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FINAL SITE MANAGEMENT PLAN FOR FISCAL YEAR 1999 NAB LITTLE CREEK VA
12/1/1999
CH2MHILL

Final

Site Management Plan:
Fiscal Year 1999
Naval Amphibious Base, Little Creek
Virginia Beach, Virginia



Prepared for

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Prepared by

CH2MHILL

Baker
Environmental, Inc.

CDM
Federal Programs Corp.

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Acronyms and Abbreviations

AOC	Area of Concern
Baker	Baker Environmental, Incorporated
BGS	Below Ground Surface
BMPs	Best Management Practices
BNA	Base-Neutral and Acid Extractable Organic Compound
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action
CMP	Corrective Measures Plan
CTO	Contract Task Order
Cy	Cubic Yards
1,1-DCA	1,1-Dichloroethane
1,2-DCE	1,2-Dichloroethene
DD	Decision Document
Ebasco	Ebasco Environmental Consultants
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FFA	Federal Facilities Agreement
FS	Feasibility Study
FWES	Foster Wheeler Environmental Services
FY	Fiscal Year
HRS	Hazard Ranking System
HRSD	Hampton Roads Sanitation District
IAS	Initial Assessment Study
IP/FP	Implementation Plan and Fee Proposal
IR	Installation Restoration
IRI	Interim Remedial Investigation
MCL	Maximum Concentration Limit
mg/kg	milligrams per kilogram
NAB	Naval Amphibious Base
NACIP	Navy Assessment and Control of Installation Pollutants
NEX	Naval Exchange
NFRAP	No Further Response Action Planned
NPL	National Priorities List

Acronyms and Abbreviations (Continued)

PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PCP	Pentachlorophenol
PRAP	Proposed Remedial Action Plan
PSI	Preliminary Site Inspection/Site Investigation
PWC	Public Works Center
RA	Remedial Action
RBCs	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RGH	Rodgers, Golden, and Halpern
RI	Remedial Investigation
RRRS	Relative Risk Ranking System
RVS	Round 1 Verification Step
SARA	Superfund Amendments and Reauthorization Act
SEA	Supplemental Ecological Assessment
SI	Site Inspection/ Site Investigation
SMP	Site Management Plan
SRI	Supplemental Remedial Investigation
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
µg/l	Micrograms per Liter

Executive Summary

This Site Management Plan (SMP) summarizes the background information, previous investigations, and proposed plans of action at various Installation Restoration (IR) sites and solid waste management units (SWMUs) at Naval Amphibious Base (NAB) Little Creek for fiscal year (FY) 1999. In addition to site-specific activities, base-wide activities scheduled for FY 1999 at NAB Little Creek include the development of Master Project Plans and the preparation of an updated SMP for FYs 2000 through 2004. The proposed plans of action for each active IR site and SWMU at NAB Little Creek for FY 1999 are summarized below.

During FY 1999, a proposed remedial action plan (PRAP) and a decision document (DD) will be submitted for IR Site 5, the Buildings 9 - 11 Motor Oil Disposal Area. The public will be notified of the final PRAP following its submittal to the Navy, the United States Environmental Protection Agency (EPA), and the Virginia Department of Environmental Quality (VDEQ).

At IR Site 7, rounds 2 and 3 of the semi-annual groundwater, surface water, and sediment monitoring program will be completed in FY 1999. Semi-annual groundwater monitoring rounds 6 and 7 will be completed at Sites 9 and 10. Results of all rounds of long-term monitoring activities at Sites 7, 9, and 10 will be reported in periodic letter reports submitted to the Navy, EPA, and VDEQ. A 3-year groundwater monitoring report will be prepared for review by the Navy, EPA, and VDEQ after the round 6 long-term monitoring event at Sites 9 and 10.

Site investigation (SI) reports, including results of a baseline qualitative human health risk assessment (BRA), will be prepared for IR Site 8 and SWMU 3 during FY 1999.

At Sites 11, 12, and 13, BRAs will be reevaluated and results will be reported in separate site-specific supplemental remedial investigation (SRI) reports. At Site 12, microcosm soil sampling, microcosm and sorption experiments, and natural attenuation modeling will be conducted in addition to a second round of groundwater sampling during FY 1999. A final Engineering Evaluation/Cost Analysis (EE/CA) will be prepared for the soil removal action at Site 13. The Site 13 soil removal action is expected to occur in FY 1999.

Field investigations will be conducted at SWMU 2 and several other SWMUs as part of a SI during FY 1999. The specific SWMUs to be investigated will be determined based on discussions with regulators and on the availability of funding.

1.0 Introduction

This SMP was prepared to present a summary of investigations to date and the proposed plan of actions for various IR sites and SWMUs at NAB Little Creek, in Virginia Beach, Virginia. Figure 1-1 provides the location of NAB Little Creek.

The SMP is a working document that is updated on a regular basis to maintain an up-to-date documentation and summary of environmental actions at NAB Little Creek. This version of the SMP summarizes the activities planned as of October 1998 at NAB Little Creek for FY 1999. This SMP updates and supercedes the February 1997 SMP prepared by CH2M HILL. This SMP addresses all activities being conducted at NAB Little Creek under the IR Program. It specifically addresses IR sites and SWMUs where site characterization, remediation, or monitoring activities are being completed, have recently been completed, or are planned.

The nine IR sites addressed in this SMP are:

- Site 5, Buildings 9 - 11, Motor Oil Disposal Area
- Site 7, Amphibious Base Landfill
- Site 8 (former SWMU 84), Demolition Debris Landfill
- Site 9, Driving Range Landfill
- Site 10, Sewage Treatment Plant Landfill
- Site 11, School of Music Plating Shop
- Site 12, Exchange Laundry Waste Disposal Area
- Site 13, Public Works PCP Dip Tank and Wash Rack
- Site 16, PCB Capacitor Spill, Pole No. 425

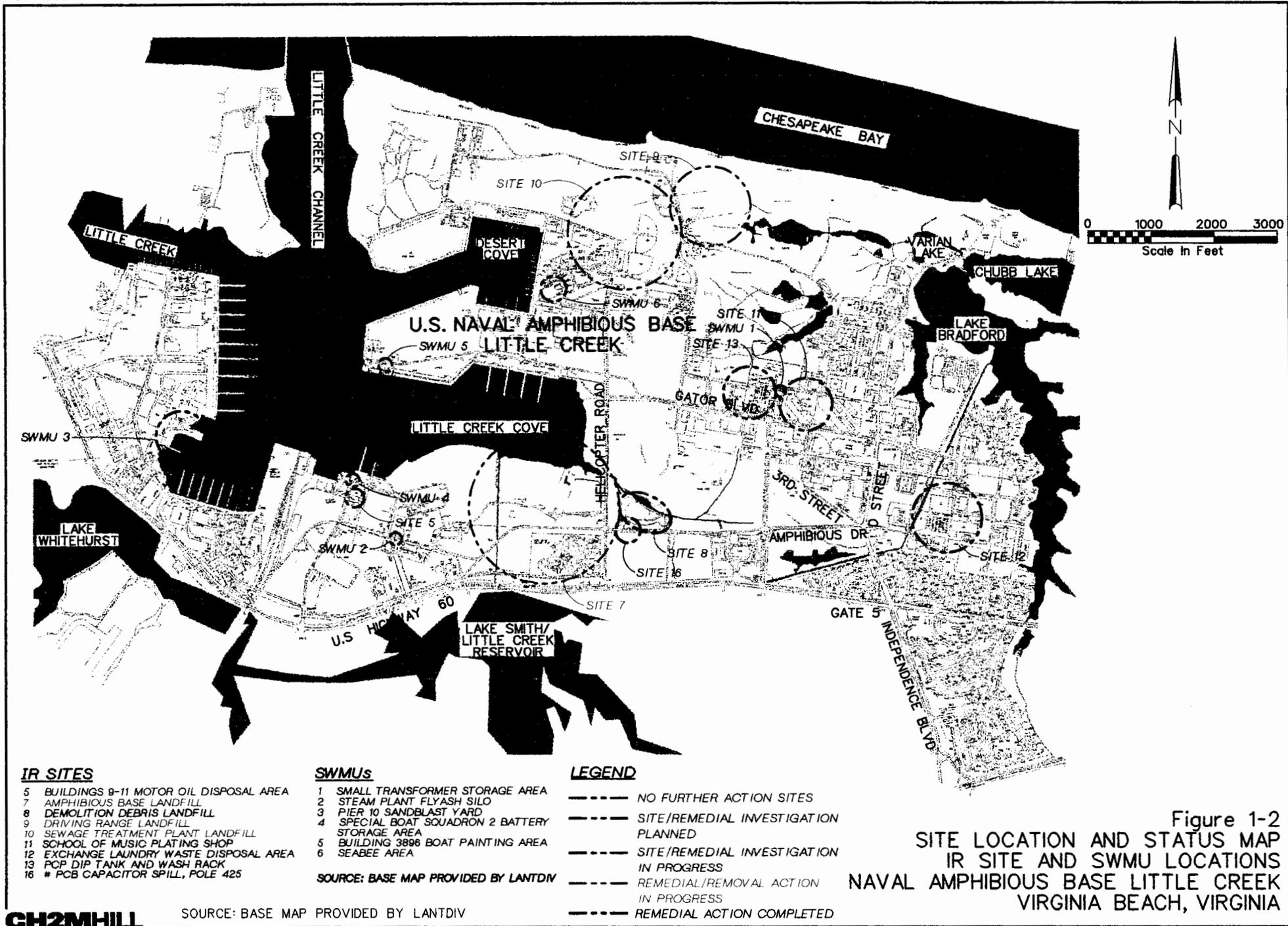
This SMP also addresses six SWMUs at NAB Little Creek. The SWMUs included in this SMP are:

- SWMU 1 (former SWMU 17), Small Transformer Storage Area
- SWMU 2 (former SWMU 105), Steam Plant Flyash Silo
- SWMU 3 (former SWMU 111), Pier 10 Sandblast Yard
- SWMU 4 (former SWMU 117), Special Boat Squadron 2 Battery Storage Area
- SWMU 5 (former SWMU 130), Building 3896 Boat Painting Area
- SWMU 6 (former SWMUs 131, 132, and 133), SeaBee Area

Figure 1-2 indicates the location of each IR site and SWMU included in the SMP.

1.1 Purpose

The purpose of the SMP is to present the projected activities planned at NAB Little Creek during FY 1999 and to provide projections for long-term progress at the facility in accordance with the Department of Navy's IR Program.



IR SITES

- 5 BUILDINGS 8-11 MOTOR OIL DISPOSAL AREA
- 7 AMPHIBIOUS BASE LANDFILL
- 8 DEMOLITION DEBRIS LANDFILL
- 9 DRIVING RANGE LANDFILL
- 10 SEWAGE TREATMENT PLANT LANDFILL
- 11 SCHOOL OF MUSIC PLATING SHOP
- 12 EXCHANGE LAUNDRY WASTE DISPOSAL AREA
- 13 PCP DIP TANK AND WASH RACK
- 16 * PCB CAPACITOR SPILL, POLE 425

SWMUs

- 1 SMALL TRANSFORMER STORAGE AREA
- 2 STEAM PLANT FLYASH SILO
- 3 PIER 10 SANDBLAST YARD
- 4 SPECIAL BOAT SQUADRON 2 BATTERY STORAGE AREA
- 5 BUILDING 3896 BOAT PAINTING AREA
- 6 SEABEE AREA

SOURCE: BASE MAP PROVIDED BY LANTDIV

LEGEND

- NO FURTHER ACTION SITES
- SITE/REMEDIAL INVESTIGATION PLANNED
- SITE/REMEDIAL INVESTIGATION IN PROGRESS
- REMEDIAL/REMOVAL ACTION IN PROGRESS
- REMEDIAL ACTION COMPLETED

Figure 1-2
 SITE LOCATION AND STATUS MAP
 IR SITE AND SWMU LOCATIONS
 NAVAL AMPHIBIOUS BASE LITTLE CREEK
 VIRGINIA BEACH, VIRGINIA

1.2 Objectives

This SMP documents the decisions and evaluations made during the project planning and scoping process for NAB Little Creek. The SMP includes proposed deadlines for primary documents to be submitted for the various sites at NAB Little Creek. The SMP is conducted in accordance with the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract N62470-95-D-6007, Contract Task Order (CTO) 90. The implementation plan and fee proposal (IP/FP) for this CTO is dated July 13, 1998.

This SMP is built upon the results of several previous investigations conducted at NAB Little Creek. These reports are listed in Section 6.0 of this SMP.

1.3 SMP Report Organization

This SMP consists of six sections. This section establishes the purpose and objective of the SMP. Section 2.0 presents a brief history of environmental activities at the base and at each site. Section 3.0 presents the proposed scope of work at each site and also discusses potential remedial activities to be conducted in the future, if warranted. Section 4.0 presents detailed schedules for investigations and document submissions for each site. Section 5.0 specifically addresses remedial and removal actions. Section 6.0 presents references.

2.0 Site Background

NAB Little Creek, located in Virginia Beach, Virginia, provides logistic facilities and support services for local commands, organizations, homeported ships, and other units to meet the amphibious warfare training requirements of the Armed Forces of the United States. The base is in the northwest corner of Virginia Beach and its western border abuts the city of Norfolk, Virginia. The area surrounding this 2,147-acre base is low lying and relatively flat with several fresh water lakes (Chubb Lake, Lake Bradford, Little Creek Reservoir/Lake Smith, and Lake Whitehurst) located on or adjacent to the base.

NAB Little Creek is primarily an industrial facility that centers around three saltwater bodies: Little Creek Cove, Desert Cove, and Little Creek Channel that connects the coves with the Chesapeake Bay. In addition to industrial land-use, NAB Little Creek is also used for recreational, commercial, and residential purposes. Specifically, the southeast corner of the base had been developed for residential use. Land development surrounding the base is residential, commercial, and industrial. Little Creek Reservoir/Lake Smith, located upgradient of the base, serves as a secondary drinking water supply for parts of the city of Norfolk.

NAB Little Creek was commissioned on July 30, 1945, by combining four contiguous activities. The Navy began purchasing land in the area from private estates and the Pennsylvania Railroad just prior to World War II. The first activity to be commissioned was the Amphibious Training Base in the southwestern corner of the present base near Little Creek Harbor. The base's mission was the training of landing craft personnel for operational assignments. Over the last 50 years, NAB Little Creek has expanded in both area and the complexity of its mission.

A large concentration of military installations exists within a 25-mile radius of NAB Little Creek. They include Fort Monroe and Langley Air Force Base to the north, Fort Story to the east, Naval Air Station Oceana to the southeast, Norfolk Naval Shipyard and St. Juliens Creek Annex to the south, and Norfolk Naval Base and Naval Supply Center-Craney Island Fuel Terminal to the southwest.

2.1 Environmental History

The purpose of the Navy's IR Program is to identify, assess, characterize, and clean up or control contamination from past waste management activities at Navy and Marine Corps facilities. Given the nature and extent of its operations, the Navy has been involved with toxic and hazardous materials for several decades. The Department of Defense, as well as general industry, have realized that previously acceptable methods of disposal are no longer sufficient and actions are being taken, through the IR program, to clean up Navy sites that pose a threat to human health or the environment. Current Navy waste management operations are in compliance with all federal, state, and U.S. Navy regulations to ensure safe operation and disposal.

In 1981 the Department of the Navy initiated the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The NACIP Program used a three-phased approach to study

and clean up sites. NAB Little Creek initiated its environmental restoration, study and investigation efforts under the NACIP Program by conducting an initial assessment study (IAS) in 1984. The program was changed in 1986 to reflect the requirements of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).

On July 28, 1998, the EPA proposed that NAB Little Creek be added to the National Priorities List (NPL). EPA scores all industrial sites using the Hazard Ranking System (HRS) and those facilities with scores exceeding 28.5 are proposed for the NPL. The HRS score of 50, assigned by the EPA to NAB Little Creek, is mainly attributed to the surface water component at Site 7 (NAB Landfill). The proposed listing is followed by a minimum 60-day review and comment period prior to the inclusion of NAB Little Creek on the NPL. In the past, the Virginia Department of Environmental Quality (VDEQ) has primarily provided regulatory oversight at NAB Little Creek. After NAB Little Creek is placed on the NPL, the EPA will take a more active role in providing regulatory and technical oversight to support the IR Program at NAB Little Creek. In addition, once NAB Little Creek is placed on the NPL, a Federal Facilities Agreement (FFA) will be negotiated between the Navy, the EPA, and the VDEQ. As part of the FFA negotiation process, all past and future work at IR sites and SWMUs will be reviewed and a course of action for future work requirements at each site will be developed. The FFA will also include specific requirements for the preparation and contents of the SMP.

The following paragraphs briefly summarize the major multi-site studies completed to date at NAB Little Creek. Individual site-specific investigations and studies are discussed in Section 2.2 and 2.3. Table 2-1 lists each of the studies conducted and identifies the various sites that the studies addressed.

