5	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	5	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Metals - CLP ILM04.0	5	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
Groundwater	TCL VOCs - CLP OLM04.0	3	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	3	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Metals - CLP ILM04.0	3	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

5. Site 17 – Discarded Metal Parts Along Mattawoman Creek Shoreline

5.1 Background Information and Site Description

Site 17 is located adjacent to Site 11 to the east northeast along Mattawoman Creek. Buildings 1569 and 1570 are found on a 20-ft ridge above this site. Site 17 is defined as a 1000-foot stretch of shoreline along the Mattawoman Creek where metal parts were discarded. The nearest potable water well is Well 17 that is 1,000 feet north of the site. Figure 5-1 shows existing conditions at the site.

Metal parts were discarded along the Mattawoman Creek shoreline from the 1960s until the early 1980s. The disposed materials included rocket motor casings, shipping containers, empty drums, and various metal parts. A site reconnaissance done for the Initial Assessment Study in 1983 confirmed the presence of rusted metal parts in the vicinity of the reported disposal area. They noted that the submerged materials were covered over with bottom sediments. The Phase II RCRA Facility Assessment in August 1988 stated that NOS representatives intended to remove the metal parts in 1989 under the direction of the Army Corps of Engineers and the Fish and Wildlife Department. It is assumed that this removal occurred since recent site reconnaissance could not locate any large metal items on the shoreline.

The defined area of this site was expanded in 1997 to include the forested area 100 feet from the shoreline where dozens of rusted drums were identified. A site reconnaissance during January 2000 found the drums disintegrated with rust and partially buried in the soil. The majority of the drums had holes exposing a yellow wax-like material. In 1997, the first time these drums were located, the substance was described as being fluid and the drums were noted to be more intact. The origin of these drums cannot be verified by base personnel; however, the Indian Head laboratory has analyzed the contents and determined that the substance is wax. The contents were found to be safe to handle (e.g., not explosive) though they may contain residual levels of explosives.

5.2 Previous Environmental Investigations

The IAS was conducted by NEESA in 1983. The Phase II RCRA Facility Assessment was completed in 1988. No samples were collected at this site during these studies and there is no known analytical data for the site.

5.3 Human Health Risk Assessment

A human health risk assessment for Site 17 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate

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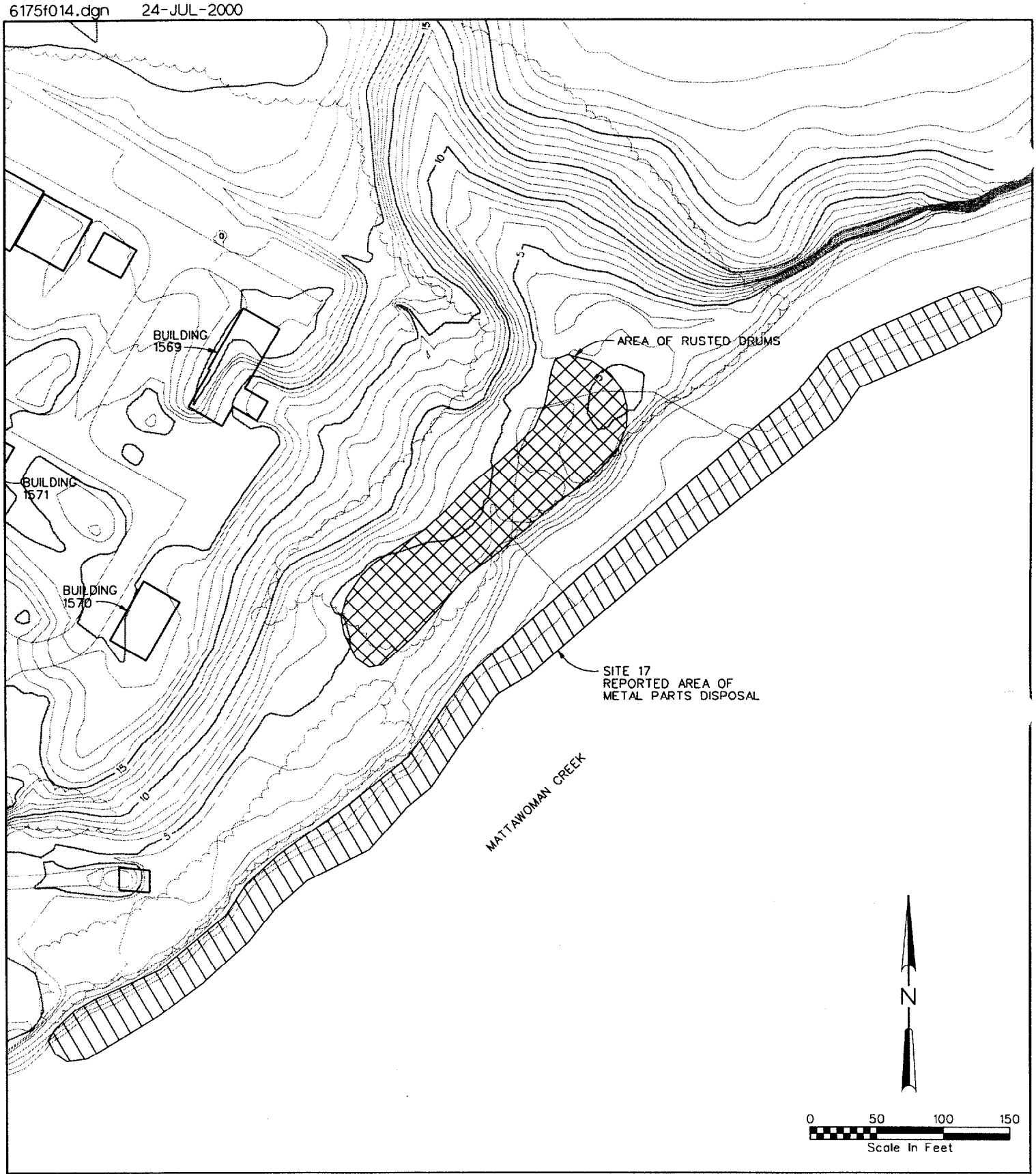

Figure 5-1
SITE 17 EXISTING CONDITION
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER,
INDIAN HEAD DIVISION

NOTE:
NEAREST POTABLE WATER WELL IS WELL 17 (1,000 FEET NORTH).

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whether site contaminant concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 17 human health risk assessment, including the screening methods for determination of COPCs and exposure scenarios to be evaluated.

Site 17 is a wooded area adjacent to Mattawoman Creek. Currently, there are no development plans for the site and surrounding area. However, it is Navy policy to evaluate a hypothetical conservative scenario for future residential use. Therefore, the Region III RBCs for the residential scenario and SSLs for transfer from soil to air will be used for screening soil levels at Site 17. The sediment data from the site will be screened against an RBC that is ten times the residential soil value. The Region III RBCs for tap water will be used to screen the groundwater data and ten times the tap water RBC will be used to screen the surface water data. 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 5-1 summarizes the potential receptors that will be evaluated in the human health risk assessment for Site 17. The trespasser adult and adolescent are included in the evaluation because access to the site is not restricted from Mattawoman Creek (except by signs). The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. The site is not anticipated to be used for residential purposes in the future, however, the future resident is conservatively included in this evaluation.

5.4 Ecological Risk Assessment

An assessment of the potential ecological risks associated with Site 17 is conducted following the Navy-Tier II 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) and is described in Section 3.4. This section of the work plan presents Step 1 of the 8-step ecological risk assessment (ERA) process for Site 17.

5.4.1 Objectives

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?

5.4.2 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the screening ERA. These components of the problem formulation are developed for Site 17 in this section. In addition, the fate, transport, and toxicological properties of the chemicals present at a site are also considered.

TABLE 5-1
POTENTIAL EXPOSURE PATHWAYS
SITE 17 - METAL DEBRIS ON MATTAWOMAN CREEK SHORELINE
INDIAN HEAD, MARYLAND

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

X Quantitative evaluation.

* Current and Future are the same.

** Groundwater data will only be collected if the soil investigation determines contamination.

5.4.2.1 Environmental Setting

Habitats and Biota. Site 17 habitat includes Mattawoman Creek, its shoreline, and the riparian forested buffer. The western Cornwallis Neck Marsh Protection Area, which supports the state endangered tickseed sunflower (*Bidens coronata*), is located approximately 950 feet downstream of the site.

Mattawoman Creek supports spawning populations of fish including white perch (*Morone americana*), yellow perch (*Perca flavenscens*), American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), and largemouth bass (*Micropterus salmoides*). Mattawoman Creek also supports channel catfish (*Ictalurus punctatus*) and bluegill (*Lepomis macrochirus*) (DINRMP 2000). The shoreline of Mattawoman Creek is gravelly and degraded with discarded metal parts and other debris used for erosion control. Vegetation within the intertidal shore includes wild rye (*E. villosus*) and rose-mallow (*H. palustris*).

The riparian forested buffer is sparsely vegetated with black locust (*R. pseudoacacia*) and sweet gum (*L. styraciflua*). Japanese honeysuckle (*Lonicera japonica*) is also common within the buffer. Wild rye (*E. villosus*) dominates the herbaceous layer. The ground surface is littered with rusted drums.

Surrounding Land Uses. Site 11 borders Site 17 on the west. A propellant disposal facility, which never went into operation, is located north of the site. The surrounding land to the east of the site is primarily forested.

5.4.2.2 Summary of Available Analytical Data

There are no known analytical data currently available for the site.

5.4.2.3 Preliminary Conceptual Model

Figure 3-2 illustrates the preliminary diagrammatic conceptual model for Sites 11 and 17 (these two sites are evaluated together since they are adjacent to one another). Potential source areas are the areas of bulk metal and drum disposal at Site 17.

Exposure Pathways. Based on the preliminary conceptual model for Site 17 (illustrated on Figure 3-2), complete exposure pathways in terrestrial habitats exist to surface soils located on and adjacent to the area of rusted drums (Figure 5-1). Mattawoman Creek (a tidal fresh to brackish water body) borders the site to the south and metal parts have been disposed of in near shore areas of the creek. Potentially complete transport pathways via surface runoff and groundwater link the disposal areas (source) to the creek, based on topography and proximity. Thus, complete exposure pathways exist to the surface water and sediments in the creek. Complete exposure pathways also exist to upper trophic level receptors that may feed on prey items in these terrestrial and aquatic habitats.

Endpoints and Risk Hypotheses. Preliminary assessment endpoints, risk hypotheses, and measurement endpoints (Table 3-2) are developed for Site 17 based on the preliminary conceptual model (illustrated on Figure 3-2) and the complete exposure pathways it identifies. Table 3-2 also identifies specific receptor species or groups associated with each endpoint.

5.5 Work Plan

The objectives of the remedial investigation at Site 17 are to determine whether the metal parts disposed of along the shoreline contaminated sediment and surface water in the adjacent creek and to determine whether the drums and/or their contents contaminated the surface/subsurface soil and groundwater in the surrounding area. The sampling is targeted to address each of these goals. The sediment and surface water sampling will address the potential contamination by the metal parts on the shoreline and the surface soil, subsurface soil, and groundwater sampling will address the potential contamination under the rusted drums. The sampling adjacent to the rusted drums will be phased. If surface and subsurface soils are found to be contaminated then monitoring wells will be installed and groundwater will be sampled.

The Indian Head laboratory has performed an initial sampling and screening for explosives. The results of this analysis indicate that the material in the drums is wax, and is non-explosive. However, since it is not known whether all of the drums disposed of at Site 17 contained the same substance, a program of surface and subsurface soil sampling is proposed in the vicinity of the drums. Surface soil samples collected near the drums will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives. Explosive analysis at this site will include in addition to the analyte list for EPA Method 8330A, the nitrate esters nitroguanidine and nitroglycerin, pentaerythritol tetranitrate (PETN), and ammonium perchlorate. Because historical information indicates that metal parts (potentially with traces of explosives) are the source of contamination along the shoreline, the sediment samples will only be analyzed for TAL inorganics and explosives. All samples will be submitted for analysis with a standard 28-day TAT.

Background samples collected for Site 11 will be used as reference for comparison of analytical results from Site 17 samples. Sediment background samples will be collected on the Mattawoman Creek shoreline upstream of the site.

The proposed scope for the field investigation is summarized on Table 5-2. Table 5-3 reviews the sampling program for Site 17, and Table 5-4 provides sample bottleware, preservation, and holding time requirements. Figure 5-2 shows proposed sampling locations. A breakdown of the sampling by media is given below:

- *Sediment*: To determine if the discarded metal parts had any affect on Mattawoman Creek, four sediment samples will be collected from the shoreline. Two additional sediment samples will be collected from the shoreline upstream of the site to determine upgradient conditions (these are not true background samples due to possible influence of other IR sites upgradient of Site 17 along Mattawoman Creek). All sediment samples will be analyzed for TAL inorganics and explosives.

- *Surface Water*: Four surface water samples will be collected at the same locations as for sediment. All surface water samples will be analyzed for TAL total and dissolved metals, cyanide, explosives, and hardness. Field measurements of water temperature, pH, conductivity, DO, and salinity will also be collected at each location.

- *Surface Soil*: Ten surface soil samples will be collected near the rusted drums and in areas where surface soil might collect to determine whether the drums have

contaminated the surrounding soil. Soil will be collected from 0 to 6 inches below ground surface. The background samples collected for Site 11 will be used as a reference. All surface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, explosives, TOC, and pH.

- *Subsurface Soil*: Ten subsurface soil samples will be collected near the rusted drums at the same locations as the surface soil samples. Soil will be collected from 2 to 2.5 feet below ground surface. The background samples collected for Site 11 will be used as a reference. All subsurface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and explosives.
- *Groundwater*: If surface and subsurface soil samples are determined to be contaminated, up to three monitoring wells will be installed and sampled for groundwater. The groundwater sample will be analyzed for TCL VOCs, TCL SVOCs, TAL total and dissolved metals, cyanide, and explosives.

TABLE 5-2
SITE SPECIFIC WORK PLAN
SITES 17 - METAL DEBRIS ON MATTAWOMAN CREEK SHORELINE
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis [a]
Phase 1						
Sediment	Site 17 Shoreline	Determine whether prior metal materials disposed of on shoreline contaminated the Mattawoman Creek sediment.	Collect sediment along Mattawoman Creek approximately every 200 ft.	See Figure 5-2	4	TAL inorganics, explosives, TOC, AP
	Upgradient	Determine contaminant levels in upgradient sediment at Mattawoman Creek.	Collect sediment along Mattawoman Creek upstream of Site 17	See Figure 5-2	2	TAL inorganics, explosives, TOC, AP
Surface Water	Site 17 Shoreline	Determine whether prior metal materials disposed of on shoreline contaminated the Mattawoman Creek surface water.	Collect surface water at sediment sample locations.	See Figure 5-2	4	TAL metals (total and dissolved), cyanide, explosives, hardness, AP
	Upgradient	Determine contaminant levels in upgradient surface water at Mattawoman Creek.	Collect surface water at sediment sample locations.	See Figure 5-2	2	TAL metals (total and dissolved), cyanide, explosives, hardness, AP
Surface Soil	Site 17 Drum Area	Determine whether surface soil next to drums is contaminated.	Collect surface soil samples near rusted drums or in areas where surface soil might collect.	See Figure 5-2	10	TCL VOCs, TCL SVOCs, TAL, explosives, TOC, pH, AP
Subsurface Soil	Site 17 Drum Area	Determine whether subsurface soil next to drums is contaminated.	Collect subsurface soil samples near rusted drums.	See Figure 5-2	10	TCL VOCs, TCL SVOCs, TAL, explosives, AP
Phase 2 [b]						
Groundwater	Site 17 Drum Area	Determine whether discarded metal debris or drums have contaminated groundwater (wells to be installed only if contamination is detected in soil samples)	Install and sample monitoring wells. Locations to be determined after soil sample results are received.	See Figure 5-2	3	TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), cyanide, explosives, AP

Notes:
a) Explosives analysis will include nitroglycerin, PETN, and nitroguanidine as well as explosives analyzed for by EPA Method 8330A.
b) Phase 2 soil and groundwater sampling will only be performed if surface soils are determined to be contaminated. Groundwater analytical list may be reduced if analytes are not detected in site soils.

TABLE 5-3
SAMPLING PROGRAM
SITES 17 - METAL DEBRIS ON MATTAWOMAN CREEK SHORELINE AND DRUM DISPOSAL AREA
INDIAN HEAD, MARYLAND

Sample Media	Sample ID From	Sample ID To	Purpose	Sample Depth/Location	Analysis: VOC	SVOC	Total Metals and Cyanide	Dissolved Metals	Explosives	TOC & pH	Hardness	Ammonium Perchlorate
Sediment	IS17SD030001	IS17SD060001	Site Sample	0' - 1' / Obtain Sediment Samples from Mattawoman Creek (downstream to upstream) - number samples west to east (see Figure 5-2)			x		x	x		x
	IS17SD010001	IS17SD020001	Upgradient	0' - 1' / Obtain upgradient Sediment Samples from Mattawoman Creek (downstream to upstream) - number samples west to east (see Figure 5-2)			x		x	x		x
Surface Water	IS17SW03	IS17SD06	Site Sample	Obtain surface water samples at same locations as sediment samples (see Figure 5-2)			x	x	x		x	x
	IS17SW01	IS17SW02	Upgradient	Obtain surface water samples at same locations as sediment samples (see Figure 5-2)			x	x	x		x	x
Surface Soil	IS17SS010001	IS17SS100001	Site Sample	0" - 6" / Collect surface soil samples near rusted drums - exact locations based on field observations (see Figure 5-2)	x	x	x		x	x		x
Subsurface Soil	IS17SB010203	IS17SB100203	Site Sample	2' - 2' 6" / Collect subsurface soil samples near rusted drums - exact locations based on field observations (see Figure 5-2)	x	x	x		x			x
Groundwater *	IS17MW01*MMYY*	IS17MW03*MMYY*	Site Sample	Monitoring Well locations to be determined based on soil sample results(see Figure 5-2 for temporary location)	x	x	x	x	x			x

* Groundwater analytical list may be reduced if analyte is not detected in any samples collected in Phase 1.

NOTES:
BDED = Beginning Depth End Depth as a 4-digit number rounded to the nearest foot (i.e. 2' - 2' 6" = 0203)
MMYY = Month and Year as a 4 digit number (i.e. Jan 2001 = 0101)

TABLE 5-4
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITES 17 - METAL DEBRIS ON MATTAWOMAN CREEK SHORELINE
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Soil	TCL VOCs - CLP OLM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	10	1	4 oz. Glass	Cool to 4°C	14 days to analysis
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	10	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Subsurface Soil	TCL VOCs - CLP OLM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	10	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	10	1	4 oz. Glass	Cool to 4°C	14 days to analysis
Groundwater	TCL VOCs - CLP OLM04.0	3	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	3	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	3	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	3	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	3	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days
	Ammonium Perchlorate	3	1	250 ml Plastic bottle	Cool to 4°C	14 days to analysis

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

TABLE 5-4
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITES 17 - METAL DEBRIS ON MATTAWOMAN CREEK SHORELINE
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Sediment	TAL Inorganics - CLP ILM04.0	6	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	6	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	6	1	4 oz. Glass	Cool to 4°C	14 days to analysis
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	6	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Surface Water	TAL Inorganics - CLP ILM04.0	6	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	6	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	6	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days
	Ammonium Perchlorate	6	1	250 ml Plastic bottle	Cool to 4°C	14 days to analysis
	Hardness - EPA Method 130.1	6	1	250 ml glass bottle	HNO_3 to pH<2; Cool to 4°C	6 months

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

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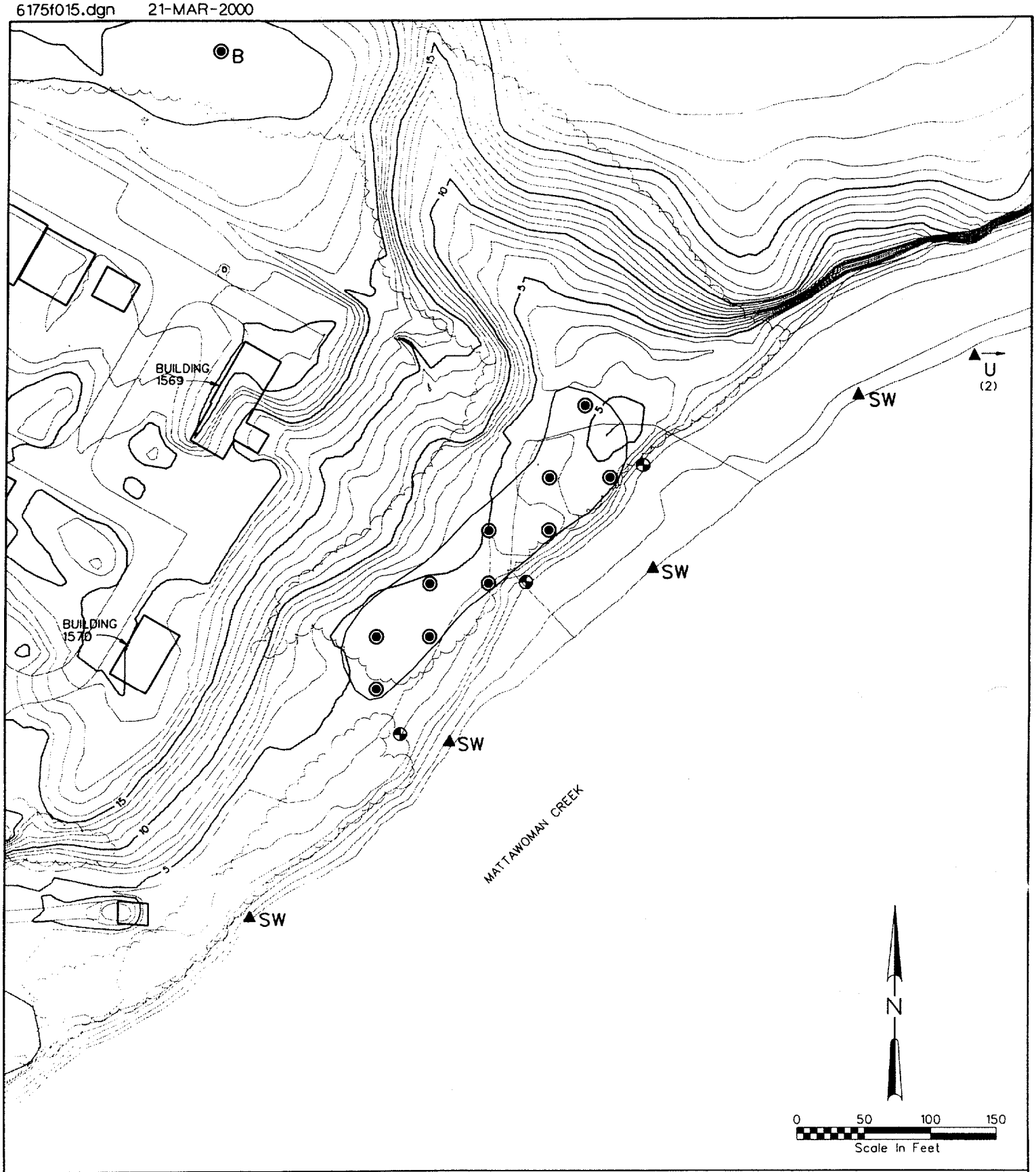