2.1.1 Initial Assessment Study (IAS)

The IAS at NAB Little Creek was completed in December 1984 by Rogers, Golden, and Halpern, of Philadelphia, Pennsylvania. Its purpose was to identify and assess sites posing a potential threat to human health or the environment due to contamination resulting from prior hazardous waste management activities. The study entailed the collection and evaluation of archival and activity records relating to waste generation, handling and disposal; characterization of physical conditions at the site such as soil hydrogeology, and identification of migration pathways and potential receptors. The results of these data evaluation efforts were used to develop recommendations concerning the need for a confirmation study at a given site, the goal of which was to verify the presence of contamination and determine the need for further characterization and/or remediation.

The IAS examined 17 sites at NAB Little Creek. Six sites were recommended for confirmation studies: Sites 7, 9, 10, 11, 12, and 13. Of the remaining 11 sites, mitigation measures were recommended for 4 of the sites (Sites 4, 5, 15, and 16), and no further action was recommended for 6 of the sites (Sites 1, 2, 6, 8, 14, and 17). Site 3, the West Annex Fuel Spill, was addressed under a separate action to recover free-floating oil from the water table. Site 17, the Building 1256 Motor Oil Disposal Area, was added to the preliminary site inspection (PSI) by the Navy.

The IAS recommendations to conduct confirmation studies were based largely on the finding that contaminants from disposal areas may migrate toward surface water bodies with little attenuation, owing to a lack of clays and organic material in the subsurface soil, and in a

**Table 2-1
Activities Conducted to Date at IR Sites and SWMUs (Report Dates)**

IR Site or SWMU	Preliminary Studies and Investigations									Detailed Investigations				Decision Documents		Remedial Designs/Actions				
	IAS ^a	Confirmation Study		Environmental Assessment		SCR	RFA	RRRS Study	PSI ^b	SI	RV/FS	Phase I SRI	GW Monitoring	FS EE/CA	PRAP	DD	Removal Action	RD	Remedial Action	Long-Term Monitoring Period
		RVS	IRI	Phase 1	Phase 2															
IR Site 5	Dec-84							Jul-91	Nov-94			May/Dec-96			Draft Final NFRAP Sept.-98					
IR Site 7	Dec-84	Oct-86	Nov-91							Nov-94				Oct-97	Oct-97	Jan-98		May-97	May-98	1998 through 2002
IR Site 8	Dec-84						Dec-89	Jan-96												
IR Site 9	Dec-84	Oct-86	Nov-91							Nov-94					Jan-97	Draft Final				1996 through 2000
IR Site 10	Dec-84	Oct-86	Nov-91							Nov-94					Jan-97	Draft Final				1996 through 2000
IR Site 11	Dec-84	Oct-86	Nov-91							Nov-94		May/Dec-96	Nov-94 (soil)			Nov-94(soil)	1995 (soil)			
IR Site 12	Dec-84	Oct-86	Nov-91	Aug-90	Apr-91	Jun-92				Nov-94	Draft									
IR Site 13	Dec-84	Oct-86	Nov-91							Nov-94	Draft		Draft Final Sept-98 (Soil)							
IR Site 16	Dec-84							Jul-91	Nov-94										1995	
SWMU 1							Dec-89	Jan-96												
SWMU 2							Dec-89	Jan-96												
SWMU 3							Dec-89	Jan-96												
SWMU 4							Dec-89	Jan-96												
SWMU 5							Dec-89	Jan-96												
SWMU 6							Dec-89	Jan-96												

^a - also addresses Sites 1-4, 6, 14, 15, and 17

^b - also addresses Sites 4,15, and 17

DD: Decision Document
 FS: Feasibility Study
 GW: groundwater
 IAS: Initial Assessment Study
 IR: Installation Restoration
 IRI: Interim Remedial Investigation
 NFRAP: No Further Response Action Planned
 PRAP: Proposed Remedial Action Plan
 PSI: Preliminary Site Inspection
 RD: Remedial Design
 RFA: RCRA Facility Assessment
 RI: Remedial Investigation
 RRRS: Relative Risk Ranking System
 RVS: Round 1 Verification Step
 SCR: Site Characterization Report
 SI: Site Inspection
 SRI: Supplemental Remedial Investigation
 SWMU: Solid Waste Management Unit

relatively short time because of high hydraulic conductivities in the water table aquifer. The potentially affected surface waters include Little Creek Cove, Lake Bradford, and Lake Smith. Lake Bradford and Lake Smith are used for recreational purposes, and Lake Smith serves as the secondary municipal water supply for the Norfolk-Virginia Beach area. Delineation of an actual threat or risk was not possible due to the lack of site-specific hydrogeologic and groundwater quality data.

The IAS presented a number of detailed recommendations concerning the installation and sampling of monitoring wells, the sampling of surface soil, surface water and sediment, and the types of laboratory analyses to be completed. The recommendations also addressed well completion depths and water level monitoring requirements. Many of the recommendations were aimed at resolving the data gaps identified in the IAS. These recommendations became the scope of work for the round 1 verification step (RVS).

2.1.2 Round 1 Verification Step (RVS)

The RVS at NAB Little Creek, the first step in the confirmation study process, was completed in October 1986. The purpose of the study was to verify the presence and/or absence of contamination at the six sites recommended in the IAS for a confirmation study (Sites 7, 9, 10, 11, 12, and 13). The scope of work of the RVS activities at each site was established by the recommendations presented in the IAS, with notable deviations concerning the number of monitoring wells completed and samples collected.

As part of the work conducted for the RVS, 31 monitoring wells were installed to facilitate the collection of groundwater samples and hydraulic head data to determine groundwater flow directions. Surface water and sediment samples were collected to investigate impacts on nearby surface water bodies and determine whether contaminated run-off was migrating from the IR Sites. Subsurface soil samples also were collected to delineate the vertical extent of contamination in probable source areas.

As stated in the RVS, the results of the round 1 sampling and analysis activities indicated that little or no contamination was leaving any of the three landfill sites addressed in the RVS (Sites 7, 9, and 10). Contamination was detected in one or more environmental media at the other three sites. These results indicated that contamination was being released from these three sites, but the magnitude and distribution of this contamination could not be determined on the basis of the RVS findings alone. The results of the sampling and analysis activities were used to develop recommendations for additional investigations at all six sites. These recommendations were generally limited to continued or expanded sampling conducted during the interim RI (IRI) to confirm the RVS results (IRI, 1991).

2.1.3 Interim Remedial Investigation (IRI)

The IRI was conducted in 1991 to determine whether or not further characterization activities or remedial actions (RAs) were warranted at Sites 7, 9, 10, 11, 12, or 13. The objectives of this investigation, as identified by Naval Facilities Engineering Command, were to conduct a second round of sampling at the six sites sampled for the RVS, and to integrate the historical and newly acquired data along with site-specific recommendations for further action into a single document. The data were used to develop recommended response action, a human health assessment, and site specific recommendations concerning additional characterization.

2.1.4 Background Groundwater Quality Study

A background groundwater quality study was conducted during 3 rounds of groundwater sampling completed on November 31, 1991, September 15, 1992, and June 30, 1993 at NAB Little Creek. The Background Groundwater Quality Study report was finalized in December 1992. Results of the third round of background groundwater quality sampling were reported in the RI/FS. The purpose of this study was to collect, organize, and present data on background groundwater quality and conditions. The groundwater quality information was obtained from a network of eight monitoring wells installed for this study. Since the objective was to obtain representative samples from all portions of the base, the wells were located throughout the base, and areas of known or suspected contamination were avoided. Information on the hydraulic characteristics of the water table aquifer was obtained by conducting pump tests at three locations.

Soil samples were collected from each well boring and analyzed for target analyte list (TAL) metals and moisture content. The wells were sampled and analyzed for target compound list (TCL) volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs), TAL metals, total petroleum hydrocarbons (TPH), pesticides, polychlorinated biphenyls (PCBs), total organic carbon (TOC), total organic halogens (TOX), ethylene dibromide, cyanide, hexavalent chromium, and anions.

Water level measurements were taken in the background monitoring wells and plotted to determine groundwater flow patterns. The data was not collected at the same time, however, and groundwater may be subject to tidal fluctuations. The general direction of groundwater flow for most of the eastern portion of the site is to the north, towards Chesapeake Bay and Little Creek Harbor. In the western portion of the base, the groundwater appears to generally flow to the west.

2.1.5 Preliminary Site Inspection (PSI)

A PSI was prepared in 1991 to assess the threat to human health and the environment from five sites at NAB Little Creek (Sites 4, 5, 15, 16, and 17). Chemical constituents of concern were detected in the groundwater at Site 5 and further sampling was recommended. At Site 16, elevated levels of PCBs were detected in soil and additional sampling was recommended to delineate contamination. Remediation was also recommended for Site 16. No further action was proposed for Sites 4, 15, and 17.

2.1.6 Remedial Investigation/ Feasibility Study (RI/FS) and Site Inspection (SI)

From 1993 through 1994, Foster Wheeler Environmental Services (FWES) conducted a RI/FS of Sites 7, 9, 10, 11, 12, and 13. The RI/FS included a Phase 1 BRA. At this same time, FWES conducted a SI at Sites 5 and 16. The investigations included soil, groundwater, sediment, surface water, and soil-gas sampling. Additional groundwater monitoring wells were also installed. The FS recommended long-term groundwater monitoring for Sites 9 and 10, a source removal action and post-removal monitoring for Site 11, and additional evaluations at Sites 7, 12, and 13. The SI recommended semiannual groundwater monitoring at Site 5 and a soil removal action at Site 16.

2.1.7 Supplemental Remedial Investigation (SRI) – Phase I

In 1995, FWES conducted a supplemental remedial investigation (SRI) to further characterize the soil and groundwater contamination at Sites 12 and 13. The SRI included soil, sediment, groundwater, and surface water sampling. Additional wells were installed at both sites. The report has not been finalized and will be incorporated into the Phase II SRI reports for these two sites.

2.1.8 RCRA Facility Assessment (RFA) Report

A Resource Conservation and Recovery Act (RCRA) facility assessment (RFA) was conducted at NAB Little Creek in 1989 by A.T. Kearny as a contractor to EPA Region III. The RFA is the first step in the RCRA corrective action process, an investigation and remediation process that facilities with RCRA Part B permits must go through in order to renew their permits. The RFA, which involves a records search and a SI, but no sampling and analyses, identified 147 SWMUs and several areas of concern (AOCs). SWMUs and AOCs are areas where wastes have been stored and/or where contaminants may have been released to the environment.

Prior to conducting a RCRA facility investigation (RFI), the next step in the corrective action process, NAB Little Creek decided not to renew their Part B permit. As a result, the base dropped out of the corrective action program. NAB Little Creek decided, however, to investigate 17 of the SWMUs by including them in the Navy's relative risk ranking system (RRRS) sampling program. The 17 SWMUs investigated were chosen because EPA had identified them as the sites of highest concern.

2.1.9 Relative Risk Ranking System (RRRS) Report

A RRRS and a revised RRRS analysis were completed by Baker Environmental, Inc. (Baker) in 1996. The purpose of the analysis was to gather contaminant, pathway, and receptor information for 17 SWMUs. The SWMUs addressed were originally identified in the RFA as being potential sites affected by contamination. Data were collected for each of the 17 SWMUs through a field investigation in October 1995. The field investigation was aimed at identification of contaminants in surface soil, subsurface soil, and groundwater. The results of the investigation were used to identify the relative risk posed by each SWMU according to the contaminants present, the migration pathway, and the potential receptors for each media at the SWMU. Both human health and ecological receptors were considered.

Based on the RRRS, three of the SWMUs were identified as posing a high risk, and six SWMUs were identified as presenting medium risk.

The nine high- and medium-risk SWMUs are listed below. The SWMUs were consolidated and renumbered as indicated.

High-risk SWMUs:

- SWMU 84—Demolition Debris Landfill (redesignated as IR Site 8)
- SWMU 105—Steam Plan Flyash Silo (redesignated as SWMU 2)
- SWMU 111—Pier 10 Sandblast Yard (redesignated as SWMU 3)

Medium-risk SWMUs:

- SWMU 17—Small Transformer Storage Area (redesignated as SWMU 1)
- SWMU 117—Special Boat Squadron 2 Battery Storage Area (redesignated as SWMU 4)
- SWMU 130—Building 3896 Boat Painting Area (redesignated as SWMU 5)
- SWMU 131-133—SeaBee Area (consolidated and redesignated as SWMU 6)

2.2 IR Site Descriptions

Descriptions of individual IR sites follow. Descriptions of SWMUs are provided in Section 2.3.

2.2.1 Site 5—Buildings 9 - 11, Motor Oil Disposal Area

Site 5 consists of Buildings 9 through 11 and the area between the buildings. This area measures approximately 100 feet by 150 feet. There is very little topographic relief in this area and drainage from rainfall appears to be to the west-southwest past Building 10. A small, concrete-bermed drum storage area, approximately 10 feet by 10 feet, and an oil/water separator were located on the northern side of Site 5 along Building 9. A drain in the middle of the concrete storage area was connected to the oil/water separator. The area between the buildings was previously covered by Marsden matting. Marsden matting consists of a layer of steel grating over top of solid steel plates. The spaces within the steel grating, and between the grating and the steel plate, would typically get filled with soil. A site visit conducted as part of the IAS noted that the soil within the Marsden matting was heavily stained with motor oil. However the construction of the matting (i.e.: the presence of the underlying steel plates) would have prevented the infiltration of the oil into the subsurface soil. Observations during a January 1992 site visit by FWES confirmed that the matting had been removed.

Buildings 9 and 11 had been used continuously since 1943 by Special Warfare Group 2.

Building 9 was used for motor pool maintenance, including trucks, trailers, and general purpose military vehicles. Used motor crankcase oil from this maintenance shop was reportedly disposed of on the ground in the area covered by the Marsden matting between Buildings 9 and 11 (RGH, 1984). However, given the construction of the matting, this seems unlikely. The IAS estimated that 1,230 gallons of oil and antifreeze were generated and disposed of each year. It is presumed that similar quantities were used in the past, since the level of activity has remained fairly constant. The potential quantity generated at Site 5 could be as high as 50,000 gallons of oil and antifreeze. There is no visible evidence at the site, based on observations made in December 1990 and April 1991 that would suggest disposal activities of this magnitude had occurred on or near the Marsden matting. Sampling and analyses conducted during 1991 and 1993 lend support to these visual observations. Building 9 was demolished in 1996 and a new building, Building 116, was constructed in roughly the same location.

Building 11 was originally built as a cable tank building. The ten cable tanks were concrete-lined inground tanks measuring 20 by 28 by 8 feet deep. They may have been used to store or perform maintenance on the mooring cables for mines. Seven of the tanks were backfilled with select fill and capped with a concrete cover in 1969. Three of the tanks, located near the center of the floor, were covered with steel plates. According to the IAS, from 1969 until 1981 used motor oil, solvents, and antifreeze from boat engines maintained in Building 11 were

reportedly stored in these three tanks. The IAS also reported that 2,285 gallons of oil were generated annually from activities in Building 11. If similar quantities are projected back to 1969, as much as 43,000 gallons may have been generated at Site 5 and placed in the cable tanks (PSI, 1991). In 1991, Building 11 was demolished to make way for new facilities, and only the concrete slab foundation and the three remaining subsurface cable tanks were kept in place. The liquid in the cable tanks was sampled and analyzed in 1993. Sampling results found low concentrations of total petroleum hydrocarbons (TPH). In May 1995, the remaining three of the original ten cable tanks were cleaned and drained. These three cable tanks were drained and cleaned again prior to being filled with sand and capped with concrete in June 1996.

Site 5 was the subject of a PSI performed by Ebasco Environmental Consultants (Ebasco) in 1991 and a SI performed by FWES in 1993. No constituents of concern were detected in surface soils sampled within the limits of the study area during the SI. Elevated levels of 1,1-dichloroethane (1,1-DCA) had been consistently detected in one monitoring well, GW-2. The level had increased from 23.2 µg/l in 1991 to 76 µg/l in May 1993. 1,1-DCA was not detected in any of the three other wells at the site during either of the sampling events. 1,1-DCA also was not detected in any soil samples. All four monitoring wells contained low levels of lead.

Soil samples obtained during the PSI contained only low levels of TPH suggesting that the reported dumping of waste oil between Buildings 9 and 11 was grossly overestimated or overstated. Further soil sampling was not required during the SI.

Results of soil and groundwater sampling at Site 5 obtained during the PSI and SI indicate that no risk is posed by contaminants in soil and groundwater. Verification groundwater monitoring on a semiannual basis, for a duration of one year, was proposed to verify the no-risk determination. The first round of verification sampling was conducted in May 1996 by FWES. The second round was conducted in December 1996 by CH2M HILL. The results of the two rounds of verification groundwater sampling confirm the results of previous groundwater sampling at Site 5. Two chlorinated VOCs (1,1-DCA and chloroethane) continued to be detected at one well at the site (LC5-GW2) at relatively constant concentrations. Neither compound has a maximum concentration limit (MCL).

Additional groundwater sampling was requested by the EPA in 1998 to confirm groundwater conditions downgradient of the site. After sampling results are received, a PRAP and DD for institutional controls will be prepared and submitted to regulators and the public for review in FY 1999.

A discussion of future activities associated with Site 5 is provided in Section 3.2.1 of this SMP.

2.2.2 Site 7—Amphibious Base Landfill

The Amphibious Base Landfill is located in the south-central portion of the installation. The area is bounded on the north by the southeast shoreline of Little Creek Cove, on the east by Helicopter Road, on the south by Amphibious Drive and the Hampton Roads Sanitation District (HRSD) treatment plant, and on the west by an undeveloped area and an ordnance magazine. The Amphibious Base Landfill was originally thought to comprise 50 acres; however, the 1994 RI/FS investigation determined through a review of historical aerial photographs and the HRSD treatment plant construction boring logs (which show no

indication of waste, debris, or contamination south of Amphibious Drive) that the areal extent of the landfill is approximately 38 acres. The area was originally an arm of Little Creek Cove which was filled with dredge spoils prior to its use as a landfill. A chain link fence borders the landfill to the east and south and Little Creek Cove borders the northern side of the site. Two entrances with locked gates and a gravel access road control access to the site. Restricted access signs are in place around the perimeter of the site.

The current appearance of the landfill ranges from small stands of mature trees on the western portion of the site to tall, thick grasses in the central and eastern portions of the site. The area bordering Little Creek Cove also is well vegetated, with numerous trees, dense brush, and tall grasses. All of the visible debris has been removed from the landfill surface and additional cover soil and topsoil were added to the site's open areas in May 1998. The landfill was constructed so that the central portion is comprised of a broad flat area bounded by gentle slopes on all sides. Erosion-prone areas of the site have been reinforced on each side of the canal crossing the west side of the site.

According to the IAS, the landfill operated from 1962 to 1979, spanning the period during which land waste disposal of many chemicals and other materials was changed from an acceptable to an unacceptable technology. Before its use as a landfill, the site was used for the disposal of spoils from the dredging of Little Creek Cove. Some of the original dikes built to contain the dredging spoils are still visible in the northeast corner of the landfill area.

The Amphibious Base Landfill was initially operated as a trench-type landfill with open burning of refuse in the trenches. The trenches were excavated to the depth at which groundwater filled the trench as fast as it could be excavated. Standing water in the trenches was common. Cover was applied as necessary to maintain traction for the vehicles involved in the operations. For a landfill operated in this manner, it is difficult to establish the degree of combustion or the fate of any particular item disposed. Remaining evidence of the trenches is easily seen along the southern edge of the area. The ground surface has settled as the wastes in the trenches have become more compacted than the adjacent soils. The landfill was later operated as an area landfill, with refuse spread over the ground surface and covered on a regular basis. This aspect of the operation has brought the surface elevation up to its present level.

The estimated volume of waste in the landfill is approximately 500,000 cubic yards (cy). Most of this total volume is presumed to be composed of nonhazardous solid waste from base housing and other residential and commercial activities at the installation. Specific records documenting the types and quantities of waste placed in the Amphibious Base Landfill are not available. Because the landfill received all wastes generated by NAB Little Creek during its operation, it most likely received potentially hazardous materials.

Waste oils and metals segregated from the wastes were placed in the landfill starting in 1970. A hazardous waste management plan was not implemented until 1979, the year in which the landfill closed. Up until 1979, the landfill was operated under a Virginia solid waste permit (No. 276). The permit was terminated in 1982 and the landfill was considered closed by the state. After closure, the landfill area continued to be used as a metal collection and transfer site, temporary storage for wastes, and burn area for scrap wood and trees. Currently, there is no collection transfer activity or temporary storage of construction debris and miscellaneous rubble occurring on site. Open burning was halted in 1984 and waste storage activities were moved in 1994. In 1994, the landfill was covered with approximately 24 inches of compacted

soil and 2 to 3 inches of topsoil cover. A vegetative cover was also established to mitigate dermal contact with surface soils in 1994. The thickness of the soil cover was largely confirmed by soil borings collected by CH2M HILL in preparation for the soil cover constructed in 1998.

Due to its location within the explosive arc for the ordnance magazine, the Navy does not currently intend to build on the landfill; thereby eliminating potential exposure to the subsurface soils by intrusive activities. If construction at Site 7 is desired in the future, further evaluation of the subsurface conditions would be required, including delineation of the extent of contamination and a detailed characterization of the landfill.

The IAS initiated at NAB Little Creek in 1984 concluded that Site 7, in addition to several other sites, posed sufficient potential threats to human health or the environment to warrant further evaluation in a confirmation study. A confirmation study subsequently was performed at Site 7 and several other sites that were recommended for further investigation in the IAS. The confirmation study was conducted in two rounds consisting of the RVS, conducted by CH2M HILL, dated October 1986, and the IRI, conducted by Ebasco, dated November 1991. The study verified the presence or absence of potential contamination at the IR sites identified in the IAS. Nine groundwater samples, five surface-water samples, and five sediment samples were collected at Site 7 during this phase of the investigation. Groundwater and surface water samples were analyzed for volatile organic compounds (VOCs), base neutral and acid extractable organic compounds (BNAs), pesticides, PCBs, and metals.

The RVS report concluded that little or no contamination was leaving the landfill at that time. However, the source of the low-level concentrations of some contaminants in surrounding surface water could not be adequately assessed, based on available data. The RVS, in turn, recommended that a second round of samples be collected from the previously sampled monitoring wells and surface water and sediment locations.

The IRI was conducted to determine whether further characterization activities or RA were warranted at Site 7. Additional sampling was performed, as recommended in the RVS. The results tended to confirm the findings of the RVS.

On the basis of the combined results of the RVS and IRI, the IRI report concluded that the landfill was not releasing contaminants to the groundwater. The IRI recommended that the status of the landfill, according to Virginia regulations, be determined.

The RI/FS was conducted at six sites, including Site 7, by FWES in November 1994. Eight surface soil, five subsurface soil, nine groundwater, six surface water, and six sediment samples were collected at Site 7.

A Final FS was completed for Site 7 by FWES in October 1997. The FS identified remedial alternatives to reduce potential human health and environmental risks associated with the various contaminants of concern identified at Site 7. The preferred alternative was identified on the basis of the evaluation provided in the FS and was finalized after a public comment period. The Final Proposed Remedial Action Plan (PRAP) was completed in October 1997. Alternative 2 of the FS, institutional controls, was recommended as the preferred alternative. The alternative consists of removing visible debris from the landfill surface and placing topsoil in selected areas of the landfill where the existing cover is insufficient, construction of a new perimeter fence, and semiannual monitoring.

A Draft Final DD was submitted in October 1997 for comment. The Navy signed the final DD in January 1998. The design for the alternative was completed and the alternative was implemented in the spring of 1998. A draft final supplemental ecological assessment (SEA) (Baker, May 1996) was prepared for the site to address potential risks to environmental receptors.

In June 1998, RAs were completed at Site 7. The remedy included the removal of 610 cy of debris along the landfill shoreline. Approximately 8,640 cy of clean fill and 11,260 cy of topsoil were placed on the landfill during the RA. A 12 to 18 inch thick fill layer was placed over some areas of the landfill where cover was inadequate and a 6 to 8 inch topsoil cover was placed over the entire landfill area. The landfill waste is currently located an average of 30 inches below the ground surface.

A long-term monitoring plan for groundwater, surface water, and sediment was proposed, and the first of the proposed ten rounds of semiannual long-term monitoring was conducted in June 1998. A long-term monitoring letter report was submitted to the Navy, EPA, and VDEQ in October 1998. The first round of long-term monitoring results at Site 7 were similar to results reported in the RI/FS.

Discussions of future activities associated with Site 7 are discussed in Sections 3.2.2 and 3.3.1 of this SMP. Discussions of RAs at Site 7 are discussed in Section 5.1.1.

2.2.3 Site 8—Demolition Debris Landfill

Site 8, the Demolition Debris Landfill, was formerly classified as SWMU 84. The site was originally identified in the RFA Report (A.T. Kearney, 1989) as being a potential site affected by contamination

The Demolition Debris Landfill, located on the northeast corner of the intersection of Amphibious Drive and Helicopter Road, was operated from 1971 to 1979 as a disposal area of inert materials. Approximately 4,840 cy of waste are contained in the landfill. The Amphibious Base Landfill (Site 7/SWMU 124) was in operation during the same time as the Demolition Debris Landfill and is located directly across Helicopter Road from the Demolition Debris Landfill. The Demolition Debris Landfill waste was disposed of to a depth of approximately 3 feet and covered an approximate 2-acre area. The landfill was constructed in a pit where the Public Works Center (PWC)-Transportation Division excavated material from the site to surface parking lots. The landfill area did not include the wooded areas between the tributary of Little Creek Cove and Amphibious Drive. Wastes contained within the landfill included mercury-contaminated carpeting from the demolition of a dental clinic, debris from buildings destroyed by fire, concrete piping, and debris removed from the bar screen in the base sewage pump stations. An old loading ramp which may have been used in the borrow pit operations, is visible along with sections of old concrete pipe at the landfill. There is no evidence of past hazardous waste disposal at the site. No release controls were in place at the site and no waste inventory is available.

Site 8 is situated adjacent to wetlands fed by a drainage canal from Lake Bradford and possibly by discharge from the surficial aquifer. The wetlands drain into Little Creek Cove and experience tidal fluctuations. A wildlife observation station is located at the east end of the site. Access to the area is unrestricted, although its designation as a wildlife area is believed to minimize access by base personnel.

The Demolition Debris Landfill was included in the Navy's RRRS. The high risk ranking evaluated by the RRRS was primarily due to the presence of metals in the soil and groundwater. The analytes found to drive the risk in soil and groundwater include manganese, arsenic, beryllium, aluminum, vanadium, antimony, chromium, lead, and zinc. Also detected in soils at Site 8 were several SVOCS, mostly polycyclic aromatic hydrocarbons (PAHS), PCBs, and a few VOCs. In addition to the metals in the groundwater at Site 8, two VOCs, four SVOCS, and four pesticides were detected.

In September 1998, as part of a SI, five monitoring wells were installed at Site 8. Additional investigations including groundwater monitoring, the collection of surface and subsurface soil samples at eight locations and the collection of sediment samples at four locations also occurred in September 1998.

Discussions of future activities associated with Site 8 are provided in Section 3.2.3 of this SMP.

2.2.4 Site 9—Driving Range Landfill

The Driving Range Landfill is located in the northeast portion of the installation, northwest of the golf course, directly east of the Sewage Treatment Plant Landfill and Hewitt Drive, and approximately 500 feet south of the Chesapeake Bay shoreline. The northern perimeter of the landfill is bounded by a network of sand dunes that parallels the Bay shoreline. The landfill comprises approximately 6 acres. Although precise boundaries for the fill area have not been delineated, the boundary of the landfill generally coincides with that of the currently operating driving range. The existing surface features include a relatively level and vegetated (grass turf) soil cover.

The Driving Range Landfill operated from 1952 through 1956, and was not closed by a regulatory authority at any time. Prior to landfilling operations, the area was apparently a marsh or other lowland environment adjoining the easternmost arm of Little Creek Cove. Landfilling methods reportedly entailed the excavation of trenches with a dragline or other heavy equipment. The trenches were filled with waste and backfilled. The depth of excavation probably varied but was likely limited by the depth to the water table, typically within 5 feet of the ground surface.

An incinerator, located on Hewitt Drive opposite the western perimeter of the Driving Range Landfill, was active during much of this time, and apparently burned combustible materials generated by NAB Little Creek. The resulting ash was disposed of in the Driving Range Landfill, as were any noncombustible items that bypassed the incinerator. After the incinerator was decommissioned, solid waste from the base was disposed of directly in the landfill. According to the IRI, some of this material may have been burned after being placed in the trench.

The IAS estimated that the landfill contains approximately 40,000 cy of waste. Historical data concerning the types and quantities of wastes in the landfill were not available, but it was reported in the IAS that the landfill contents include various hazardous wastes such as PCBs and pesticides as well as potentially large quantities of used motor oil. Given the sizable population of the base and resulting significant quantities of nonhazardous solid wastes that would be generated, it is likely that the overall quantity of hazardous waste is small compared to the total volume of solid waste placed in the landfill.

After landfill operations at the site were terminated, the installation converted the area into a driving range. The depth of the cover on the surface of the driving range is not known. A berm was constructed, using clean fill, along the east side of Hewitt Drive and sewage sludge was brought in from the HRDS treatment plant along the southern base boundary to enhance growth of the grass (IRI, 1991). The Navy does not currently intend to build on this site, thereby eliminating potential exposure to the subsurface soils by intrusive activities. If construction at the site is desired in the future, further evaluation of the subsurface conditions, including delineation of extent of fill and subsurface soil contamination, would be required.

Site 9 was the subject of RI/FS performed by FWES in 1993. The findings were summarized in the RI/FS report dated November 1994. Results of RI/FS sampling and the BRA indicate that no current risk is posed by contaminants in soil and groundwater.

A PRAP for both Sites 9 and 10 was prepared by Baker in January 1997. The PRAP called for long-term groundwater monitoring due to the contents of the landfill and its proximity to the Chesapeake Bay and other surface water bodies. A long-term monitoring program was prepared by FWES in 1996. Groundwater monitoring was proposed to be conducted semiannually for a period of 5 years (10 rounds of sampling). The first round of monitoring was conducted in May 1996 by FWES. Since May 1996, 4 additional rounds of groundwater monitoring have been conducted semiannually by CH2M HILL. Groundwater monitoring results are presented in periodic letter reports submitted to the Navy, EPA, and VDEQ following each round of sampling.

Discussions of future activities associated with Site 9 are provided in Sections 3.2.4 and 3.3.2 of this SMP.

2.2.5 Site 10—Sewage Treatment Plant Landfill

The Sewage Treatment Plant Landfill is located in the northeast portion of NAB Little Creek, approximately 500 feet south of the Chesapeake Bay shoreline and due west of the Site 9 Driving Range Landfill. The landfill is bounded on the north and the west by sand dunes, on the south by 11th Street and recreational facilities that extend onto the landfill area, and on the east by Hewitt Drive. The landfill is approximately 18 acres, and its boundary is generally well-defined by the dunes and roads. However, precise delineation of the fill area has not been performed. Existing surface features include a well-vegetated soil cover that has been partially reclaimed for use as baseball diamonds and vegetated sand dunes.

The Sewage Treatment Plant Landfill began operation in 1941 and was the first landfill to be used at NAB Little Creek. Landfilling operations began in the southern portion of the area, which included an extension of Desert Cove and associated lowlands. Disposal in this area was reportedly directly into the water and resulted in the filling of approximately 5 acres of the cove. Disposal activities then moved northward into an area of marshy lowlands, and eventually encompassed an area of approximately 18 acres. According to the IAS, the average depth of fill in both areas is 6 feet, which yields a combined total volume of waste of 46,500 cy.

The types of waste placed in the Sewage Treatment Plant Landfill were predominantly solids until 1952. Subsequently, most of the waste was diverted to the incinerator and the ash was disposed in the Site 9 Driving Range Landfill. Disposal of sewage sludge from the on-site sewage treatment plant, formerly located in the southeast portion of the fill area, continued until 1968, the year in which the treatment plant closed. The bulk of the sewage sludge was

disposed of along the northwest perimeter of the landfill, near the base of the sand dunes that border the landfill.

According to the IAS, between 1941 and 1952, this landfill was the only operational landfill on the base, and received all of the household and industrial wastes generated on the base, including a variety of potentially hazardous constituents. A large quantity of demolition debris also was disposed of in the landfill. Historical data concerning the actual types and quantities of waste placed in the Sewage Treatment Plant Landfill are not available. It is likely that the volume of hazardous waste disposed of in the landfill is small relative to the volume of nonhazardous waste. The Navy does not currently intend to build on this site, thereby eliminating potential exposure to the subsurface soils by intrusive activities. If construction at the site is desired in the future, further evaluation of the subsurface conditions, including delineation of extent and magnitude of subsurface soil contamination, would be required.

Site 10 was the subject of an RI/FS performed by FWES in 1993. The findings were summarized in the RI/FS report dated November 1994. Results of RI/FS sampling and the BRA indicate that no current risk is posed by contaminants in soil and groundwater.

A PRAP for both Sites 9 and 10 was prepared by Baker in January 1997. The PRAP called for long-term groundwater monitoring due to the contents of the landfill and its proximity to the Chesapeake Bay and other surface water bodies. A long-term monitoring program was prepared by FWES in 1996. Groundwater monitoring was proposed to be conducted semiannually for a period of 5 years (10 rounds of sampling). The first round of monitoring was conducted in May 1996 by FWES. Four additional rounds of groundwater monitoring have been conducted semiannually by CH2M HILL. Groundwater monitoring results are presented in periodic letter reports submitted to the Navy, EPA, and VDEQ following each round of sampling.

Discussions of future activities associated with Site 10 are provided in Sections 3.2.5 and 3.3.3 of this SMP.

2.2.6 Site 11—School of Music Plating Shop

The School of Music Plating Shop was located in Building 3651. This building is located in the eastern portion of the base, near the intersection of 7th and E Streets. The School of Music, located in Building 3602, is southwest of the former plating shop. The site consisted of an in-ground concrete tank used to neutralize plating solutions, its associated piping, and potentially contaminated soil surrounding the tank and piping.