LEGEND

- ▲ SEDIMENT SAMPLE LOCATION
- ◐ MONITORING WELL (ACTUAL LOCATIONS TO BE DETERMINED FROM DRUM CONTENTS ANALYSIS)
- B BACKGROUND SAMPLE
- U UPGRADIENT SAMPLE
- SW SURFACE WATER SAMPLE
- ◉ SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION

Figure 5-2
SITE 17 PROPOSED SAMPLING LOCATION
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER,
INDIAN HEAD DIVISION

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6. Site 21 – Bronson Road Landfill

6.1 Background Information and Site Description

Site 21 (1980 Naval Shore Activity Disposal Site Fact Form Site 7) is located on Bronson Road across from Bldg. 1384 approximately 500 feet from Mattawoman Creek. It extends from Bldg. 478 on the north and to Bldg. 480 on the south. An unpaved road runs along the eastern side of the reported site limit. Originally this site was the location of a two-acre gravel mining pit. However, around 1975 the NOS PW Department began filling in the pit with trash generated in the explosives manufacturing area. This practice ended in November 1981 when a 40-cubic-yard dumpster was placed at the site to act as a transfer station. This dumpster was collected weekly by a private contractor for off-station disposal. The site also accepted sludges from paint spray booths and bagged asbestos until June 1982. The IAS reports that the underlying soils are relatively impermeable and that the groundwater is an estimated 40 to 50 ft below the deposited materials, but there are no known soil borings or monitoring wells at the site to support this statement. The site was formerly surrounded by 20-foot cliffs on three sides; however, placement of fill from other sites on IHDIV-NSWC has brought the ground surface nearly up to the elevation of the cliff tops. The nearest potable water well is Well 18 that is 450 feet north of the site. Figure 6-1 shows existing conditions at the site.

The landfill was filled using trench excavation methods and is estimated to contain approximately 1,500 tons of trash and various quantities of paint sludges, asbestos, and barium sulfate. Table 6-1 lists some of the materials and quantities reportedly disposed of at the Bronson Road Landfill. Table 6-2 provides calculations of hazardous materials deposited at the Bronson Road Landfill based on reported quantities and the assumption that approximately 60 gallons of paint and varnish were disposed of at the site during the facility's total operating years. These items were included in the estimate since some of them were observed in the 40-cubic-yard dumpster near the landfill and were reported by various sources to have been deposited at the site. This analysis indicates that asbestos, barium and various other metals (notably zinc and lead), and non-halogenated solvents are the contaminants estimated to be present in the largest quantities.

Site reconnaissance conducted in 1982 indicated the facility had a partial cover over the deposited material (6 inches to 1 foot in depth). Uncovered bags of asbestos were observed, as well as several small dark brown colored pools of water which may have been leachate. However, by 1989 the inactive landfill had been completely covered with a soil cap. The thickness of the cap is being continually increased using soil from various locations at IHDIV-NSWC. The dumpster was removed in 1996, and the area was regraded, so that the current ground surface is approximately 10 to 15 feet higher than the level of the dumpster. Excavation of a sediment pond near the north end of the site in 1996 uncovered waste consisting mostly of plastic, glass, and metal.

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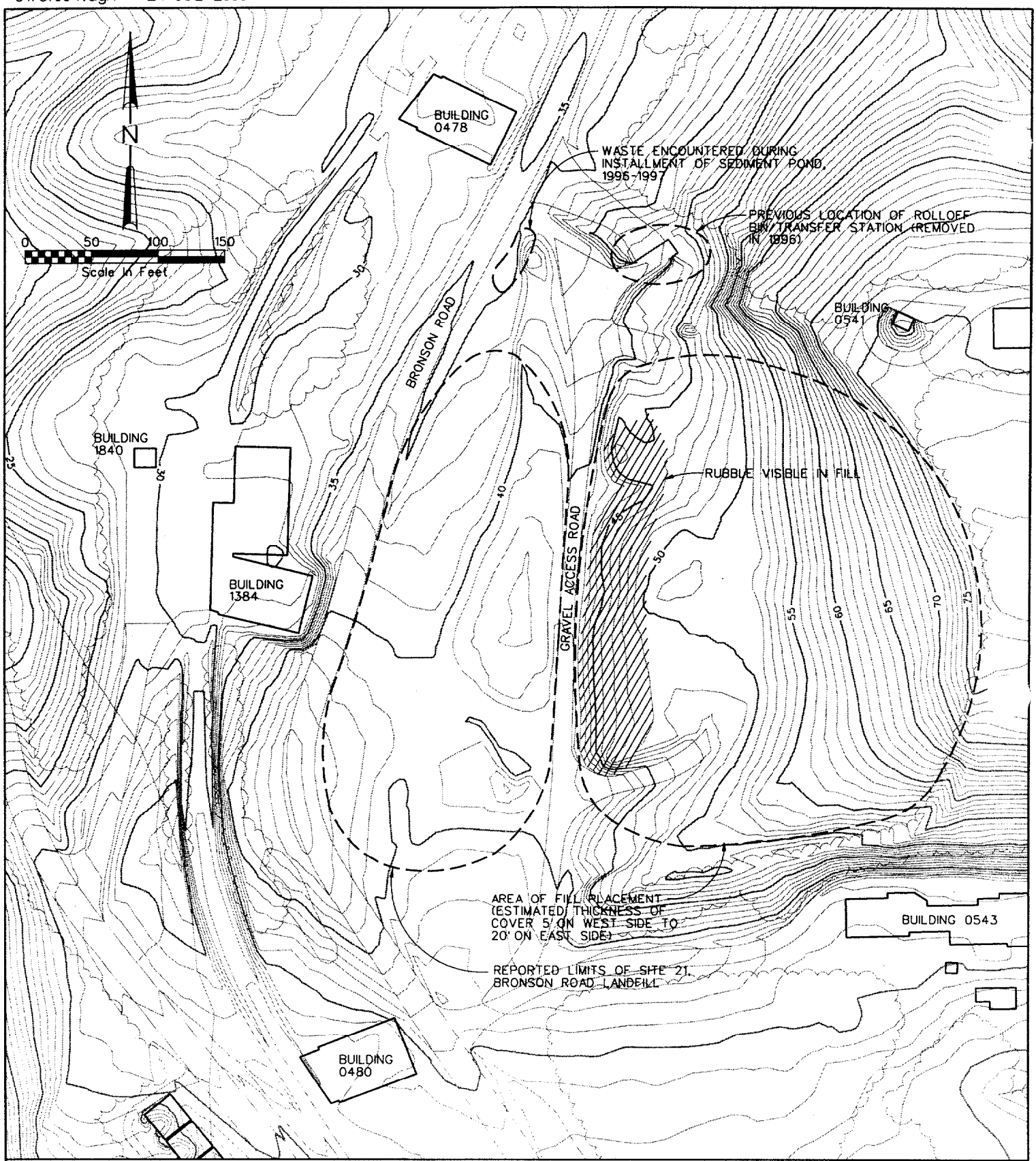

Figure 6-1
SITE 21 EXISTING CONDITION
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

NOTE:
NEAREST POTABLE WATER WELL IS WELL 18 (450 FEET SOUTHEAST).

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TABLE 6-1
Site 21
Material Disposed of at Bronson Road Landfill

Material	Quantity [1] (tons)	Description
Solid Waste	1500 [2, 3, 4]	Shop trash, lumber, metal, empty boxes, empty cans, tires, glassware, bottles, pallets
Barium sludge	2. 5 [3]	Insoluble white powder delivered in 55 gallon drums
Asbestos	3. 3 [5]	Pyrolock delivered in colored plastic bags
Paint sludge	3. 0 [6]	Sludge from paint spray booths delivered in sealed 55 gallon drums

NOTES:

[1] Total Estimated Quantity of Material Deposited = Depositing Rate x Period of Facility Use

1500 tons = 1 ton per day x 5 days/wk. x 50 wks. x 6 yrs.

2.5 tons = 0.625 ton [(4)] per yr. x 4 yrs.

3.3 tons = 0.55 ton [(5)] per yr. x 6 yrs.

3.0 tons = 0.5 ton per yr. x 6 yrs.

[2] Team site reconnaissance survey June 16, 1982.

[3] Source: EES, NAVORDSTA, Indian Head, MD, UIC N00174, June 1980.

[4] Source: Team NOS personnel interview June 16, 1982.

[5] Source: NOS List of Hazardous Materials, June 1980.

[6] Source: NSADSFF, CHESDIV, December 15, 1980.

SOURCE: Fred C. Hart Associates, 1983.

TABLE 6-2
Site 21
Estimate of Quantity of Hazardous Materials Deposited at Bronson Road Landfill

Contaminant	Quantity (range-pounds)[4]
Asbestos, barium [2]	1,000 - 10,000
Zinc, lead, titanium, ethyl alcohol, acetone [1]	100 -1,000
Benzene, toluene, xylene, ethyl acetate, ethylene glycol, iron, chromium, tetrachloroethane, phenols [3]	10 -100

NOTES:

[1] Estimated Quantity of Material in Discarded Cans Discarded at Site

Paint = (13 lbs/gal)(0.l gal/can)(l can/wk)(52 wks/yr)(6yrs) = 405 lbs

Varnish = (10 lbs/gal)(0.l gal/can)(l can/wk)(52 wks/yr)(6yrs) = 312 lbs

[2] Estimated Quantity of Discarded Barium, Asbestos, and Paint Sludges: 5000 lbs, 6600 lbs, and 6000 lbs, respectively.