The tank was approximately 10 feet east of the south corner of Building 3651. Surrounding areas, apart from buildings and paved areas, are covered with grass and are generally level between man-made drainage ditches.

The neutralization tank for the plating shop had a diameter of 5 feet and a depth of 11 feet. Approximately 2.5 cy of crushed limestone were placed in the pit to neutralize the acidic plating bath wastes. Wastewater entered the tank via an acid-resistant drainpipe that originated in a sink in Building 3651. According to the IRI, neutralized wastewater was discharged from the unit into the storm sewer via an outlet and drain from the northwest side of the tank. Flow through the unit was controlled by the standpipe and drain elevations, so that all wastewater had to pass through the limestone before it could enter the discharge pipe connecting with the storm sewer.

The IAS reported that plating wastes were discharged into the neutralization tank during a ten-year period beginning in 1964. In 1974, the plating operations were transferred to a separate facility and discharges into the neutralization tank were discontinued. During its period of operation, the plating shop reportedly used silver cyanide, copper cyanide, chromic acid (brite dip), nickel plating baths, and various acids. In addition, lacquer strippers and lacquer were also used. Small quantities of these plating baths, acids, and lacquer strippers were disposed of down the sink in the plating shop which drains into the neutralization tank and eventually into the storm sewer system. The IAS reported that approximately 10 gallons of each plating chemical and lacquer stripper were disposed of in the shop sinks each year.

Site 11 was the subject of a RI/FS performed by FWES in 1993. The findings were summarized in the RI/FS report dated November 1994. The surface soil, the neutralization tank and its contents, and groundwater at Site 11 were determined to be affected by contamination.

Arsenic, beryllium, and manganese were detected above screening criteria in the surface soil and trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE) were detected in the groundwater above MCL drinking water standards in one of the three wells, LC11-GW01S, at the site. The maximum concentrations of TCE and 1,1-DCE detected in three rounds of groundwater sampling were 340 ppb and 34 ppb, respectively. The MCLs for TCE and 1,1-DCE are 5 ppb and 7 ppb, respectively. The BRA conducted as part of the RI/FS indicated some risk to surface soil exposure under the future residential scenario, but no risks associated with exposure to groundwater.

A DD was issued in November 1994, proposing the removal of the neutralization tank, associated piping, and neighboring surface and subsurface soil. The neutralization tank, piping, and surrounding soil were excavated in November 1995. An interim removal action final closeout report was issued in May 1996, and was finalized without additional comments.

A short-term post-removal groundwater monitoring program was proposed (FWES, 1996) to verify the effectiveness of the source and contaminated-soil removal action. Sampling results for Site 11 were scheduled to be assessed and the program reevaluated after one year (two rounds) of sampling. The first round of post-removal monitoring was conducted in May 1996 by FWES. The second round of monitoring was completed by CH2M HILL in December 1996. The results of the groundwater monitoring program are reported in the *Final Groundwater Monitoring Report for Sites 5 and 11 by CH2M Hill* dated February 1998.

During the post-removal groundwater monitoring, no metals were detected above MCLs or RBCs, indicating the removal action removed the source of metal contamination and the metal contamination. Historically, chlorinated hydrocarbons had only been detected in one well, LC11-GW01S, at Site 11. During the last round of the post-removal groundwater monitoring program, however; low levels of TCE were detected in LC11-GW03S at concentrations below the MCL for TCE. A decrease in the concentration of all chlorinated hydrocarbon groundwater contaminants was observed during the post-removal groundwater monitoring in well LC11-GW01S. Significant fluctuations in concentrations of contaminants have been observed in the past in this well. Therefore, additional groundwater sampling was recommended to define the extent of the contamination in the groundwater and to evaluate if the contamination in LC11-GW01S is on a permanent and irreversible downward trend.

Supplemental remedial investigation field activities at Site 11 were initiated in June 1998. As part of the SRI, additional groundwater samples were collected with a Geoprobe® at 17

locations to define the source area and extent of contamination at Site 11. Concentrations of chlorinated VOCs collected from 8 to 12 feet bgs in the shallow portion of the surficial aquifer did not exceed MCLs. Concentrations of 1,1-DCE, cis-1,2-DCE, and TCE exceeded MCLs in groundwater samples collected from the deep portion of the surficial aquifer; generally from 17 to 21 feet bgs. Total chlorinated VOCs in the lower portion of the aquifer were found at greater concentrations and were more extensive than in the upper portion of the aquifer at Site 11.

As a result of the Geoprobe® groundwater sampling, one shallow monitoring well, screened from about 7 to 12 feet bgs, and 8 deep monitoring wells, screened from about 15 to 20 feet bgs were installed in September 1998. These monitoring wells serve to monitor the source area and extent of the plume. All the new and existing monitoring wells were sampled in September 1998.

Discussions of future activities associated with Site 11 are provided in Section 3.2.6 of this SMP.

2.2.7 Site 12—Exchange Laundry Waste Disposal Area

The Exchange Laundry/Dry Cleaning Facility was located in Building 3323, near the intersection of 3rd and B Streets, in the eastern portion of NAB Little Creek. Building 3323 was torn down in 1987 for the construction of the existing commissary (Building 3445). A catch basin and a major portion of a storm sewer line were removed during construction of the new building in 1992. The storm sewer line received dry cleaning wastes from the former Naval Exchange (NEX) laundry and drained to a canal that flows between Lake Bradford and Little Creek Cove.

As reported in the IAS, wastes were dumped into the storm sewer and thought to flow into the drainage canal via an outfall located immediately west of the former laundry building. However, review of the storm sewer configuration, conducted by Little Creek personnel in the summer of 1991, revealed that drainage from the catch basin reportedly used for the dumping actually flows north along B Street and then west along the north side of Building 3329, before flowing into the canal. Based on this information, the outfall for wastes dumped into the catch basin was approximately 350 feet north of the outfall sampled during the IRI investigation and the 1986 Round 1 Verification Step. Drainage into the outfall pipe sampled during the IRI comes from a relatively small area of the parking lot around Building 3432.

Based on recommendations made in the Site Characterization Report for the commissary construction project, the storm sewer was removed and the area regraded.

The ground surface at the site was mostly an asphalt-paved parking area associated with the car wash and former Buildings 3432, 3433, 3434, and 3435 (replaced by Building 3445). The current commissary building was commissioned at the site in early 1993. The former Building 3323 lot was graded for the parking area for the new commissary. The outfall immediately west of the car wash consists of a 12-inch galvanized iron pipe located approximately 3 feet below grade. This outfall is referred to as the "southern" outfall or discharge pipe. The outfall located north of Building 3445, the "northern" outfall, which is connected to the catch basin used for disposal, was not inspected during the IRI field program, but probably had a configuration similar to the southern outfall. The catch basin used for disposal, located southwest of the intersection of 4th and B Streets, has since been removed.

The drainage canal is approximately 20 feet wide and 9 feet deep from the top of the bank. The sides of the canal are steep and covered with a relatively thick growth of vegetation. At the time of the April 1991 IRI site visit, the canal contained approximately 2 to 3 feet of water, i.e., the water level was 6 to 7 feet below the top of the bank. The canal is bordered by a 20- to 30-foot-wide strip of vegetation on either side containing abundant trees, bushes, and weeds. The flow direction in the canal is to the south and is controlled by a weir at Little Creek Cove that prevents the tides in the cove from backing up into Lake Bradford. Miscellaneous trash and refuse were observed in many places along the banks of the canal and the wooded areas (IRI, 1991).

The IAS reported that wastes dumped into the storm sewer included tetrachloroethene (PCE) sludges, soap, sizing, and dyes. The period of operation and disposal lasted from 1973 until 1978, during which an estimated 1,320 gallons of waste were dumped into the storm sewer drain. Of this total, approximately 200 gallons were PCE sludges. In addition to the dumping, smaller quantities of PCE and other wastes may have entered the storm sewer through run-off from spills or overflow of waste containers (IRI, 1991).

Site 12 also was a subject of the RI/FS performed by FWES in 1993. The findings were summarized in the RI/FS report dated November 1994. A Geoprobe® investigation was conducted and four monitoring wells (LC12-GW01S through LC12-GW04S) were installed. In addition, groundwater, surface water, and sediment samples were collected and analyzed during this investigation.

Groundwater samples were collected from the four monitoring wells and were analyzed for VOCs. Toluene, 1,2-dichloroethene (total), TCE, and PCE were among the VOCs detected in groundwater samples. The highest total VOCs was 18,200 ppb at LC12-GW02.

Four surface water samples and four sediment samples were collected from the canal adjacent to Site 12. These samples were analyzed for VOCs and TAL metals. The highest total VOCs in surface water was 144 ppb. The primary constituent contributing to the total VOC concentration was toluene; observed at a concentration of 58 ppb. TAL metals detected at elevated levels in the surface water include barium, copper, lead, manganese, and zinc. Low concentrations of VOCs, including 1,2-dichloroethene (total), TCE, PCE, and other non-chlorinated VOCs, were detected in all of the sediment samples. The highest total VOCs detected was accounted for entirely by acetone at a concentration of 82 ppb at location 12-SED-102. The TAL metals aluminum, barium, chromium, copper, iron, lead, manganese, vanadium, and zinc were detected at elevated levels in the sediment sample from location 12-SED-10.

A Phase I Supplemental Remedial Investigation (SRI), which included soil sampling in the area of the former Exchange Laundry, installation of five additional monitoring wells (LC12-GW05S through LC12-GW09S), pumping tests, and collection of surface water and sediment samples from the adjacent canal, was conducted from August 1995 through September 1995.

Concentrations of VOCs and SVOCs were observed above their detection limits in subsurface soils. Three VOCs, acetone, PCE, and toluene, were detected at sample locations LC12-GW05S, LC12-GW08S, LC12-GW09S, LC12-SB01, and LC12-SB02. SVOCs were detected in samples collected from LC12-GW06S, LC12-GW07S, and LC12-GW09S.

Groundwater from wells LC12-GW03S, LC12-GW04S, LC12-GW05S, LC12-GW06S, LC12-GW07S, and LC12-GW08S contained VOCs above their detection limits. The highest total

VOC concentration was observed in LC12-GW04S. The highest groundwater PCE concentration was 1,600 ppb observed at LC12-GW05S. Groundwater sample locations with SVOC concentrations greater than their detection limits include LC-GW03S, LC12-GW04S, and LC12-GW08S. Pesticides were found above their detection limits at low concentrations at sampling locations LC12-GW02S and LC12-GW05S. Pesticides with prescribed MCLs were below their MCLs. Several TAL metals were observed at concentrations exceeding their MCLs.

Aluminum and manganese MCLs were exceeded in surface water samples. Acetone was detected in sediment sample LC12-SED-105 and chlorobenzene was detected in sediment sample LC12-SED-107.

Additional SIs were conducted by CH2M HILL in October 1997 as the first step in the Phase II SRI. CH2M HILL reported interim results of these investigations in December 1997 in the *Interim Results of the Phase II SRI*. Geoprobe and well sampling activities, as well as surface water and sediment sampling and water level monitoring activities were conducted during this portion of the SRI.

The highest total chlorinated VOC concentration was detected in well LC12-GW05S at 13,643 ppb. A PCE concentration of 13,600 ppb was observed in this well. Concentrations of total chlorinated VOCs in LC12-GW01S and LC12-GW03S have been decreasing over time during the three rounds of groundwater sampling associated with the RI (June 1993), Phase I SRI (August 1995), and the current Phase II SRI. During this same time period, concentrations of total chlorinated VOCs have been increasing in samples collected from LC12-GW05S and LC12-GW06S. Groundwater samples collected from LC12-GW02S and LC12-GW04S have varied greatly over the three sampling events and do not show a distinct trend with time. Chlorinated VOCs were not detected during the Phase II SRI Interim Activities in surface water and sediment samples.

From June through September 1998, eight monitoring wells and eight multi-level samplers were installed at Site 12. Two monitoring wells are screened across the majority of the aquifer and monitor the downgradient extent of contamination at the site. Three monitoring wells and eight multi-level samplers monitor the variation of contamination and other parameters with depth in the Columbia Aquifer. Groundwater flow in the Columbia Aquifer is influenced by the infiltration of groundwater into sanitary sewers on the western portion of Site 12. The influence of these sewers on the surficial groundwater at the site will be further investigated during FY 1999. Three monitoring wells, installed in the Yorktown aquifer below the Yorktown confining unit, defined the lithology underlying the surficial aquifer, monitor the groundwater flow between the surficial and Yorktown aquifers and within the Yorktown aquifer, and monitor the extent of contamination in the Yorktown aquifer.

Groundwater sampling for natural attenuation parameters as well as for chlorinated VOCs was conducted in July and September of 1998. Biodegradation is occurring at the site, based on the reduction in concentrations of chlorinated VOCs over time and the presence of PCE breakdown products (TCE and cis-1,2-DCE) in the groundwater collected from selected wells. The purpose of this sampling was to determine the extent of contamination and if biodegradation is occurring at a rate that would make it a viable remedial alternative.

Discussions of future activities associated with Site 12 are provided in Section 3.2.7 of this SMP.

2.2.8 Site 13—Public Works PCP Dip Tank and Wash Rack

The pentachlorophenol (PCP) Dip Tank and Wash Rack is located near the intersection of 7th and F Streets in the eastern portion of NAB Little Creek, approximately one block west of Site 11. The site consisted of the dip tank formerly used to treat wood with a mixture of PCP, diesel, and kerosene, an adjacent area that contained drying racks for the PCP-treated wood, an open area formerly used by the PWC for storage of supplies and equipment, and a concrete wash rack at the southwestern end of that area.

The PCP dip tank was located in the southwest corner of the fenced compound behind (west of) Building 3165E. According to a former Public Works Supervisor, the tank was constructed of metal, was 20 feet in length, and 5 feet in diameter. The top third of the tank was cut off and replaced with a metal lid. The bottom half of the tank was buried in the ground. A tank of this size and specifications would hold approximately 1,500 gallons.

The contents of the tank were a mixture of one part PCP to ten parts diesel and kerosene. Wood was dipped into the tank and either set on racks for drying or placed directly on trucks for delivery to where it was to be used on base. The drying racks were located immediately east of the dip tank between the tank and Building 3165E. A pump was located at the south end of the tank, outside the fenced compound. This pump was used to keep the contents of the tank mixed and to empty the contents of the tank into 55-gallon drums when it became spent. According to the former PWC supervisor, there had only been one PCP tank throughout the history of this area and it was always in this location. The dip tank was cleaned out approximately every 6 months, at which time the approximately 55 gallons of PCP sludge generated are believed to have been disposed of in the Amphibious Base Landfill (IAS, 1984). All remaining PCP solution and associated sludges were removed from the tank in 1975. The tank itself was dismantled in 1982. The area formerly containing the PCP dip tank and drying racks has since been paved with asphalt and converted to a PWC storage area.

The wash rack and associated storage area, both of which were immediately south of the dip tank and west of Building 3165D, continue to be used by the PWC. The wash rack, located at the southwestern corner of the storage area, is a concrete pad with bermed sides and centrally-located deck drain. The rack is used by the PWC to clean vehicles, equipment, and miscellaneous objects with steam and biodegradable chemical cleaners. Wash water and other run-off from the rack drains through the central deck drain into an oil/water separator located under the paved driveway between the wash rack and Building 3165. The oil/water separator was accessible via a rectangular steel manhole located in the driveway. The contents of the separator, as observed in April 1991, included both oily sludge and oil.

The unpaved storage area immediately north of the wash rack, between the wash rack and the former location of the PCP dip tank, was used for the storage of various materials and equipment. The IAS reported readily observable solvents, paint, fuel, and tar staining the surface in this area. At the time of the April 1991 SI during the IRI, the gravel area was free of surface staining, indicating that although the area continued to be used as a storage yard by Public Works, the occurrence of spillage and other releases has been significantly reduced (IRI, 1991).

Site 13 was the subject of an RI/FS performed by FWES in 1993. The findings were summarized in the RI/FS report dated November 1994. Three monitoring wells were installed

as part of the RI effort. In addition, groundwater, surface and subsurface soil samples were collected and analyzed during this investigation.

Five surface soil samples were collected from the former location of the PCP dip tank and a drainage ditch onsite. These samples were collected from a depth of 0 to 6 inches bgs and were analyzed for VOCs, SVOCs, and TOC. VOCs were detected at all five surface soil sampling locations. The highest total VOCs detected was 19 ppb and the total SVOCs detected ranged from 1,210 ppb to 95,800 ppb.

Three subsurface soil samples were collected at varying depths from soil borings at Site 13. These samples were analyzed for VOCs, SVOCs, and TOC. VOCs were detected at two of the three subsurface soil sampling locations. Xylene, acetone, and ethylbenzene were among the VOCs detected. The highest total VOC concentration was 250 ppb. SVOCs, including PCP, were detected at all three subsurface soil sampling locations. PCP concentrations ranged from 11,000 ppb to 890,000 ppb. Total concentrations of SVOCs detected ranged from 11,260 ppb to 890,000 ppb.

Groundwater samples were collected from 6 of the 8 monitoring wells at Site 13 (LC13-GW3S through LC13-GW8S). These samples were analyzed for VOCs and SVOCs. VOCs were detected at all six groundwater sampling locations. A maximum total VOCs concentration of 262 ppb was detected at LC13-GW06S. TCE, chlorobenzene, and PCE were detected at the highest concentrations, 5 ppb, 110 ppb, and 7 ppb, respectively, at LC13-GW04S. The highest concentration of vinyl chloride detected was 200 ppb at LC13-GW06S. SVOCs were detected at four of the six groundwater sampling locations (LC13-GW03S, LC13-GW05S, LC13-GW06S, and LC13-GW08S). PCP was detected at three of the six groundwater sampling locations (LC13-GW03S, LC13-GW06S, and LC13-GW08S); the highest concentration detected was 1,700 ppb at LC13-GW08S.

Additional site data were obtained during the Phase I SRI through Geoprobe® groundwater sampling west and southwest of the site, the installation of five new monitoring wells (LC13-GW09S through LC13-GW13S), groundwater sampling of monitoring wells, slug testing, and collection of soil samples from the dip tank and drying rack area. Surface and subsurface soil sampling during the Phase I SRI focused on delineating the areas of soil contamination found during the RI.

VOCs were detected in ten of the twelve groundwater samples collected from monitoring wells at the site. The highest concentration of PCE was 1,200 ppb; observed at LC13-GW06. VOCs detected in this well during the Phase I SRI were significantly greater than those observed during the RI/FS. Several SVOCs were detected in seven of the twelve groundwater samples. PCP was detected at the greatest concentrations; with a maximum concentration of 2,300 ppb observed in LC13-GW08S. During both the RI/FS and Phase I SRI sampling, PCP was detected at LC13-GW08S at the highest concentrations. The PCP concentration observed during the Phase I SRI sampling was slightly greater than the level observed during the RI/FS. PCP was the SVOC detected at the highest concentrations in groundwater and subsurface soils.

Additional soil and groundwater sampling, as part of a Phase II SRI, was recommended to fully delineate the contamination in these media. As part of the Phase II SRI, soil samples were collected in May 1998 around the former PCP dip tank to define the surficial and subsurface contamination in the PCP source area. Results of this portion of the Phase II SRI are reported in the *Engineering Evaluation/Cost Analysis (EE/CA) for Soil at Site 13: Public Works PCP Dip Tank*

and Wash Rack by CH2M HILL dated September 1998. The EE/CA was prepared to address the PCP soil contamination in the area of the former dip tank. The EE/CA recommended excavation of approximately 150 cy of soil. A PCP removal action is scheduled for FY 1999.

In June and July 1998, additional groundwater samples were collected using Geoprobe® to define the source and extent of contamination at Site 13. The results of the Geoprobe® groundwater sampling indicated the PCP plume is similar to the plume observed during the Phase I SRI sampling investigation. Concentrations of PCP in groundwater near the source area indicate a continuing source may be present. The chlorinated VOC concentrations observed during the groundwater sampling differ significantly from concentrations observed during the Phase I SRI. Total chlorinated VOC concentrations in monitoring wells were found to be much less than those found during the Phase I SRI.

Three wells, screened in the deeper portion of the surficial aquifer, and seven monitoring wells, screened across the majority of the surficial aquifer, were installed in September 1998 to monitor the extent of contamination and concentrations in the source areas of the plumes. All new and existing monitoring wells were sampled in September 1998.

Discussion of future remedial activities, including the proposed removal action at Site 13, are discussed in Sections 3.2.8 and 5.2.1 in this SMP.

2.2.9 Site 16—PCB Capacitor Spill, Pole No. 425

The area of the PCB capacitor spill around Pole No. 425 is located approximately 300 feet east of the intersection of Amphibious Drive and Helicopter Road on the south side of Amphibious Drive, approximately 12 feet from the road. This area of the facility is relatively level with a preferred direction of runoff to the north toward a swampy area in the woods, approximately 300 feet north of the road. During heavy rainstorms, water ponds in the grassy area where the pole is located between Amphibious Drive and the wooded area to the south until it reaches the level of the road and then drains to the north. An above-ground steam line parallels Amphibious Drive in this area and is located between Pole No. 425 and the woods, approximately 25 feet south of Amphibious Drive (PSI, 1991).

Less than 5 gallons of dielectric fluid were found missing from the capacitor, formerly attached to Pole No. 425, after a lightning strike in the early 1980s (IAS, 1984). The capacitor was removed from the pole. There was no visible evidence at the site that would indicate a spill of PCB-laden fluid.

A campground is located in the wooded area south of Amphibious Drive. Access to the camping area is gained by two driveways located 50 feet east and 50 feet west of Pole No. 425. An electrical hookup from Pole No. 425 to the campground was installed after the PCB spill. During installation a ditch was excavated from Pole No. 425, passing southward through the woods, approximately 40 feet, to the area that had been cleared for the campground. The depth of the ditch is estimated to have been between 2 and 3 feet. After completion of the electrical hookup, the area was regraded and revegetated.

Site 16 was the subject of a PSI performed by Ebasco in 1991 and an SI performed by FWES in 1993. PCBs had been detected at concentrations above the RCRA cleanup level since the 1981 capacitor spill. A concentration of 1,000 milligrams per kilogram (mg/kg) was reported in 1981. The PSI reported PCB concentrations up to 750 mg/kg. Analysis conducted during the SI indicated concentrations as high as 2,100 mg/kg for aroclor-1248. A soil removal action was

recommended for the site. A corrective measures plan (CMP) was prepared in September 1994 to identify removal action alternatives and costs. In addition, soil samples were collected for field screening to determine PCB levels, if any, across the road from Pole No. 425.

A removal action consisting of excavation and disposal of PCB-contaminated soil, vegetation, and the utility pole was completed in 1995, and the site was formally closed. No further actions are planned for the site.

2.3 SWMU Descriptions

Descriptions of individual SWMUs at NAB Little Creek follow. Descriptions of IR sites are provided in Section 2.2. The SWMUs were originally identified in the RFA. Samples were collected at each SWMU in October 1995, in support of the RRRS report. Note that SWMU identification numbers have been revised from those cited in the RRRS report; the SWMUs identified as posing medium to high risk by the RRRS were renumbered and are described below. Former SWMU identification numbers are cited.

2.3.1 SWMU 1—Small Transformer Storage Area

SWMU 1 (formerly classified as SWMU 17) is the Small Transformer Storage Area located in the vicinity of Buildings 3175, 3292, and 3293, south of 7th Street. The paved yard was used beginning in 1975 for storage of small, non-PCB-containing transformers. However, according to the 1984 IAS the site may have been used in the past for repair of PCB-containing transformers. The release history or contaminants that may have been released are unknown. The yard is covered with asphalt that is cracked in some places. No drains or berms are included in the yard. The site is located within a fenced service area which limits access to the SWMU.

Surface soil is exposed between Buildings 3292 and 3293. The other parts of the site are paved with asphalt (cracked in some places) that would preclude normal contact with the soil. Exposure to potentially contaminated soil would, however, be possible during excavation associated with utility maintenance or other activities.

The underlying soils consist of silty sand with occasional thin clay lenses. The soils would retard, but not prevent, vertical migration of constituents to the surficial aquifer. The surficial aquifer at NAB Little Creek is not used as a potable water source. No water supply wells are located in the area of the site. No surface water features are present in this area. Human contact with groundwater is therefore not anticipated.

Two surface soil samples were collected and analyzed for SVOCs and pesticides/PCBs in October 1995. Aroclor-1260, alpha- and gamma-chlordane, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, and SVOCs were detected in the sample collected from between Buildings 3292 and 3293. Other analytes were not detected above detection limits.

This SWMU was concluded to pose a medium risk due to PCBs in the surface soil.

2.3.2 SWMU 2—Steam Plant Flyash Silo

SWMU 2 (formerly classified as SWMU 105) is an area containing a flyash silo for the steam plant that has been operating since 1953. The SWMU is located north of the steam plant (Building NAB 757). Baghouses are used to remove flyash from the steam plant exhaust. The

collected flyash is stored in a silo until it is removed for disposal. Flyash is sprayed with water as a dust control measure before being transferred from the silo to railroad cars or disposal trucks. A trench located beneath the flyash silo collects the water sprayed on the flyash and transports the water to the Coal Pile Treatment Lagoons. Water in these permitted lagoons is tested and undergoes treatment before going to HRSD. Some flyash may still, however, be released during transfer to the rail cars or trucks due to wind. Releases from the conveyor used to transfer flyash from the baghouses to the silo are considered unlikely because a vacuum (suction) pump is used for conveyance of the flyash.

The site is partially covered with concrete under and around the flyash silo, with a paved asphalt road to the north. Vegetation covers the remaining areas around the silo. Access to the site is unrestricted. Contact with contaminants would be most likely from airborne particulates generated during the offloading of flyash from the silo. There is also evidence of soot/flyash on the ground and building wall next to the silo. Infiltration of flyash constituents into the aquifer could occur in the unpaved areas around the silo.

The underlying soils consist of silty sand with occasional thin clay lenses. The soils would retard, but not prevent, vertical migration of constituents to the surficial aquifer. The surficial aquifer at NAB Little Creek is not used as a potable water source. No water supply wells are located in the area of the site. No surface water features are present in this area. Human contact with groundwater is therefore not anticipated.

One groundwater and three surface soil samples were collected and analyzed for metals in October 1995. Nickel and zinc were found in the groundwater at concentrations that indicated possible site-related contamination. The highest measured concentrations in surface soil were found in the sample collected south of the silo. Levels of copper, nickel, and zinc were slightly higher than background levels. Concentrations in the two surface soil samples collected immediately north of the flyash silo were generally lower.

This SWMU was concluded to present a high risk due to metals in the fly ash and soil. An SI has been proposed for the site in 1999. Discussions of future activities associated with SWMU 2 are presented in Section 3.2.10.

2.3.3 SWMU 3—Pier 10 Sandblast Yard

SWMU 3 (formerly classified as SWMU 111) is the Pier 10 Sandblast Yard. This area was used for sandblasting boats from 1962 to 1984. After 1984, anchors and anchor chains were sandblasted at the site. Up until 1995, sandblasting took place on a concrete pad located on the west side of Building 1263. The sandblast material was periodically removed from the site for disposal following EPA toxicity testing indicating the residue was not hazardous. Paint chips and grit covered the unpaved ground south of the pad to the water's edge and the nearshore bottom of Little Creek Channel. In 1982, a fence was installed around the sandblasting area to limit access to the site. The fence also prevents windblown sandblast materials from migrating outside the fenced area. This fence is generally closed and locked outside working hours. Also, in 1993, photos indicated that the area had been covered with asphalt, except for a small area to the west of the sandblasting pit. Little or no vegetation covers this unpaved area. In approximately 1995, a new sandblasting area was constructed in the northwest corner of the compound. This new area consisted of a concrete pad surrounded by a 4 to 5 foot concrete wall; the old area is no longer used. Prior to 1993, runoff from sandblasting operations

occurred as sheet flow. In approximately 1993, a catch basin and a regulated outfall were constructed at the site.

Within the sandblasting area, surface water drainage flows toward a catch basin. Some runoff from other areas of the site may flow into Little Creek Channel, located on the east side of SWMU 3. Little Creek Channel is not used for recreational purposes, but NAB Little Creek boat traffic and maneuvers are practiced in the area. A picnic area located in the southwest portion of SWMU 3 is not currently used because there are no personnel occupying the Building 1265. The picnic area will be modified to prevent soil contact in the future.

Historic releases likely occurred in the past when sandblasting residue was lying directly on the ground surface.

SWMU 3 was originally identified in the RFA as being a potential site affected by contamination and was one of the SWMUs included in the Navy's RRRS. The soils at SWMU 3 were found to result in a high risk ranking as defined by the Navy's RRRS. Arsenic, barium, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and zinc were detected in soils. Relatively high concentrations of metals have been observed in the groundwater; however, these results were for total (unfiltered) metals from temporary wells, which typically yield high levels of metals.

In September, as part of the SI, four monitoring wells were installed at SWMU 3. Groundwater sampling of the four newly installed wells and one existing upgradient well, the collection of surface and subsurface soil samples at 10 locations and the collection of sediment samples at four locations also occurred in September 1998.

Discussions of future activities associated with SWMU3 are provided in Section 3.2.11 of this SMP.

2.3.4 SWMU 4—Special Boat Squadron 2 Battery Storage Yard

SWMU 4 (formerly classified as SWMU 117) is the Special Boat Squadron 2 Battery Storage Yard, located in the vicinity of Buildings 103 and 104. The approximately 300 to 400 square foot area was used from 1943 until 1980. Lead-acid batteries were stored in this area on wooden pallets placed on bare soil. Paint wastes, oily wastes, and scrap metal were also stored in this area. There were no release controls present in the area. Oil stains have been noted on the ground in the area. There are also reports of batteries rupturing during the winter, and their contents being released onto the ground.

The site is paved with concrete and asphalt, with the exception of grass areas along the fence and around the buildings. Human contact with contaminated soil is possible in areas with exposed soil. Access to the site area is limited as the area is fenced with a controlled security gate.

The underlying soils consist of silty sand with occasional thin clay lenses. The soils would retard, but not prevent, vertical migration of constituents to the surficial aquifer. The surficial aquifer at NAB Little Creek is not used as a potable water source. No wells are located in the area. Human contact with groundwater is therefore not anticipated. Little Creek Channel/Cove is located north of the site and may receive some surface water discharge.

Two surface soil samples and one groundwater sample were collected and analyzed for SVOCs and metals in October 1995, in support of the RRRS report. No SVOCs were detected

in surface soil or groundwater above detection limits. Metals were detected in both surface soil and groundwater samples at concentrations that indicated possible site-related contamination. Both surface soil samples collected had comparable levels of metals.

This SWMU is considered to constitute a medium risk due to metals in the surface soil and groundwater.

2.3.5 SWMU 5—Building 3896 Boat Painting Area

SWMU 5 (formerly classified as SWMU 130) is the Building 3896 Boat Painting Area. Activities at this site included grinding of boat hulls in preparation of painting, and painting of boats. Metal grindings and paint over-spray were allowed to fall onto the ground. No release controls were present. In addition, bilge water, metal grindings, paints, and thinners were released to the soil.

The site was paved with concrete and/or asphalt after boat maintenance activities were initiated at the site. There is, however, an area north of the current boat maintenance area and along the compound fence that is unpaved and has little vegetative cover.

Access to the site is restricted. The service area is fenced off and kept locked during non-working hours.

The underlying soils are believed to be comparable to soils over much of the base, consisting of silty sand, a thin clay layer, and cobbles. The concrete and/or asphalt cover reduces but will not eliminate the volume of water infiltrating through the soil to the surficial aquifer. The surficial aquifer at NAB Little Creek is not used as a potable water source. No wells are located in the area. Human contact with groundwater is therefore not anticipated. Little Creek Channel/Cove is located south of the site and may receive some surface water discharge.

Surface soil and groundwater samples were collected and analyzed for VOCs, SVOCs and metals in October 1995, in support of the RRRS report. No VOCs were detected in surface soil above detection limits. SVOCs were detected above detection limits in the surface soil sample collected immediately east of Building 3896 (sample ID LC13S2). The groundwater sample contained metals at concentrations that indicated possible site-related contamination.

This SWMU is considered to present a medium risk due to SVOCs in the surface soil and metals in the groundwater.

2.3.6 SWMU 6—SeaBee Area

SWMU 6 (formerly classified as SWMUs 131, 132, and 133) is the SeaBee Area. The area consists of three separate waste management areas. Former SWMU 131, Satellite Accumulation Point for Paint Wastes, included a 55-gallon drum and several smaller cans stored on a wooden pallet over bare soil. Wastes included paints and thinners. No release controls were present and soil staining was evident.

Former SWMU 132, Inoperative Wire Degreaser, was an elevated trough 20 feet long and 12 inches deep that had been filled with JP-5 aircraft fuel to degrease wires. The degreaser has been taken out of service. No release controls were present and there was evidence that JP-5 apparently leaked from a valve and stained the soil below.

Former SWMU 133, Excess Material Storage Area, is a gravel yard that was used to store excess paints and cables. The paints were stored on wooden pallets and were covered with canvas tarps. Stains were observed in this area.

An asphalt road exists along the perimeter of the site. Concrete slabs indicate the locations of former structures. The remainder of the site is soil with little to no vegetative cover. The site is completely open, with unrestricted access. Human contact with potentially contaminated soils is therefore possible.

The underlying soils consist of silty sand with occasional thin clay lenses. The soils would retard, but not prevent, vertical migration of constituents to the surficial aquifer. The surficial aquifer at NAB Little Creek is not used as a potable water source. No water supply wells are located in the area. No permanent surface water features are present in the area; however, standing water (3 to 5 inches deep) has been observed in the area.