[3] Composition of Discarded Materials,

Paint = Zinc (15%), lead (5%), titanium (2%); chromium, iron, benzene, toluene, xylene, tetrachloroethane, ethyl acetate, acetone, ethyl alcohol, ethylene glycol (each 1%)

Varnish = Phenols (10%); ethyl alcohol, ethyl acetate, acetone (each 15%)

Source: Riegel's Handbook of Industrial Chemistry, J.A. Kent, ed., 7th ed., 1974.

[4] Quantity of each contaminant listed is estimated to fall within range shown.

SOURCE: Fred C. Hart Associates, 1983.

6.2 Previous Environmental Investigations

The Initial Assessment Study conducted by NEESA in 1983 did not recommend a Confirmation Study because NEESA concluded that the contaminants would not migrate due to the nature of the site hydrology. However, the IAS did recommend that the portion of the landfill that was uncovered be capped and properly closed to minimize any potential for subsurface or air-borne contamination migration. The Phase II RCRA Facility Assessment conducted in 1988 reported that a soil cover had been placed over the site. Samples were not collected during these studies and there is no known analytical data for the site.

6.3 Human Health Risk Assessment

A human health risk assessment for Site 21 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate whether site contaminant concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 21 human health risk assessment, specifically the screening methods for determination of COPCs and exposure scenarios to be evaluated.

Site 21 is a former landfill that is covered with fill. Currently, there are no development plans for the site and since the site was a landfill, future residential use it is not anticipated. However, it is Navy policy to evaluate a hypothetical conservative scenario for future residential use. Therefore, the Region III soil RBCs for the resident and SSLs for transfer from soil to air will be used for screening soil levels at Site 21. The Region III RBCs for tap water will be used to screen the groundwater data. 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 6-3 summarizes the potential receptors that will be evaluated in the human health risk assessment for Site 21. The trespasser adult and adolescent are included in the evaluation because although the shoreline of Mattawoman Creek is either fenced or contains steep slopes, trespassing would be unlikely, but not impossible. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. The site is not anticipated to be used for residential purposes in the future, however, the future resident is conservatively included in this evaluation.

6.4 Ecological Risk Assessment

An assessment of the potential ecological risks associated with Site 21 is conducted following the Navy-Tier II 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), as described previously in Section 3.4. This section of the work plan presents Step 1 of the 8-step ERA process for Site 21.

6.4.1 Objectives

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?

6.4.2 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the screening ERA. These components of the problem formulation are developed for Site 21 in this section. In addition, the fate, transport, and toxicological properties of the chemicals present at a site are also considered.

6.4.2.1 Environmental Setting

Habitats and Biota. Habitat at Site 21 is primarily old field. The Hog Island Cove Protection Area is located approximately 300 feet west of Bronson Road and downgradient of the site. The tidal emergent marsh in the coves of each side of Hog Island supports river bulrush (*Scirpus fluviatilis*), a state rare species and queen snake (*Regina septemvittata*), an uncommon species in Maryland.

TABLE 6-3
POTENTIAL EXPOSURE PATHWAYS
SITE 21 - BRONSON ROAD LANDFILL
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current			Future			
		Industrial Worker	Trespasser/Visitor		Onsite Resident		Construction Worker	Industrial Worker
			Adult	Adolescent	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*
Groundwater								
	Ingestion				X	X		
	Dermal				X	X	X	
	Inhalation				X		X	

X Quantitative evaluation.

* Current and Future are the same.

A gravel access road bisects the site into an eastern and western section as shown on Figure 6-1. Portions of the eastern section are being filled with additional soil and graded to restore the hillside. The site has been seeded with tall fescue (*Festuca arundinacea*), which dominates the herbaceous layer. Immature red cedar (*Juniperus virginiana*) and black locust (*R. pseudoacacia*) have become established in clusters in the western section. A small sediment pond has been constructed in the northern corner of the site to collect storm water runoff. An emergent wetland has established itself in the pond and is dominated by cattails (*Typha* spp.). A mixed oak forest borders the site to the east and northeast. The forest understory is dominated by American holly (*I. opaca*).

Surrounding Land Uses. As described above, the site is bordered by forest to the east and northeast. The land south and immediately west of the site is developed with military buildings and other structures.

6.4.2.2 Summary of Available Analytical Data

There are no known analytical data currently available for the site.

6.4.2.3 Preliminary Conceptual Model

Figure 6-2 illustrates the preliminary diagrammatic conceptual model for Site 21. The potential source area is the landfill at Site 21.

Exposure Pathways. Based on the preliminary conceptual model for Site 21 (illustrated on Figure 6-2), potentially complete exposure pathways in terrestrial habitats exist to surface soils located on and adjacent to the landfill. However, the soil cover and re-grading activities currently occurring on the site may influence potential ecological exposures. Except for the small storm water pond, no surface water bodies occur on Site 21. Potentially complete transport pathways via groundwater may link the landfill (source) to wetland areas located approximately 300 feet downgradient of the site, but this would need to be confirmed. Complete exposure pathways may also exist to upper trophic level receptors that may feed on prey items in these terrestrial and (possibly) wetland habitats.

Endpoints and Risk Hypotheses. Preliminary assessment endpoints, risk hypotheses, and measurement endpoints (Table 6-4) are developed for Site 21 based on the preliminary conceptual model (illustrated on Figure 6-2) and the complete exposure pathways it identifies. Table 6-4 also identifies specific receptor species or groups associated with each endpoint.

6.5 Work Plan

The objectives of the remedial investigation at Site 21 are to determine the lateral extent and depth of waste disposed of at the site and to determine whether the waste is a source of contamination in the underlying soils or the groundwater at the site.

Since historical information indicates a wide variety of materials may have been disposed of at the site and no previous analytical data is available, samples collected will be analyzed for a full suite of analytes including TCL VOCs, TCL SVOCs, TAL inorganics, and explosives. Explosive analysis at this site will include in addition to the analyte list for EPA Method 8330A, the nitrate esters nitroguanidine and nitroglycerin, pentaerythritol tetranitrate

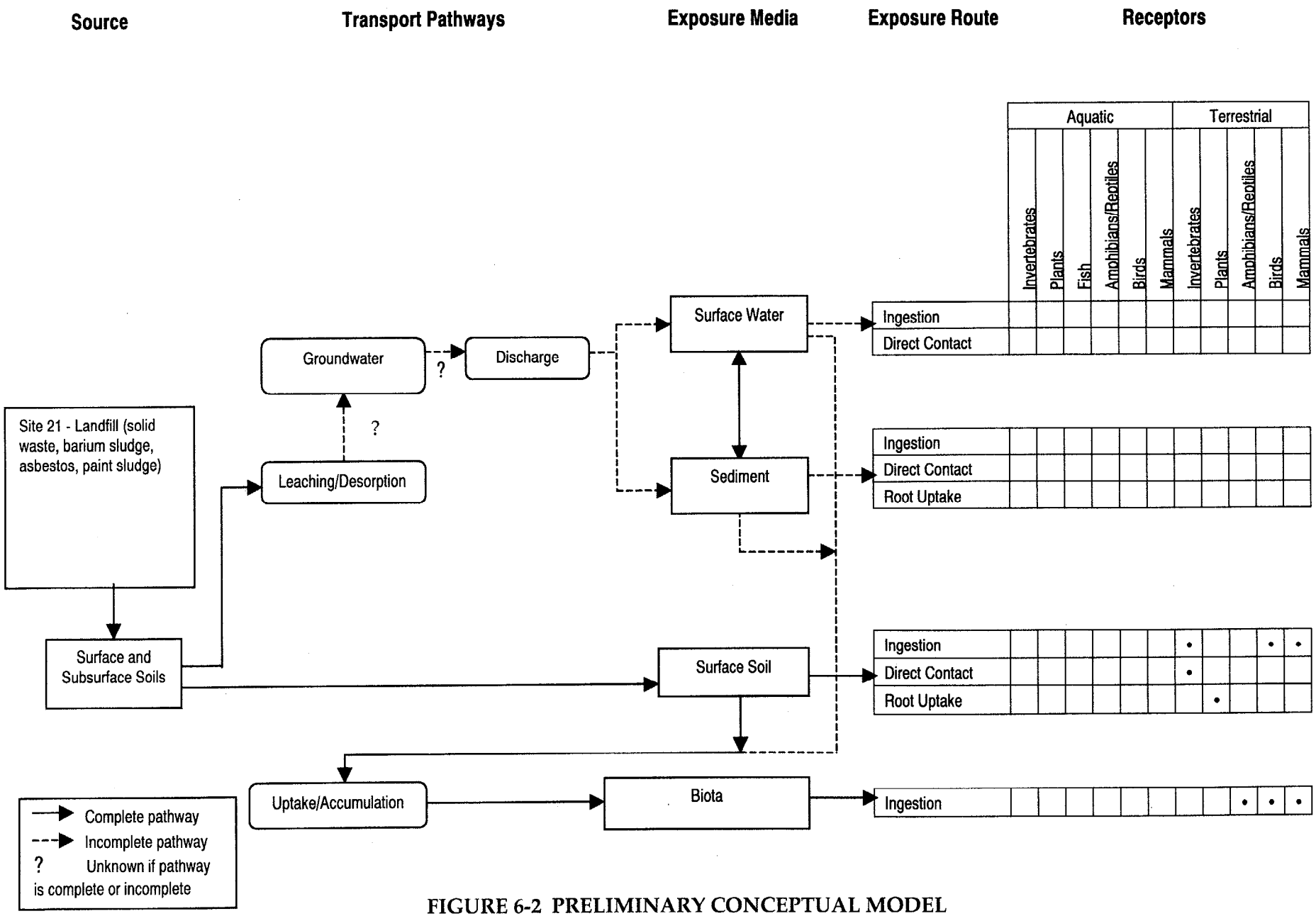

FIGURE 6-2 PRELIMINARY CONCEPTUAL MODEL
NSWC INDIAN HEAD - SITE 21

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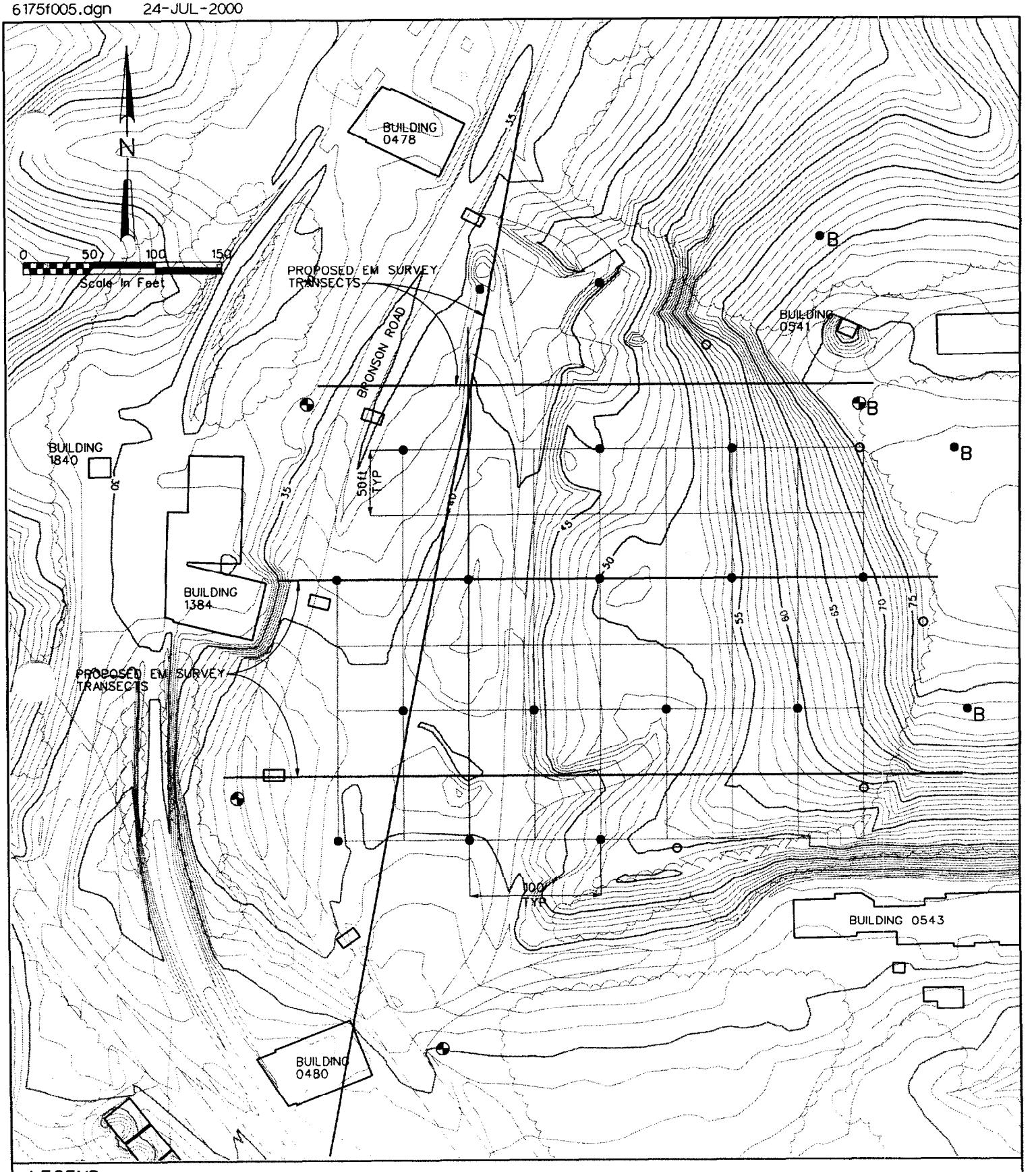

LEGEND

- MONITORING WELL LOCATION
- BACKGROUND SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION
- CONFIRMATORY SOIL BORING LOCATION
- TEST PIT LOCATION

Figure 6-3
SITE 21 PROPOSED SAMPLE LOCATIONS
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NAVAL SURFACE WARFARE CENTER
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Table 6-4
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Site 21
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Terrestrial Habitats			
Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related surface soil concentrations sufficient to adversely effect soil invertebrate communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Soil Invertebrates (earthworms)
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related surface soil concentrations sufficient to adversely effect terrestrial plant communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American robin
Survival, growth, and reproduction of avian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American kestrel
Survival, growth, and reproduction of mammalian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Short-tailed shrew
Survival, growth, and reproduction of mammalian terrestrial herbivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume terrestrial plants from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Meadow vole
Survival, growth, and reproduction of mammalian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Red fox

(PETN), and ammonium perchlorate. All samples will be submitted for analysis with a standard 28-day TAT.

Background samples will be collected in areas that are physically upgradient of the site and not expected to be affected by any potential contamination originating at Site 21. Background samples will be used as reference for comparison of analytical results from site samples.

The proposed scope for the field investigation is summarized on Table 6-5. Table 6-6 reviews the sampling program for Site 2, and Table 6-7 provides sample bottleware, preservation, and holding time requirements. Figure 6-3 shows proposed sampling locations. A breakdown of the sampling by media is given below:

- *Waste*: The limits of the waste will be estimated by surveying the area with electromagnetic induction or other geophysical method. Four transects are proposed, three running east-west from the west side of Bronson Road to the top of the hill 500 feet to the east and one running south southwest to north northeast that passes through the reported fill area. The survey results will be confirmed with visual logging of 5 test pits and 5 soil borings.

- *Surface Soil*: Fifteen surface soil samples will be collected in a 100-foot grid pattern across the reported site limits and the adjacent upper elevation fill area. Two additional surface soil samples will be collected from the rolloff bin transfer station location and near the stormwater management pond where waste was observed during excavation. Three background surface soil samples will be collected from the upper elevation area to the east. All surface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, explosives, AP, TOC, and pH.

- *Groundwater*: Three monitoring wells will be installed next to Bronson Road to determine if the waste in the landfill has contaminated the groundwater. An additional well will be installed upgradient above the site near Bldg. 541. All groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, TAL total and dissolved metals, cyanide, AP, and explosives.

TABLE 6-5
SITE SPECIFIC WORK PLAN
SITE 21 - BRONSON ROAD LANDFILL
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis[a]
Waste	Site 21	Determine limits of waste	Use electromagnetic induction or other geophysical method to survey area, with test pit or test boring confirmation	See Figure 6-2 for proposed transects	4 transects, approx. 5 test pits and 5 test borings	Interpretation of survey results and visual logging of test pits and borings
Surface Soil	Site 21	Determine whether surface soil is contaminated as result of waste disposal.	Collect surface soil samples in 100 ft grid pattern in area next to Bronson Road, at historic rolloff bin location, and at stormwater pond.	See Figure 6-2	17	TCL VOCs and SVOCs, TAL Inorganics, explosives, TOC, pH, AP
	Background	Determine contaminant levels in background soils	Collect background soil samples at 3 locations on top of ridge east of the landfill.	See Figure 6-2	3	TCL VOCs and SVOCs, TAL Inorganics, explosives, TOC, pH, AP
Groundwater	Site 21	Determine whether waste in landfill has contaminated groundwater	Install and sample monitoring wells. Locations to be determined after test pit survey.	See Figure 6-2	3	TCL VOCs and SVOCs, TAL Metals (total and dissolved), cyanide, explosives, AP
	Background	Determine contaminant levels in groundwater upgradient from Site 21.	Install and sample background monitoring well on top of ridge south of Bldg. 541.	See Figure 6-2	1	TCL VOCs and SVOCs, TAL Metals (total and dissolved), cyanide, explosives, AP

Notes:
a) Explosives analysis will include nitroglycerin, PETN, nitroguanidine, and ammonium perchlorate as well as explosives analyzed for by EPA Method 8330A

TABLE 6-6
SAMPLING PROGRAM
SITE 21 - BRONSON ROAD LANDFILL
INDIAN HEAD, MARYLAND

Sample Media	Sample ID		Purpose	Sample Depth/Location	Analysis						
	From	To			VOC	SVOC	Total Metals and Cyanide	Dissolved Metals	Explosives	TOC & pH	Ammonium Perchlorate
Surface Soil	IS21SS010001	IS21SS170001	Site Sample	0" - 6" / Collect surface soil samples in grid pattern (see Figure 6-3 for grid location)	x	x	x		x	x	x
	IS21SS180001	IS2SS200001	Background	0" - 6" / Collect 3 background surface soil samples on top of the ridge east of the landfill (see Figure 6-3)	x	x	x		x		x
Groundwater	IS21MW01*MMYY*	IS21MW03*MMYY*	Site Sample	See Figure 6-3	x	x	x	x	x		x
	IS21MW04*MMYY*		Background	Background monitoring well located on top of ridge south of Bldg. 541 (see Figure 6-3)	x	x	x	x	x		x

NOTES:
BDED = Beginning Depth End Depth as a 4-digit number rounded to the nearest foot (i.e. 2' - 2' 6" = 0203)
MMYY = Month and Year as a 4 digit number (i.e. Jan 2001 = 0101)

TABLE 6-7
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITES 21 - BRONSON ROAD LANDFILL
INDIAN HEAD, MARYLAND

Sample Media	Analysis	Total Number of Samples	Number of Containers Per Sample	Container Type	Preservation	Holding Times
Surface Soil	TCL VOCs - CLP OLM04.0	20	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	20	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	20	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	20	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	Ammonium Perchlorate	20	1	4 oz. Glass	Cool to 4oC	14 days to analysis
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	20	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Groundwater	TCL VOCs - CLP OLM04.0	4	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	4	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	4	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	4	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	Explosives - Modified SW-846-8330 and SW-846-8332*	4	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days
	Ammonium Perchlorate	4	1	250 ml Plastic bottle	Cool to 4°C	14 days to analysis

* = Includes analysis for nitrate esters (nitroglycerine and nitroquanidine) and pentaerythritol tetranitrate (PETN) in modified SW-846-8330

7. Site 25 – Hypo Discharges from Building 588

7.1 Background Information and Site Description

Site 25 is the drainage ditch that runs from the Rocket Motor Loading Building (Bldg. 588) into the industrial wastewater outfall IW46. Flow in the ditch is intermittent, occurring only during stormwater runoff events or when there is discharge from the building. Water draining from Bldg. 588 flows southwest down a steep slope into the ditch. The drainage then flows south for approximately 500 feet until it reaches the road which leads to Bldg. 871, where it takes a sharp turn to the west and follows the road for about 100 feet before flowing under the road. The outfall into Mattawoman Creek is approximately 100 feet south of this road. The Rocket Motor Loading Building, constructed in 1944, contained facilities used for X-ray film developing. The X-ray section of this building is no longer in use. The nearest potable water well is Well A that is 400 feet southeast of the site. Figure 7-1 shows existing conditions at the site.

For the period beginning in 1944 and ending circa 1964, wastewater discharges from this facility included fixer (sodium thiosulfate); developer (hydroquinone); and silver, discharged in a silver thiosulfate complex. This silver represents the most significant contaminant from the standpoint of potential adverse environmental impact. Table 7-1 provides an estimate of the total quantity of contaminants discharged into IW46 during the 20-year period the X-ray facilities discharged untreated wastewater into the ditch. Team site reconnaissance for the Initial Assessment Study indicated no vegetation stress or contamination immediately behind the building at the point of outfall discharge. However, there was evidence of disposal of paint materials and accessories including paint brushes, empty solvent cans, and trash.