Six surface soil and four groundwater samples were collected and analyzed for VOCs, SVOCs, and metals in October 1995, in support of the RRRS report. Acetone was detected in all but one of the surface soil samples. No SVOCs were detected in surface soil above detection limits. Metals concentrations in surface soil were generally comparable to each other. No VOCs or SVOCs were detected in groundwater above detection limits. Lead, zinc, and several other metals were detected in one groundwater sample (LC14-W1) at concentrations that indicated possible site-related contamination.

This SWMU is considered to pose a medium risk due to metals concentrations in the groundwater.

3.0 Proposed 1999 Scope of Work

This section summarizes ongoing and planned IR Program activities at each site and SWMU. The discussion focuses on activities that are proposed for FY 1999 (October 1998 through October 1999) but also includes currently funded activities that may expand beyond October 1999.

Additional scope items may be identified during, or as a result of, the execution of this scope of work. The scope is presented on a site-by-site basis. Section 3.1 discusses base-wide activities, Section 3.2 describes site characterization and remediation activities, and Section 3.3 addresses long-term monitoring and maintenance activities.

3.1 Development of Base-Wide Planning Documents

In addition to site-specific activities, base-wide scopes of work have been developed for FY 1999 for development of Master Project Plans and for updating the SMP for FYs 2000 through 2004. The development of the Master Project Plans is designed to expedite project plan development for individual sites at the base and to promote consistency in all project plans and investigations conducted at the base. The schedule for development of the base-wide Master Project Plans is presented in Figure 4-1. The SMP for FYs 2000 through 2004 will be updated and revised as presented in Figure 4-2.

3.2 Site Characterization and Remediation Activities for 1999

3.2.1 Site 5—Buildings 9 and 11 Motor Oil Disposal Area

As described in Section 2.2.1, a PSI and a SI have already been completed at this site. Results of soil and groundwater sampling to date indicate that no risk is posed by contaminants in soil and groundwater. Two rounds of verification groundwater sampling were conducted in 1996.

A *Final Groundwater Monitoring Report Sites 5 and 11* was prepared by CH2M HILL in February 1998. The report summarized and evaluated the results of the two rounds of sampling. The report recommended that no further groundwater monitoring be conducted at the site and that a NFRAP DD be prepared for Site 5

Additional groundwater sampling was requested by the EPA in 1998 to confirm groundwater conditions downgradient of the site. After sampling results are received, a Proposed Plan and DD for institutional controls will be prepared and submitted to regulators and the public for review in FY 1999.

The schedule for the above activities associated with Site 5 is presented in Figure 4-3.

3.2.2 Site 7—Amphibious Base Landfill

The DD for Site 7 was signed in January 1998. The selected remedial alternative was implemented and completed in June 1998 (See Section 5.1.1). Proposed activities at the site consist of long-term monitoring and maintenance as described in Section 3.3.1.

Semi-annual groundwater, surface water, and sediment monitoring and maintenance activities at Site 7 commenced in June 1998 and will continue during 1999. Detailed information regarding these activities is presented in section 3.3.1.

The estimated overall schedule for the above activities associated with Site 7 is presented in Figure 4-4.

3.2.3 Site 8—Demolition Debris Landfill

As discussed in Section 2.2.3, Site 8 (formerly classified as SWMU 84) was assessed in the RRRS report (Baker, 1996). The site has been classified as posing a high risk based on the findings of the RRRS. Risks are due to potential for exposure to surface soil, subsurface soil, and groundwater.

Project plans for a SI at Site 8 were prepared in 1998. SI activities commenced in September 1998 with the installation of five groundwater monitoring wells. Additional activities including groundwater sampling, the collection of surface and subsurface soil samples at eight locations and the collection of sediment samples at four locations also occurred in September 1998. As part of the SI, a qualitative baseline human health risk assessment (BRA) will be performed using new data. The BRA results will be incorporated in the SI report. The *Site Investigations for SWMU 3 and Site 8* will be submitted to the Navy, regulatory agencies, and the public for review during FY 1999.

The estimated overall schedule for the above activities associated with Site 8 is presented in Figure 4-5.

3.2.4 Site 9—Driving Range Landfill

As described in Section 2.2.4, an IAS, RVS, IRI and RI/FS have already been completed at this site. Results of soil and groundwater sampling to date indicate that no current risk is posed by contaminants in soil and groundwater. A PRAP that addresses both Sites 9 and 10 and recommends no further investigative activities was finalized in 1997. The PRAP called for long-term groundwater monitoring due to the contents of the landfill and its proximity to the Chesapeake Bay and other surface water bodies.

Detailed information regarding semi-annual groundwater monitoring activities is presented in Section 3.3.2. No other activities are proposed for this site.

The estimated overall schedule for the above activities associated with Site 9 is presented in Figure 4-4.

3.2.5 Site 10—Sewage Treatment Plant Landfill

As described in Section 2.2.5, an IAS, RVS, IRI and RI/FS have already been completed at this site. Results of soil and groundwater sampling to date indicate that no current risk is posed by contaminants in soil and groundwater. A PRAP that addresses both Sites 9 and 10 and

recommends no further investigative activities was finalized in 1997. The PRAP called for long-term groundwater monitoring due to the contents of the landfill and its proximity to the Chesapeake Bay and other surface water bodies.

Detailed information regarding semi-annual groundwater monitoring activities is presented in Section 3.3.3. No other activities are proposed for this site.

The estimated overall schedule for the above activities associated with Site 10 is presented in Figure 4-4.

3.2.6 Site 11—School of Music Plating Shop

A short-term post-removal groundwater monitoring program consisting of one year (two rounds) of groundwater sampling of three existing groundwater wells was conducted in 1996 after the removal of the neutralization tank. The results of the groundwater monitoring program were reported in the *Final Groundwater Monitoring Report Sites 5 and 11* by CH2M HILL dated February 1998. This report recommended an additional investigation be performed at Site 11 to define the extent of groundwater chlorinated VOC contamination at the site.

Project plans for a SRI at Site 11 were prepared in 1998 by CH2M HILL. In June and July of 1998, additional groundwater samples were collected with a Geoprobe® at 17 locations to define the source area and extent of contamination at Site 11. As a result of the Geoprobe® groundwater sampling, one shallow and 8 deep monitoring wells were installed in the surficial aquifer in September 1998. These monitoring wells, which serve to monitor the source area and extent of the plume, were sampled in September 1998.

Results of the Geoprobe® groundwater sampling, monitoring well installation, and monitoring well sampling will be reported in the *Draft Supplement Remedial Investigations for Site 11* to be submitted in August 1999. The draft final and final SRI will be submitted by CH2M HILL in October and December 1999. The BRA prepared and presented in the 1993 RI/FS report will be revised based on the new data and will be updated in the SRI report.

Following approval of the SRI report, an FS will be prepared. The draft FS, draft final FS, and final FS are expected to be completed in February, April, and June 2000, respectively.

The overall schedule for Site 11 activities is presented in Figure 4-6.

3.2.7 Site 12—Exchange Laundry Waste Disposal Area

Site investigations (SIs) were conducted by CH2M HILL in October 1997 as the first step in the Phase II SRI. CH2M HILL reported interim results of these investigations in December 1997 in the *Interim Results of the Phase II SRI*. Geoprobe and well sampling activities, as well as surface water and sediment sampling and water level monitoring activities were conducted during this investigation.

From June through September 1998, eight monitoring wells and eight multi-level samplers were installed at Site 12 to further define the extent of contamination and the plume characteristics with depth. Groundwater sampling for natural attenuation parameters as well as for chlorinated VOCs was conducted from July through September 1998. The results of the Geoprobe® sampling, groundwater, sediment, and surface water sampling, and monitoring

well installation during the Phase II SRI, as well as the results of the Phase I SRI, will be reported in the *Draft Supplemental Remedial Investigations for Site 12* to be submitted in April 1999. Draft final and final Phase II SRI reports will be submitted in June and August 1999, respectively. The BRA presented in the 1993 RI/FS report will be revised based on the new data and will be updated in the SRI report.

Additional data evaluation, through microcosm and sorption studies, will be conducted from October 1998 through June 1999. During this time, the biodegradability and degradation rates of chlorinated VOCs by onsite microbial populations and the bioavailability and site-specific sorption constants of chlorinated VOCs will be assessed using laboratory-scale studies. The results of these studies will be implemented in a fate and transport model designed to simulate natural attenuation of chlorinated solvents at Site 12. The model will be developed and validation from August 1998 through June 1999.

A second round of groundwater sampling for natural attenuation parameters and chlorinated VOCs is scheduled at Site 12 for May and June 1999.

A draft FS is scheduled for submittal in September 1999. The draft final and final versions of the FS are to be completed in December 1999 and February 2000, respectively.

The overall schedule for Site 12 activities is presented in Figure 4-7.

3.2.8 Site 13—Public Works PCP Dip Tank and Wash Rack

Site characterization activities, as part of the Phase II SRI, commenced with the collection of soil samples around the former dip tank in May 1998. Results of this portion of the Phase II SRI are reported in the *Draft Engineering Evaluation/Cost Analysis (EE/CA) for Soil at Site 13: Public Works PCP Dip Tank and Wash Rack* by CH2M HILL dated July 1998. The recommended soil removal action is to be completed April 1999.

As part of the Phase II SRI field investigations, additional groundwater samples were collected in June and July 1998 using a Geoprobe® to define the source and extent of contamination at Site 13. As a result of the Geoprobe® groundwater sampling, ten monitoring wells were installed in September 1998 to monitor the extent of contamination and concentrations in the source areas of the plumes. All monitoring wells were sampled in September 1998.

Results of the Geoprobe® soil and groundwater sampling, monitoring well installation, and monitoring well sampling performed during the Phase II SRI, as well as the results of the Phase I SRI, will be reported in the *Draft Supplement Remedial Investigations for Site 13* to be submitted in July 1999. Draft final and final Phase II SRI reports will be submitted in September and November 1999, respectively. The BRA prepared and presented in the 1993 RI/FS report will be revised based on the new data and will be updated in the Phase II SRI report.

A draft FS report will be prepared and submitted in January 2000. The draft final and final FS reports will be submitted in March and May 2000.

The overall schedule for Site 13 activities is presented in Figure 4-8.

3.2.9 SWMU 2—Steam Plant Flyash Silo

As discussed in Section 2.3.2, SWMU 2 (formerly classified as SWMU 105) was assessed in the RRRS report (Baker, 1996). The site has been classified as posing a high risk based on the findings of the RRRS. Risks are due to potential for exposure to metals in flyash that is airborne or in surface soils.

A SI has been proposed for 1999 to collect additional data from the site. The SI at SWMU 2 is scheduled to proceed in May 1999. Field investigations, including soil and groundwater sampling, at SWMU 2 are expected to be conducted in August 1999. A SI letter report will be submitted in December 1999.

In addition to the SI report, an EE/CA will be prepared, as a soil removal action is anticipated at SWMU 2 to remove the contaminant source. The draft EE/CA will be submitted in January 2000 and the draft final and final versions will be submitted in February and April 2000, respectively.

The overall schedule for SWMU 2 activities is presented in Figure 4-9.

3.2.10 SWMU 3—Pier 10 Sandblast Yard

As discussed in Section 2.3.3, SWMU 3 (formerly classified as SWMU 111) was assessed in the RRRS report (Baker, 1996). The site has been classified as posing a high risk based on the findings of the RRRS. Risks are due to potential for exposure to metals from sandblasting activity that may be present in soils and groundwater on and near the site, including a picnic/recreation area.

In September, as part of a SI, four monitoring wells were installed at SWMU 3. Groundwater sampling of the four newly installed monitoring wells and one existing upgradient monitoring well, the collection of surface and subsurface soil samples at 10 locations and the collection of sediment samples at four locations occurred in September 1998. A baseline qualitative human health risk assessment (BRA) will be performed using new data. The BRA results will be incorporated in the SI report. Results of the SI will be presented in the *Draft Site Investigations for SWMU 3 and Site 8* report to be completed in February 1999. The draft final and final SI reports will be submitted in April and June 1999.

The data collected during the SI will be used to determine appropriate future actions required for the SWMU.

The overall schedule for SWMU 3 activities is presented in Figure 4-5.

3.3 Site Monitoring and Maintenance Activities for 1999

3.3.1 Site 7—Amphibious Base Landfill

An anticipated 5-year program of semi-annual monitoring, consisting of groundwater, surface water, and sediment sampling, commenced at Site 7 in June 1998 (Round 1). Semi-annual monitoring will continue in December 1998 (Round 2) and June 1999 (Round 3) at Site 7. Groundwater and surface water samples will be analyzed for VOCs, SVOCs, PCBs, total and dissolved metals, and cyanide. Surface water samples will also be analyzed for hardness. The sediment samples will be analyzed for VOCs, SVOCs, PCBs, total metals, cyanide, and TOC.

Site 7 monitoring activities will coincide with groundwater monitoring activities at Sites 9 and 10 as described in Sections 3.3.2 and 3.3.3. Periodic monitoring reports will be submitted semi-annually following each round of monitoring.

After three years of semi-annual monitoring a summary report will be prepared in January 2001. The report will discuss sampling activities, will present and evaluate data, will discuss results as compared with action criteria (trigger levels), and will make conclusions and recommendations for future monitoring.

Based on the findings presented in the 3-year report, the sampling frequency may be reduced to annually for the 4th and 5th years. A 5-year review report will be prepared in January 2003. The report will discuss the same topics as the 3-year report, and will include an evaluation of risks to potential receptors based upon the fate and transport of Site 7 contaminants.

In addition to regular groundwater, surface water, and sediment monitoring, the Site 7 landfill surface requires regular maintenance. It is anticipated that Site 7 will be maintained by mowing new growth in the central portion of the site to a 12" base using a bush hog every one or two years. Site 7 will be evaluated on a yearly basis with EPA and VDEQ oversight to determine the exact mowing requirements and schedules. The first mowing of Site 7 is anticipated to occur during a dry period in March or April of 2000 (per VDEQ).

The overall schedule for Sites 7, 9 and 10 activities is presented in Figure 4-4.

3.3.2 Site 9—Driving Range Landfill

Semi-annual groundwater monitoring will continue at the 6 wells at Site 9. Groundwater monitoring activities will coincide with monitoring activities at Sites 7 and 10 as described in Sections 3.3.1 and 3.3.3. Groundwater will be analyzed for TCL VOCs, total and filtered TAL metals, total cyanide, and anions; including sulfate, bicarbonate, and chloride. Periodic monitoring reports will be submitted semi-annually following groundwater monitoring activities.

During FY 1999, the sixth and seventh rounds of groundwater monitoring will be conducted at Site 9. The sixth round will take place in December 1998. During the seventh round of monitoring, scheduled for June 1999, samples collected all monitoring locations at Site 9 will be analyzed for pesticides. A *Draft 3-Year Groundwater Monitoring Report* addressing both Sites 9 and 10 will be prepared in January 1999 after the sixth consecutive sampling event (3 years into the monitoring program). The report will discuss sampling activities, present and evaluate data, discuss results as compared with action criteria (trigger levels), and conclusions and recommendations for future monitoring. Draft final and final versions of the *Groundwater Monitoring Report* will be produced in March and May 1999.

Based on the findings presented in the 3-year report, the sampling frequency may be reduced to annually for the 4th and 5th years. A 5-year review report addressing both Sites 9 and 10 will be prepared in January 2001. The report will discuss the same topics as the 3-year groundwater monitoring report, as well as an evaluation of risks to potential receptors based upon fate and transport.

If the sampling frequency is not reduced after submittal of the *Groundwater Monitoring Report* after the sixth sampling event, the remaining four rounds of groundwater monitoring will be conducted at 6-month intervals from June 1999 through December 2000.

The overall schedule for Sites 7, 9 and 10 activities is presented in Figure 4-4.

3.3.3 Site 10—Sewage Treatment Plant Landfill

Semi-annual groundwater monitoring will continue at the 8 wells at Site 10. Groundwater monitoring activities will coincide with groundwater monitoring activities at Sites 7 and 9 as described in Sections 3.3.1 and 3.3.2. Groundwater will be analyzed for TCL VOCs, total and filtered TAL metals, total cyanide, and anions; including sulfate, bicarbonate, and chloride. Periodic monitoring reports will be submitted semi-annually following groundwater monitoring activities.

During FY 1999, the sixth and seventh rounds of groundwater monitoring will be conducted at Site 10. The sixth round will take place in December 1998. During the seventh round of monitoring, scheduled for June 1999, samples collected all monitoring locations at Site 10 will be analyzed for pesticides. A *Draft Groundwater Monitoring Report* addressing both Sites 9 and 10 will be prepared in January 1999 after the sixth consecutive sampling event (3 years into the monitoring program). The report will discuss sampling activities, present and evaluate data, discuss results as compared with action criteria (trigger levels), and conclusions and recommendations for future monitoring. Draft final and final versions of the *Groundwater Monitoring Report* will be produced in March and May 1999.

Based on the findings presented in the 3-year report, the sampling frequency may be reduced to annually for the 4th and 5th years. A 5-year review report addressing both Sites 9 and 10 will be prepared in January 2001. The report will discuss the same topics as the 3-year groundwater monitoring report, as well as an evaluation of risks to potential receptors based upon fate and transport.