Building 588 has a temporary waste accumulation area. The concrete pad, which is located on the southwest corner of the building, is currently used as a satellite accumulation area for the storage of non-explosive hazardous waste (i.e., waste acetone). Secondary containment is provided when the site is used (i.e., a drum in a drum or a mobile secondary containment pad with corer is used). However, prior to 1996, the concrete pad held a dumpster which was used for the storage of solid explosive hazardous waste. Drainage in the pad area is directed to the south.

7.2 Previous Environmental Investigations

The Initial Assessment Study conducted by NEESA in 1983 recommended study of this site only if silver wastes at Site 5 were found to be a danger to aquatic life. This decision was made since the chemistry and probable fate of sodium thiosulfate, hydroquinone, and silver would be similar to the fate of contaminants found in other X-ray photo lab discharges. A Confirmation Study conducted on Site 5 in September 1985 found high concentrations of silver. Most of the silver was found in the drainage ditch deposited in areas that are natural

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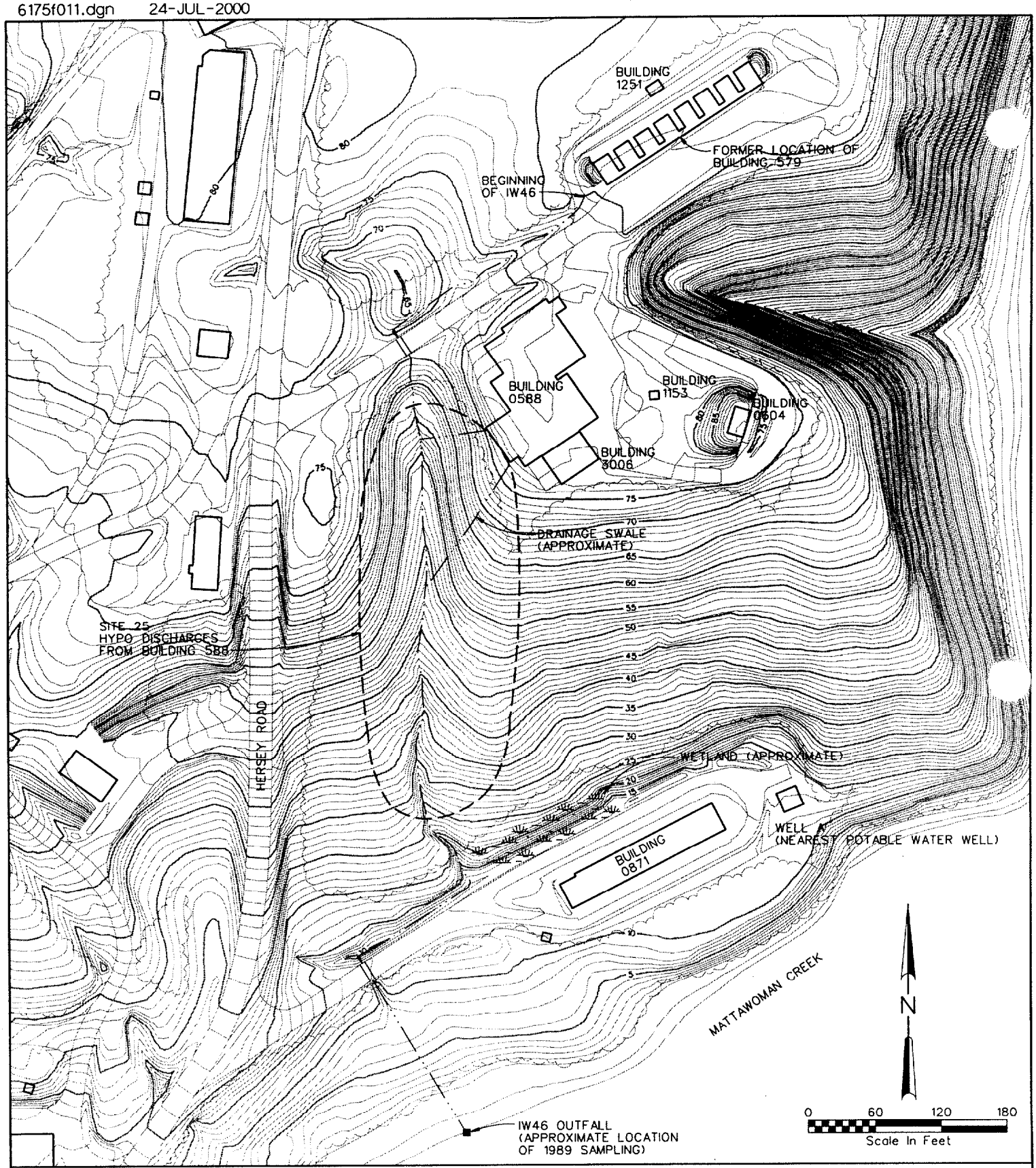

Figure 7
SITE 25 EXISTING CONDITIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

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traps for sediment. The results of the Confirmation Study at Site 5 indicate that the environment at Site 25 may also be contaminated with silver. The Phase II RCRA Facility Assessment was completed in 1988. No samples were collected at this site during the IAS or RFA.

TABLE 7-1
Site 25
Estimate of Total Quantity of Contaminants Discharged into Ditch

Contaminant	Source of Contaminant	Total Quantity of Contaminant Discharged Monthly (lbs.)	Total Number of Months Facility was Operated During 20-Year Period (Months)	Total Quantity of Contaminant Discharged During 20-Year Period (lbs.)
Sodium thiosulfate (fixer)[1]	Building 588 X-ray facility	470	240	112,800
Hydroquinone (developer)	Building 588 X-ray facility	470	240	112,800
Silver	Building 588 X-ray facility	3.6	240	864

NOTES:

[1] Estimates of quantities developed from manufacturers recommended solution application rates for fixer and developer, average monthly quantities of sheets developed at the facility and average silver concentrations of fixer baths as follows:

Fixer, developer quantities = (0.0158 gal/sheet) x (3000 sheets/mo.) = 47gal fixer/mo.

Silver quantities = (35 g silver/gal fixer) x (47 gal fixer/mo.) / (454 g/lb.) = 3.6 lbs silver/mo.

SOURCE: Fred C. Hart Associates, Inc., 1983.

All industrial wastewater outfalls were sampled by Energetics, Inc. for a point source study in September 1989. During this study Energetics sampled IW46 monthly from May 1988 until January 1989 at its outfall into Mattawoman Creek. The results are presented in Table 7-2. The only two buildings which discharged into IW46 were Bldg. 588 and Bldg. 579. Bldg. 579 housed a temperature conditioning process that discharged wastewater from washdown with a small amount of decontamination solution. It was demolished in 1999. During the sampling period, flow remained constant at 360 gal/day and the pH tended to be slightly alkaline, averaging 7.9. Oil and grease were present averaging 3.2 mg/l and total suspended solids (TSS) were low, averaging 10.0 mg/l. Biochemical oxygen demand (BOD_5) consistently exceeded permit limitations and averaged 77 mg/l. COD averaged 98 mg/l. No nitrate esters were detected in the outfall during November, 1988 (the only time the wastewater was analyzed for nitrate esters). The BOD and COD values may indicate the presence of elevated levels of organic constituents in the wastewater.

TABLE 7-2
Site 25
IW-46 Outfall Chemical Data

Sample Date	Parameter						
	Flow (gal/day)	pH	TSS (mg/L)	Oil & Grease (mg/L)	COD (mg/L)	BOD_5 (mg/L)	Nitrate Esters
May 1988	360	7.8	21	1			
June 1988	360	8.0	4	<1	62.5	56	
July 1988	360	8.2	20	<1	170	>75	
Aug 1988	360	8.0	19	<1	80	66	
Sept 1988	360	7.5	4	3.4	400	300	
Oct 1988	360	7.5	5	5.7	42	38	
Nov 1988							ND
Dec 1988	360	7.5	7	2.5	25	67	
Jan 1989	500	8.4	1	10	<5	10	

SOURCE:

Energetics, Inc., "Naval Station Ordnance Industrial Wastewater Outfalls: Sample Data, Characterization, and Analysis," Sept. 15 1989.

7.3 Human Health Risk Assessment

A human health risk assessment for Site 25 will be performed and summarized in the RI report. The risk assessment will be prepared in accordance Section 3.0 of the Master Work Plan. Analytical data collected as part of this remedial investigation will be used to evaluate if site contaminant concentrations pose a significant threat to human health. This site-specific work plan will focus on the details associated with the Site 25 human health risk assessment, specifically the screening methods for determination of COPCs and exposure scenarios to be evaluated.

Site 25 is a wooded area near Building 588. Currently, there are no development plans for the site or surrounding area. However, it is Navy policy to evaluate a conservative hypothetical scenario for future residential use. Therefore, the Region III soil RBCs for the residential scenario and SSLs for transfer from soil to air will be used for screening soil levels at Site 25. The Region III RBCs for tap water will be used to screen the groundwater data. 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 7-3 summarizes the potential receptors that will be evaluated in the human health risk assessment for Site 25. The trespasser adult and adolescent are included in the evaluation because although the shoreline of Mattawoman Creek is either fenced or contains steep slopes, trespassing would be unlikely, but not impossible. The adolescent trespasser is considered to be an individual between the ages of 6 and 16 years. The site is not anticipated to be used for residential purposes in the future, however, the future residential user is conservatively included in this evaluation.

TABLE 7-3
POTENTIAL EXPOSURE PATHWAYS
SITE 25 - HYPO DISCHARGES FROM BUILDING 588
INDIAN HEAD, MARYLAND

Media	Exposure Route	Current			Future					
		Industrial Worker	Trespasser/Visitor		Onsite Resident		Construction Worker	Industrial Worker	Trespasser/Visitor	
			Adult	Adolescent	Adult	Child			Adult	Adolescent
Surface Soil	Ingestion	X	X	X						
	Dermal	X	X	X						
	Inhalation	X	X	X						
Groundwater	Ingestion				X	X				
	Dermal				X	X	X			
	Inhalation				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

X Quantitative evaluation.

* Current and Future are the same.

7.4 Ecological Risk Assessment

An assessment of the potential ecological risks associated with Site 25 is conducted following the Navy-Tier II 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), and is described in Section 3.4. This section of the work plan presents Step 1 of the 8-step ERA process for Site 25.

7.4.1 Objectives

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?

7.4.2 Screening-Level Problem Formulation

Problem formulation establishes the goals, scope, and focus of the screening ERA. These components of the problem formulation are developed for Site 25 in this section. In addition, the fate, transport, and toxicological properties of the chemicals present at a site are also considered.