If the sampling frequency is not reduced after submittal of the *Groundwater Monitoring Report* after the sixth sampling event, the remaining four rounds of groundwater monitoring will be conducted at 6-month intervals from June 1999 through December 2000.

The overall schedule for Sites 7, 9, and 10 activities is presented in Figure 4-4.

4.0 Site Management Schedules

This section presents project schedules for each site for FY 1999 and beyond. These schedules are adjusted annually in the SMP, as the future site activities are further defined and various administrative issues are addressed.

Sites that will be active during FY 1999 are summarized in Table 4-1.

The project schedules for these sites are depicted in Figures 4-1 through 4-9. The project schedules include a detailed listing of activities for each site; the duration of each IR Program activity; and the anticipated start and finish dates for each activity. The schedules include tasks already funded and underway and tasks expected to be funded in FY 1999.

The project schedules for the sites reflect anticipated government review times. Navy turnaround times are estimated between 15 to 30 days, depending on the activity. The regulatory/public review times are estimated to be between 45 and 60 days.

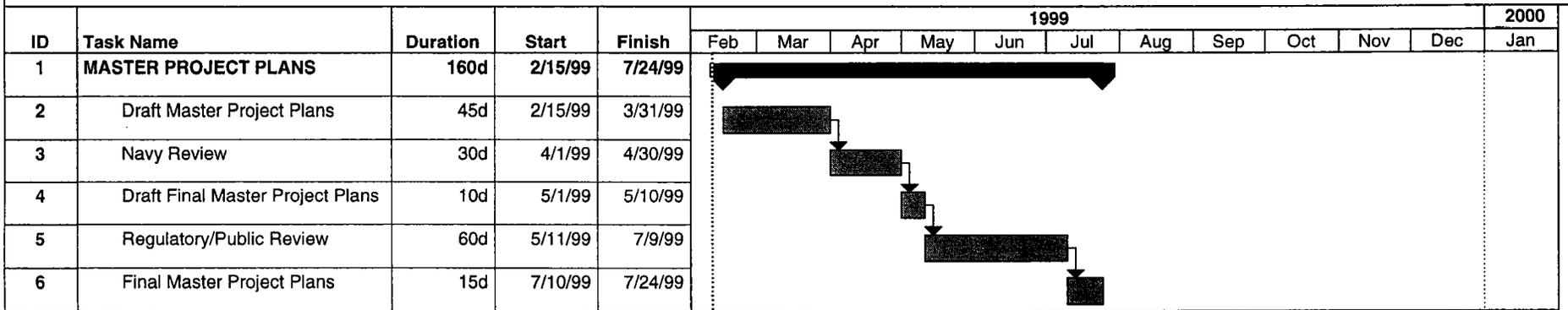
Table 4-2 identifies the primary deliverables for IR activities, such as reports and project plans. A summary listing of FY 1999 deliverables and submittal dates, by site, is provided in this table.

Table 4-3 tabulates all deliverables and activity dates on a month-by-month basis to aid in planning and meeting review times and submittal dates.

Table 4-1 Summary of Fiscal Year 1999 Activities by Site	
Site	Fiscal Year 1999 Activities
Site 5	<ul style="list-style-type: none"> • Conduct additional groundwater sampling; • Prepare Proposed Plan; • Prepare Decision Document (DD) and give public notice.
Site 7	<ul style="list-style-type: none"> • Continue semi-annual groundwater, surface water, and sediment monitoring (Rounds 2 and 3); • Submit periodic groundwater monitoring letter reports.
Site 8	<ul style="list-style-type: none"> • Perform qualitative baseline human health risk assessment; • Prepare SI report.
Sites 9 and 10	<ul style="list-style-type: none"> • Continue semi-annual groundwater monitoring (Rounds 6 and 7); • Submit periodic groundwater monitoring letter reports; • Submit 3-Year Groundwater Monitoring Report after Round 6 sampling.
Site 11	<ul style="list-style-type: none"> • Reevaluate BRA; • Prepare SRI; • Prepare FS.
Site 12	<ul style="list-style-type: none"> • Investigate sanitary sewer impacts on groundwater flow; • Conduct microcosm soil sampling; • Conduct microcosm and sorption experiments and modeling; • Reevaluate BRA; • Prepare Phase II SRI; • Conduct second round of groundwater sampling.
Site 13	<ul style="list-style-type: none"> • Prepare final EE/CA; • Conduct soil removal action; • Reevaluate BRA; • Prepare Phase II SRI; • Prepare FS.
SWMU 3	<ul style="list-style-type: none"> • Perform qualitative baseline human health risk assessment; • Prepare SI report.
SWMU 2	<ul style="list-style-type: none"> • Conduct field investigations as part of SI; • Submit SI letter report.

Figure 4-1

Master Project Plans, NAB Little Creek, Virginia Beach, VA



Project:
Date: 2/10/99

Task 
 Progress 
 Milestone 

Summary 
 Rolled Up Task 
 Rolled Up Milestone 

Rolled Up Progress 

Figure 4-2

Site Management Plan for Fiscal Years 2000 through 2004, NAB Little Creek, Virginia Beach, VA

ID	Task Name	Duration	Start	Finish	1999							2000		
					May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1	SITE MANAGEMENT PLAN UPDATE- FY 2000 - 2004	118d	7/30/99	11/24/99				[Task Bar]						
2	Draft Updated SMP	30d	7/30/99	8/28/99				[Task Bar]						
3	Navy Review	21d	8/29/99	9/18/99					[Task Bar]					
4	Draft-Final Updated SMP	11d	9/19/99	9/29/99					[Task Bar]					
5	Regulatory/Public Review	45d	9/30/99	11/13/99						[Task Bar]				
6	Final Updated SMP	11d	11/14/99	11/24/99										[Task Bar]

Project:
Date: 2/10/99

Task
Progress



Milestone
Summary



Rolled Up Task
Rolled Up Milestone

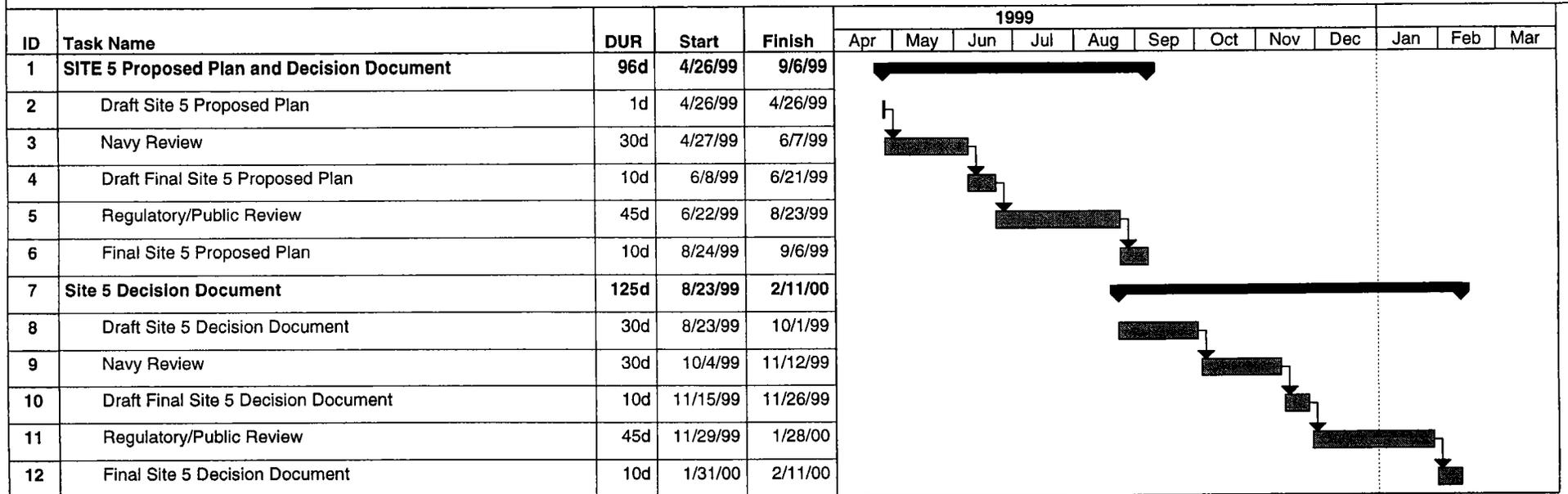


Rolled Up Progress



Figure 4-3

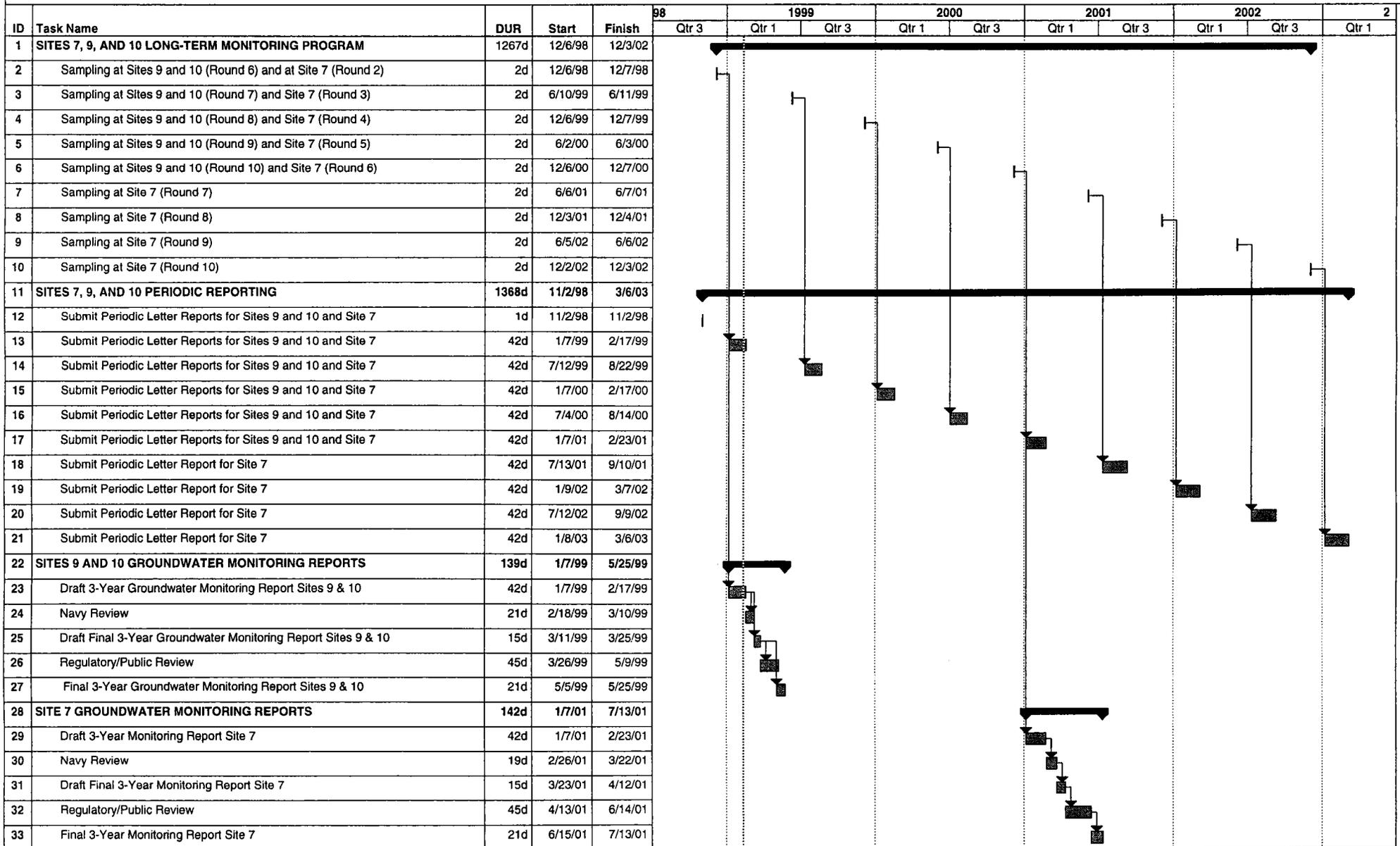
Site 5 - Buildings 9 and 11, Motor Oil Disposal Area, NAB Little Creek, Virginia Beach, Virginia



Date: 2/10/99
 REVISED: 2/10/99



Figure 4-4
 Sites 7, 9, and 10 Long-Term Monitoring
 NAB Little Creek, Virginia Beach, VA

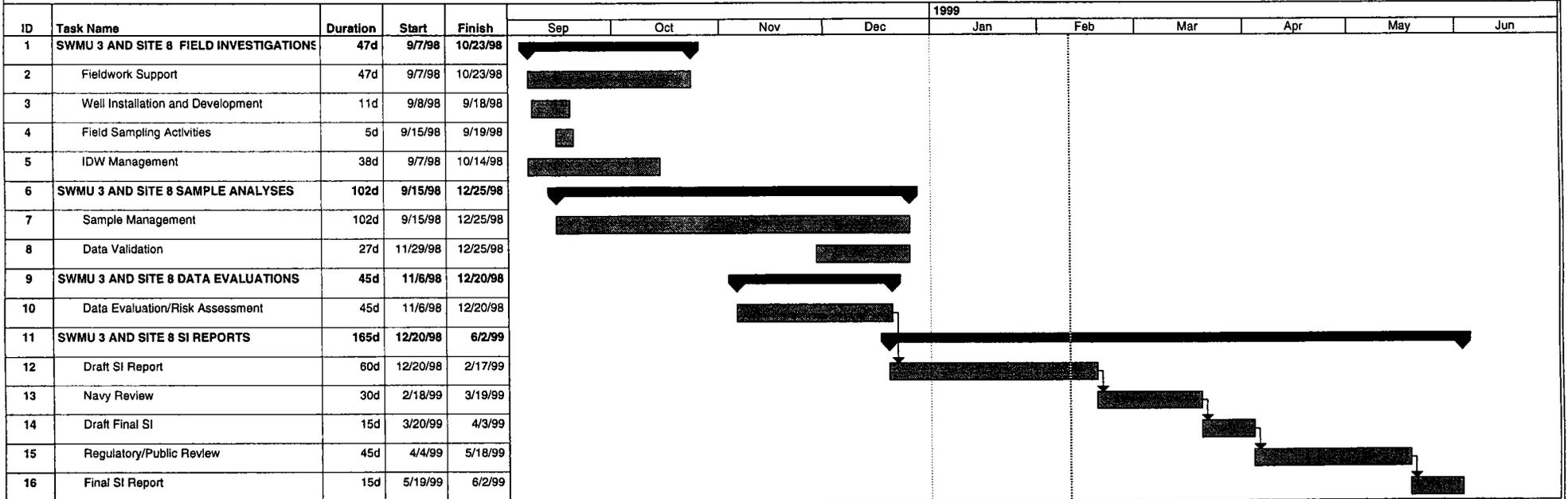


Date: 2/10/99
 Revised: 2/10/99

Task Milestone Summary

FIGURE 4-5

Site 8 and SWMU 3; NAB Little Creek, Virginia Beach, Virginia



Project:
Date: 2/10/99

Task
Progress



Milestone
Summary



Rolled Up Task
Rolled Up Milestone

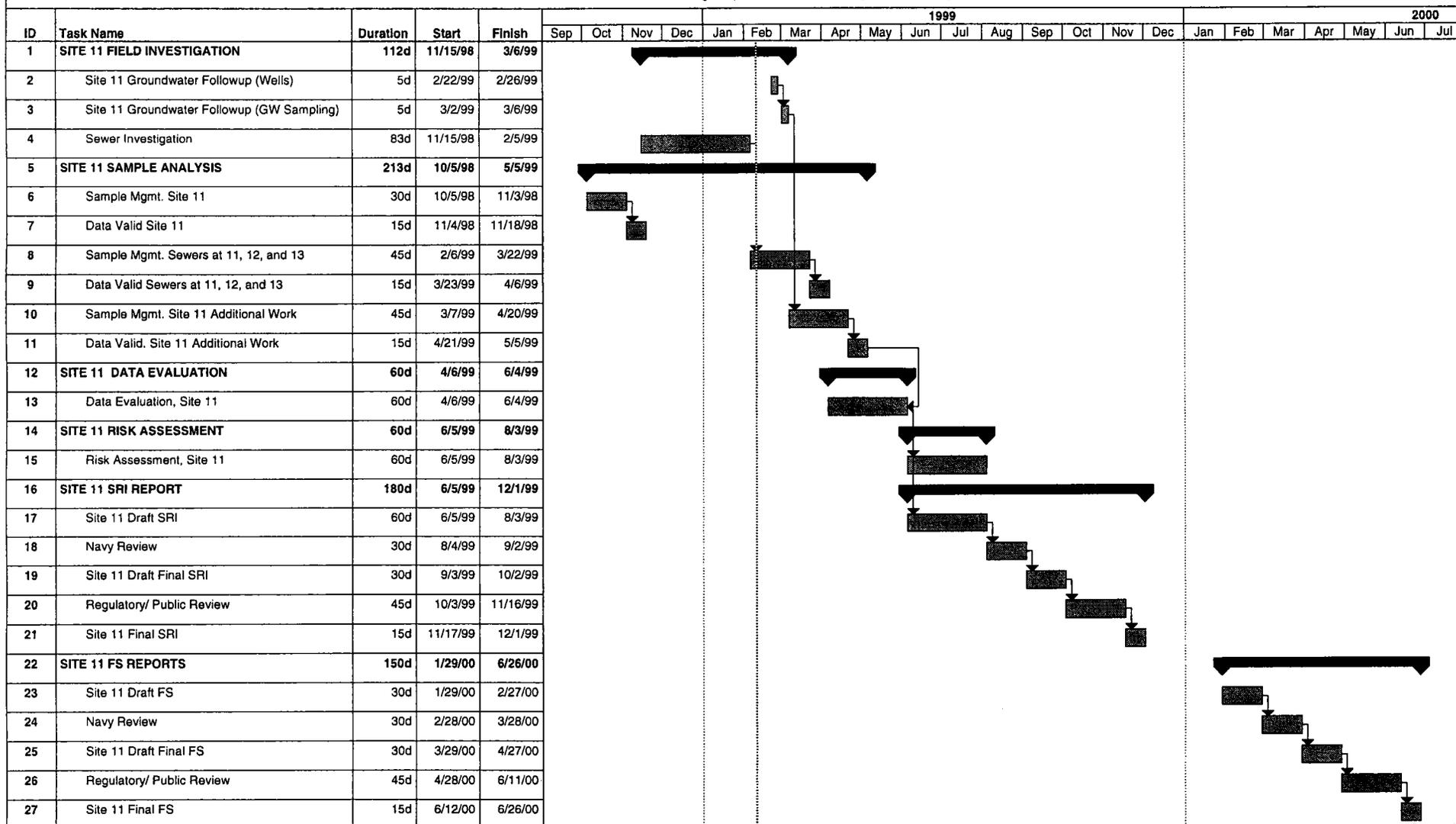


Rolled Up Progress



FIGURE4-6

Site 11- School of Music Plating Shop, NAB Little Creek, Virginia Beach, Virginia