7.4.2.1 Environmental Setting

Habitats and Biota. The steep drainage swale downgradient of Building 588 is forested. The forest is mature and dominated by oaks including white oak (*Q. alba*), red oak (*Quercus falcata*), and chestnut oak (*Quercus prinus*). The understory is dominated by American holly (*I. opaca*), some measuring 18 inches dbh. The swale channel is approximately 1 foot wide with a flow of less than 1 cubic foot per second observed on the day of the site visit (flow in the swale is intermittent). The channel intercepts a ditch along Hersey Road, which runs parallel to Mattawoman Creek. The portion of the ditch upgradient of the intersection is an emergent wetland dominated by cattails (*Typha* spp.). The ditch crosses Hersey Road and flows southeast approximately 100 feet before discharging into Mattawoman Creek. No wetlands are associated with the discharge point. The bank of Mattawoman Creek in this area is densely forested.

Surrounding Land Uses. The surrounding land west of Site 25 is heavily developed with military buildings and structures. The remaining land is primarily forest with pockets of development.

7.4.2.2 Summary of Available Analytical Data

As part of a point source study, IW46 was sampled monthly from May 1988 until January 1989 at its outfall into Mattawoman Creek. The results are presented in Table 7-2.

7.4.2.3 Preliminary Conceptual Model

Figure 7-2 illustrates the preliminary diagrammatic conceptual model for Site 25. The potential source area is Building 588.

Exposure Pathways. Based on the preliminary conceptual model for Site 25 (illustrated on Figure 7-2), complete exposure pathways in terrestrial habitats exist to surface soils located in the drainage swales. No surface water bodies occur on Site 25, although Mattawoman Creek (a tidal fresh to brackish water body) occurs approximately 500 feet downgradient of the site. Potentially complete transport pathways via surface runoff (via the swales) and possibly groundwater link the site to the creek based on topography and proximity. Thus, complete exposure pathways may exist to the surface water and sediments in the creek. Complete exposure pathways may also exist to upper trophic level receptors that may feed on prey items in these terrestrial and aquatic habitats.

Endpoints and Risk Hypotheses. Preliminary assessment endpoints, risk hypotheses, and measurement endpoints (Table 7-4) are developed for Site 25 based on the preliminary conceptual model (illustrated on Figure 7-2) and the complete exposure pathways it identifies. Table 7-4 also identifies specific receptor species or groups associated with each endpoint.

7.5 Work Plan

The objective of the remedial investigation at Site 25 is to determine whether the untreated wastewater discharged from Building 588 into the IW46 drainage area contaminated the underlying soil and groundwater. Since silver is not very mobile it should still be present on the surface in areas of deposition; thus, initially only the surface soil will be examined. If surface contamination is present, the subsurface soil and groundwater under Site 25 will be investigated in Phase 2.

Since IW46 was also used by Bldg. 579 and no previous analytical data is available, samples collected will be analyzed for a full suite of analytes including TCL VOCs, TCL SVOCs, and TAL inorganics. Processes at buildings 579 and 588 involving explosives were limited to the handling of nitroglycerin (NG), therefore NG will be the sole explosive analyzed for at Site 21. All samples will be submitted for analysis with a standard 28-day TAT.

Background samples will be collected in areas that are physically upgradient of the site and not expected to be affected by any potential contamination originating at Site 21. Background samples will be used as reference for comparison of analytical results from site samples.

The proposed scope for the field investigation is summarized on Table 7-5. Table 7-6 reviews the sampling program for Site 25, and Table 7-7 provides sample bottleware, preservation, and holding time requirements. Figure 7-3 shows proposed sampling locations. A breakdown of the sampling by media is given below:

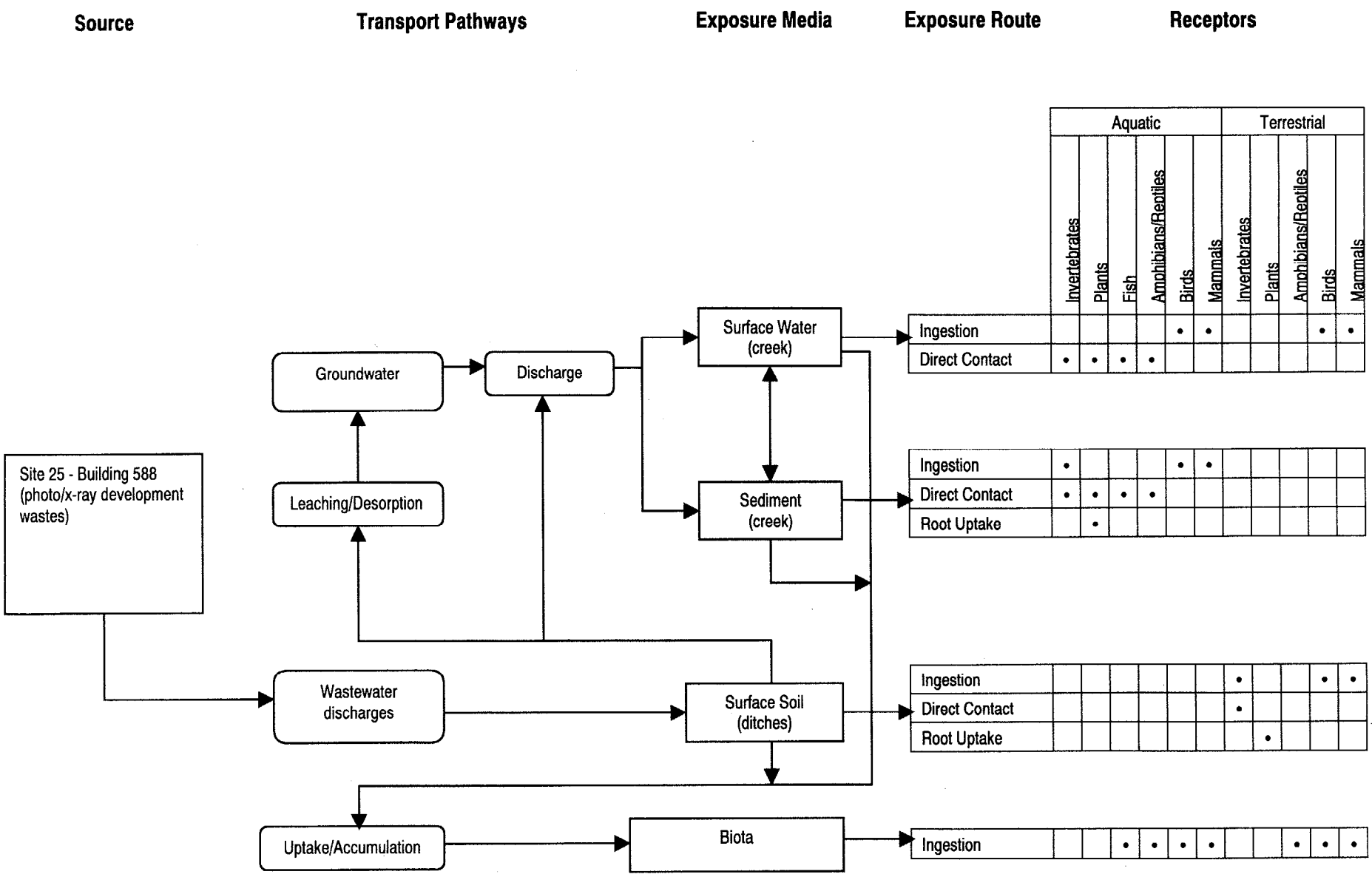

FIGURE 7-2 PRELIMINARY CONCEPTUAL MODEL
NSWC INDIAN HEAD - SITE 25

WD 292.ZIP/1/KTM

Table 7-4
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Site 25
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Terrestrial Habitats			
Survival, growth, and reproduction of terrestrial soil invertebrate communities.	Are site-related surface soil concentrations sufficient to adversely effect soil invertebrate communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Soil Invertebrates (earthworms)
Survival, growth, and reproduction of terrestrial plant communities.	Are site-related surface soil concentrations sufficient to adversely effect terrestrial plant communities based on conservative screening values?	Comparison of maximum chemical concentrations in surface soil with soil screening values.	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	American robin
Survival, growth, and reproduction of avian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Red-tailed hawk
Survival, growth, and reproduction of mammalian terrestrial insectivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume soil invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Short-tailed shrew
Survival, growth, and reproduction of mammalian terrestrial omnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume terrestrial plants and invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	White-footed mouse
Survival, growth, and reproduction of mammalian terrestrial carnivores.	Are site-related chemical concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume small mammals from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations.	Gray fox

Table 7-4
Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Site 25
NSWC Indian Head, Maryland

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Wetland and Aquatic Habitats			
Survival, growth, and reproduction of benthic invertebrate communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect benthic invertebrate communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Benthic invertebrates
Survival, growth, and reproduction of aquatic and wetland plant communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect aquatic or wetland plant communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Aquatic/wetland plants
Survival, growth, and reproduction of fish communities.	Are site-related chemical concentrations in surface water and/or sediment sufficient to adversely effect fish communities?	Comparison of maximum chemical concentrations in surface water and/or sediment with medium-specific screening values.	Fish
Survival, growth, and reproduction of avian aquatic/wetland insectivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume aquatic invertebrates from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Marsh wren
Survival, growth, and reproduction of avian aquatic/wetland piscivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species that may consume fish from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Great blue heron
Survival, growth, and reproduction of mammalian aquatic/wetland omnivores.	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species that may consume aquatic prey from the site?	Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum surface water and/or sediment concentrations.	Raccoon

TABLE 7-5
SITE SPECIFIC WORK PLAN
SITE 25 - HYPO DISCHARGES FROM BUILDING 588
INDIAN HEAD, MARYLAND

Media	Area	Objective	Investigative Technique	Locations	Number of Samples	Analysis [a]
Phase I						
Surface Soil	Site 25 - West and South of Building 588 and in Drainage Swale.	Determine whether discharge from building 588 has contaminated surface soil in the depressions behind the building and in the IW46 drainage swale.	Collect surface soil samples in areas where deposition is likely to south and west of Bldg. 588 and in IW46 drainage swale.	See Figure 7-3, exact locations to be selected in field	15	TCL VOCs and SVOCs, TAL Inorganics, nitroglycerin, TOC, pH
	Background	Determine contaminant levels in background soil.	Collect background surface soil samples at 2 locations north of Bldg. 588.	See Figure 7-3, exact locations to be selected in field	2	TCL VOCs and SVOCs, TAL Inorganics, nitroglycerin, TOC, pH
Phase II						
Groundwater	Site 25 - South of Building 588	Determine whether contaminated surface soil in IW46 drainage swale have contaminated groundwater.	Install and sample monitoring well south of Bldg. 588. Exact location determined form surface soil results.	See Figure 7-3, exact locations to be selected in field	1	TCL VOCs and SVOCs, TAL Metals (total and dissolved), cyanide, nitroglycerin
	Background	Determine contaminant levels in groundwater upgradient of Site 25.	Install and sample background monitoring well east of Bldg. 1251 and 579.	See Figure 7-3, exact locations to be selected in field	1	TCL VOCs and SVOCs, TAL Metals (total and dissolved), cyanide, nitroglycerin
Subsurface Soil	Site 25 - Drainage Swale	Determine whether contaminated surface soil in IW46 drainage swale have contaminated underlying soils.	Collect 2 subsurface soil samples from 2 depths while installing monitoring well and 6 additional samples from deposition areas in IW46 drainage way. Exact locations determined from surface soil results.	See Figure 7-3, exact locations to be selected in field	8	TCL VOCs and SVOCs, TAL Inorganics, nitroglycerin

Notes:
a) Phase II groundwater and subsurface soil sampling will only be performed if contamination is detected in Phase I surface soil samples. Phase II analytical list may be reduced if analytes are not detected in Phase I.

TABLE 7-6
SAMPLING PROGRAM
SITE 25 - HYPO DISCHARGES FROM BUILDING 588
INDIAN HEAD, MARYLAND

Sample Media	Sample ID From	Sample ID To	Purpose	Sample Depth/Location	Analysis: VOC	SVOC	Total Metals and Cyanide	Dissolved Metals	TOC & pH	Nitroglycerin
Surface Soil	IS25SS010001	IS25SS030001	Site Sample	0" - 6" / Collect 3 surface soil samples south and west of Bldg. 588 (see Figure 7-3)	x	x	x		x	x
	IS25SS040001	IS25SS060001	Site Sample	0" - 6" / Collect 3 surface soil samples from the two drainage swales that radiate from Bldg. 588 (see Figure 7-3)	x	x	x		x	x
	IS25SS070001	IS25SS130001	Site Sample	0" - 6" / Collect 7 surface soil samples from deposition areas in IW46 drainage way west and southwest of Bldg. 588 (see Figure 7-3)	x	x	x		x	x
	IS25SS140001	IS25SS150001	Site Sample	0" - 6" / Collect 2 surface soil samples from deposition areas in IW46 drainage way next to road west of Bldg. 871 (see Figure 7-3)	x	x	x		x	x
	IS25SS160001		Site Sample	0" - 6" / Collect 1 surface soil samples as close as possible to outfall into Mattawoman Creek (see Figure 7-3)	x	x	x		x	x
	IS25SS17		Site Sample	0" - 6" / Collect 1 surface soil sample from wooded hillside south of the corner of Bldg. 588 (see Figure 7-3)	x	x	x		x	x
	IS25SS180001		Background	0" - 6" / Collect a background surface soil sample west of Bldg. 1251 and 579 next to the road (see Figure 7-3)	x	x	x		x	x
	IS25SS190001		Background	0" - 6" / Collect a background surface soil sample east of Bldg. 1251 and 579 at background monitoring well location (see Figure 7-3)	x	x	x		x	x
Subsurface Soil *	IS25SB010203	IS25SB060203	Site Sample	2' - 2' 6" / Collect 6 subsurface soil samples from deposition areas in the IW46 drainage way west and southwest of Bldg. 588 - exact locations to be determined from surface soil results (see Figure 7-3)	x	x	x			x
	IS25SB070203	IS25SB080405	Site Sample	2' - 2' 6" and 4' - 4' 6" / Collect 2 subsurface soil samples from two depths while installing monitoring well south of Bldg. 588 (see Figure 7-3)	x	x	x			x
Groundwater *	IS25MW01*MMYY*		Site Sample	Monitoring Well located south of Bldg. 588 - exact location to be determined from surface soil results (see Figure 7-3 for temporary location)	x	x	x	x		x
	IS25MW02*MMYY*		Background	Background Monitoring Well located east of Bldg. 1251 and Bldg. 579 (see Figure 7-3)	x	x	x	x		x

* Groundwater and subsurface soil analytical list may be reduced if analytes are not detected in Phase 1 surface soil sampling.

NOTES:
BDED = Beginning Depth End Depth as a 4-digit number rounded to the nearest foot (i.e. 2' - 2' 6" = 0203)
MMYY = Month and Year as a 4 digit number (i.e. Jan 2001 = 0101)

TABLE 7-7
BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITES 25 - HYPO DISCHARGES FROM BUILDING 588
INDIAN HEAD, MARYLAND

Sample 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 Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	17	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	17	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Nitroglycerin	17	1	250 ml Clear wide-mouth glass	Cool to 4oC	14 days to extract; 40 days to analysis
	Total Organic Carbon and pH - EPA Method 415.1, SW-846-9045	17	1	8 oz plastic or glass	Cool to 4°C	28 days to analysis
Subsurface Soil	TCL VOCs - CLP OLM04.0	8	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	8	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	8	1	250 ml Clear wide-mouth glass	Cool to 4°C	6 months; Hg 28 days
	Nitroglycerin	8	1	250 ml Clear wide-mouth glass	Cool to 4°C	14 days to extract; 40 days to analysis
Groundwater	TCL VOCs - CLP OLM04.0	2	3	40 ml vial	HCl; Cool to 4°C	14 days to analysis
	TCL SVOCs - CLP OLM04.0	2	1	2.5 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days to extract; 40 days to analysis
	TAL Inorganics - CLP ILM04.0	2	1	1 L Polyethylene bottle	HNO_3 to pH<2; Cool to 4°C	6 months; Hg 28 days
	Total Cyanide	2	1	200ml Plastic or Glass	NaOH to pH>12, Cool to 4°C	14 days
	Nitroglycerin	2	1	1 L Amber glass with Teflon-lined cap	Cool to 4°C	7 days

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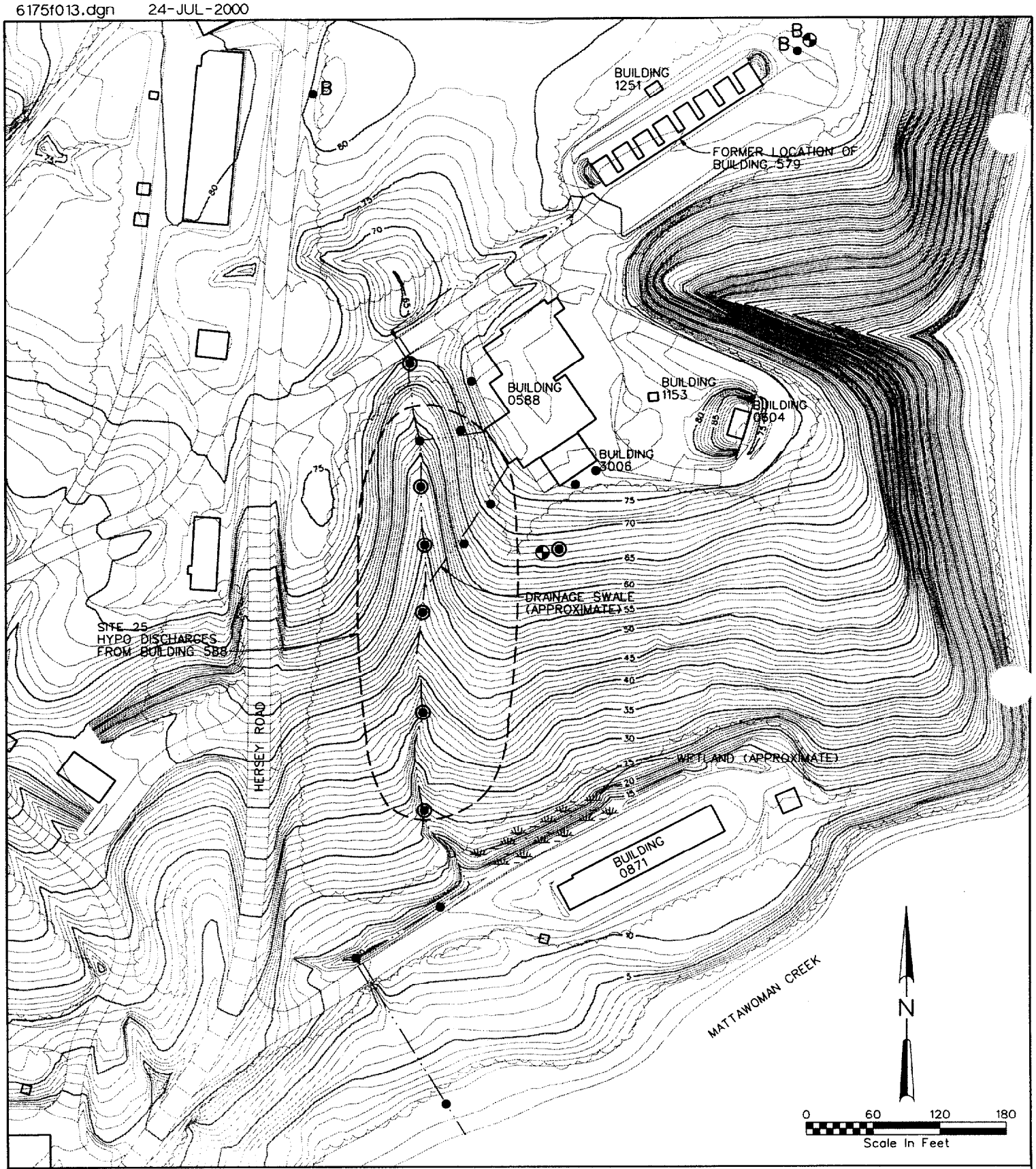

LEGEND

- MONITORING WELL LOCATION
- B BACKGROUND SAMPLE LOCATION
- SURFACE SOIL SAMPLE LOCATION (APPROXIMATE ACTUAL LOCATIONS TO BE DETERMINED IN FIELD)
- SURFACE AND SUBSURFACE SOIL SAMPLE LOCATION (ACTUAL LOCATIONS TO BE DETERMINED FROM SURFACE SOIL DATA)

Figure 7-
SITE 25 PROPOSED SAMPLING LOCATIONS
RI WORK PLAN
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD DIVISION

CH2MHILL

- *Surface Soil*: Seventeen surface soil samples will be collected in surface depressions to the west and south of Bldg. 588 (near the hazardous materials storage shed) and in the drainage swale to determine if discharge from the building has contaminated the surface soil. The samples locations will be collected from areas where deposition is likely at the discretion of the field team. Two additional samples will be collected north of Bldg. 588 to determine background conditions. All surface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, and NG.

- *Groundwater*: If the surface soils are found to be contaminated, two monitoring wells will be installed. One will be installed south of Bldg. 588 to determine whether the groundwater has been contaminated and one will be installed upgradient of Bldg. 588 to determine background levels. All groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, TAL total and dissolved metals, cyanide, and NG. Some categories of analytes may be eliminated if they were not detected in any of the surface soil samples collected in Phase 1.

- *Subsurface Soil*: If the surface soils are found to be contaminated then up to seven subsurface samples will be collected to determine whether the contaminated surface soil in the drainage ditch has affected the underlying soils. The locations will be selected after review of the surface soil data. All subsurface soil samples will be analyzed for TCL VOCs, TCL SVOCs, TAL inorganics, explosives, and NG. Some categories of analytes may be eliminated if they were not detected in any of the surface soil samples collected in Phase 1.

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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 pained 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 swallow	*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