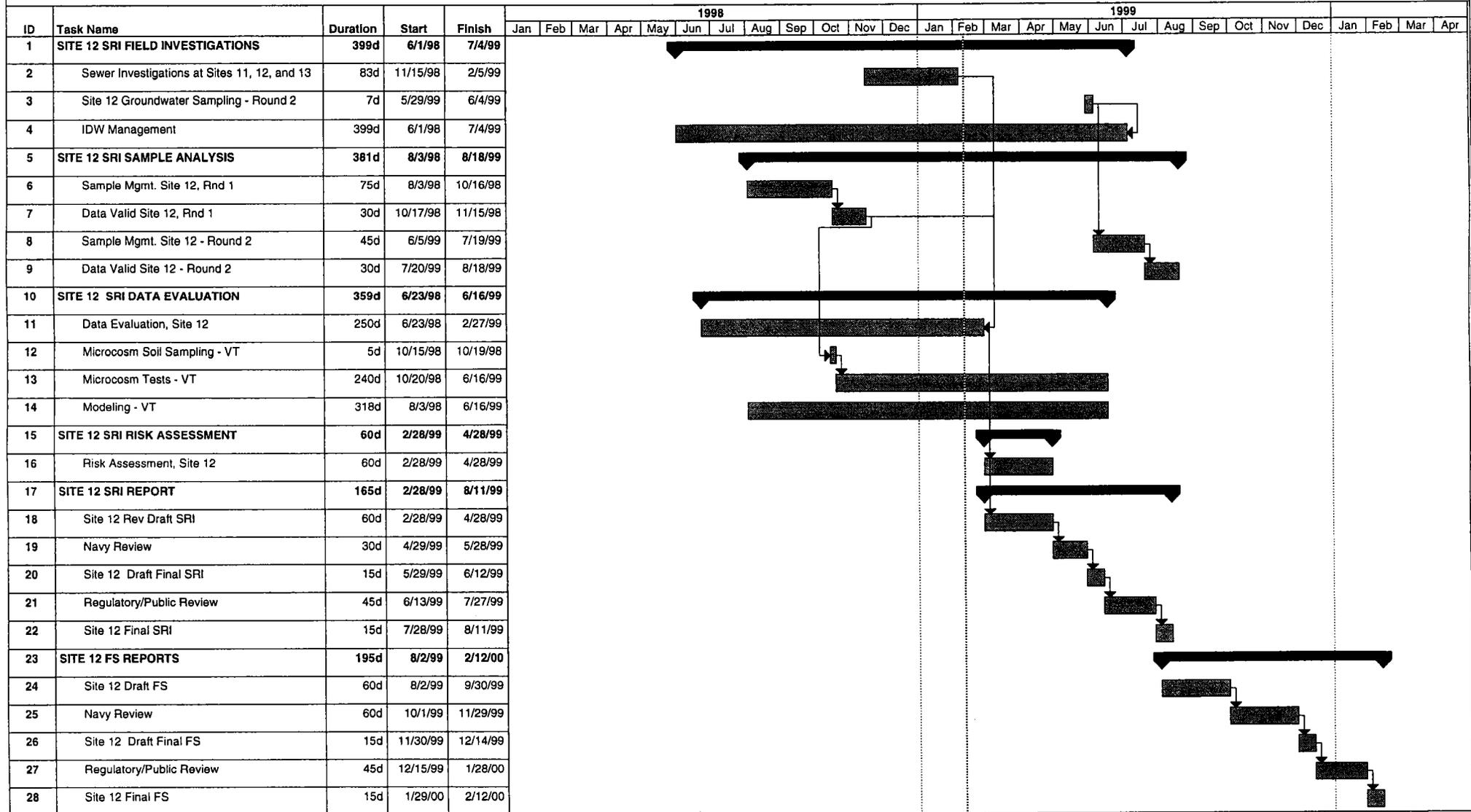
Project:
Date: 2/10/99

Task [Symbol] Milestone [Symbol] Rolled Up Task [Symbol] Rolled Up Progress [Symbol]
 Progress [Symbol] Summary [Symbol] Rolled Up Milestone [Symbol]

* WORK TO BE COMPLETED ON TIME PENDING FY 1999 FUNDING AVAILABILITY ON 11/30/98

FIGURE 4-7

Site 12 - Exchange Laundry Waste Disposal Area, NAB Little Creek, Virginia Beach, VA



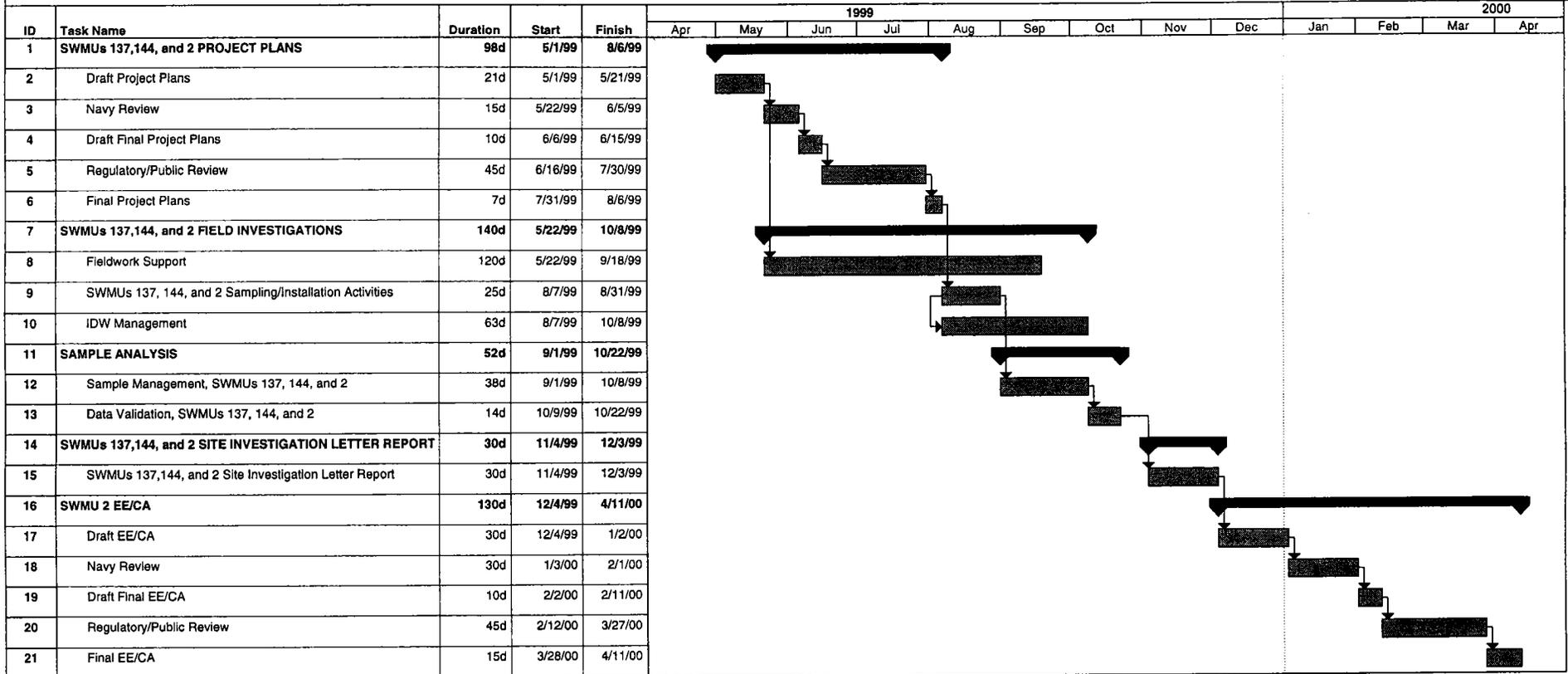
Project:
Date: 2/10/99

Task Milestone
Progress Summary

Rolled Up Task Rolled Up Progress
Rolled Up Milestone

Figure 4-9

SWMU 137, SWMU 144, and SWMU 2, NAB Little Creek, Virginia Beach, VA



Project:
Date: 2/10/99

Task
Progress



Milestone
Summary



Rollup Task
Rollup Milestone



Rollup Progress



**Table 4-2
Primary Document Submittals for Fiscal Year 1999
NAB Little Creek, Virginia Beach, Virginia**

Site	Activity	Primary Document Submittals	Anticipated Submittal Date
All Sites	Master Project Plans***	* Draft Master Project Plans ** Draft Final Master Project Plans Final Master Project Plans	March 31, 1999 May 10, 1999 July 24, 1999
All Sites	Site Management Plan (SMP) FYs 2000 - 2004***	* Draft SMP FYs 2000 - 2004 ** Draft Final SMP FYs 2000 - 2004 Final SMP FYs 2000 - 2004	August 28, 1999 September 29, 1999 November 24, 1999
Site 5	Proposed Plan	* Draft Proposed Plan ** Draft Final Proposed Plan Final Proposed Plan	April 26, 1999 June 21, 1999 September 6, 1999
	Decision Document	* Draft Decision Document ** Draft Final Decision Document Final Decision Document	October 1, 1999 November 26, 1999 February 11, 2000
Site 7	Groundwater Monitoring Periodic Letter Reports	*, ** Periodic Letter Report (Round 2) *, ** Periodic Letter Report (Round 3)	February 17, 1999 August 22, 1999
Site 8	Site Investigation (SI) Report	* Draft SI Report ** Draft Final SI Report Final SI Report	February 17, 1998 April 3, 1999 June 2, 1999
Sites 9 and 10	Groundwater Monitoring Periodic Letter Reports	*, ** Periodic Letter Report (Round 6) *, ** Periodic Letter Report (Round 7)	February 17, 1999 August 22, 1999

* DRAFT DOCUMENTS—FOR NAVY REVIEW

** DRAFT FINAL DOCUMENTS—FOR REGULATORY AND PUBLIC REVIEW

*** TO BE DETERMINED (PROJECT AWARD WILL OCCUR IN FY 1999)

Table 4-2 (continued)
Primary Document Submittals for Fiscal Year 1999
NAB Little Creek, Virginia Beach, Virginia

Site	Activity	Primary Document Submittals	Anticipated Submittal Date
Sites 9 and 10 (continued)	Groundwater Monitoring Report	* Draft 3-Year Groundwater Monitoring Report ** Draft Final 3-Year Groundwater Monitoring Report Final 3-Year Groundwater Monitoring Report	February 17, 1999 March 25, 1999 May 25, 1999
Site 11	Supplemental Remedial Investigation (SRI) Report***	* Draft SRI Report ** Draft Final SRI Report Final SRI Report	August 3, 1999 October 2, 1999 December 1, 1999
	Feasibility Study (FS) Report***	* Draft FS Report ** Draft Final FS Report Final FS Report	February 27, 2000 April 27, 2000 June 26, 2000
Site 12	Supplemental Remedial Investigation (SRI) Report	* Revised Draft SRI Report ** Draft Final SRI Report Final SRI Report	April 28, 1999 June 12, 1999 August 11, 1999
Site 13	Supplemental Remedial Investigation (SRI) Report	* Revised Draft SRI Report ** Draft Final SRI Report Final SRI Report	July 5, 1999 September 3, 1999 November 2, 1999
	Feasibility Study (FS)***	* Draft FS Report ** Draft Final FS Report Final FS Report	January 28, 2000 March 28, 2000 May 27, 2000
SWMU 3	Site Investigation (SI) Report	* Draft SI Report ** Draft Final SI Report Final SI Report	January 15, 1998 March 1, 1999 April 15, 1999

**Table 4-3
Monthly Submittal and Event Calendar for Fiscal Year 1999
NAB Little Creek, Virginia Beach, Virginia**

End Month	Submittal/Event	Beginning Date	Duration	Submittal/End Date
October 1998	Site 12 Microcosm Soil Sampling	October 20, 1998	2 days	October 21, 1998
December 1998	Sites 7, 9, and 10 Long-Term Monitoring	December 6, 1998	2 days	December 7, 1998
January 1999	Site 13 Draft Final EE/CA Report – Regulatory/Public Review	August 7, 1998	175 days	January 28, 1999
February 1999	Sewer Investigations at Sites 11, 12, and 13	November 15, 1998	83 days	February 5, 1999
	Site 13 Final EE/CA Submittal	-----	-----	February 11, 1999
	SWMU 3 and Site 8 Draft SI Report Submittal	-----	-----	February 17, 1998
	Sites 9 and 10 Draft 3-Year Groundwater Monitoring Report Submittal	-----	-----	February 17, 1999
	Sites 7, 9, and 10 Long-Term Monitoring Letter Report Submittal	-----	-----	February 17, 1999
March 1999	Sites 9 and 10 Draft 3-Year Groundwater Monitoring Report – Navy Review	February 18, 1999	21 days	March 10, 1999
	SWMU 3 and Site 8 Draft SI Report - Navy Review	February 18, 1999	30 days	March 19, 1999
	Sites 9 and 10 Draft Final 3-Year Groundwater Monitoring Report Submittal	-----	-----	March 25, 1999
	Draft Master Project Plans Submittal	-----	-----	March 31, 1999
April 1999	SWMU 3 and Site 8 Draft Final SI Report Submittal	-----	-----	April 3, 1999
	Site 13 Soil Removal Action	April 8, 1999	7 days	April 14, 1999
	Site 5 Draft Proposed Plan Report Submittal	-----	-----	April 26, 1999
	Site 12 Revised Draft SRI Report Submittal	-----	-----	April 28, 1999
	Draft Master Project Plans – Navy Review	April 1, 1999	30 days	April 30, 1999
May 1999	Sites 9 and 10 Draft Final 3-Year Groundwater Monitoring Report – Regulatory/Public Review	March 26, 1999	45 days	May 9, 1999
	Draft Final Master Project Plans Submittal	-----	-----	May 10, 1999
	SWMU 3 and Site 8 Draft Final SI Report – Regulatory/Public Review	April 4, 1999	45 days	May 18, 1999
	SWMUs 137, 144, and 2 Draft Project Plans Submittal	-----	-----	May 21, 1999
	Sites 9 and 10 Final Groundwater Monitoring Report Submittal	-----	-----	May 25, 1999
	Site 12 Revised Draft SRI Report – Navy Review	April 29, 1999	30 days	May 28, 1999
June 1999	SWMU 3 and Site 8 Final SI Report Submittal	-----	-----	June 2, 1999
	Site 12 Round 2 Groundwater Sampling	May 29, 1999	7 days	June 4, 1999
	SWMUs 137, 144, and 2 Draft SI Project Plans – Navy Review	May 22, 1999	15 days	June 5, 1999
	Site 5 Draft Proposed Plan – Navy Review	April 27, 1999	30 days	June 7, 1999

Table 4-3
Monthly Submittal and Event Calendar for Fiscal Year 1999
NAB Little Creek, Virginia Beach, Virginia

End Month	Submittal/Event	Beginning Date	Duration	Submittal/End Date
June 1999 (continued)	Sites 7, 9, and 10 Long-Term Monitoring	June 10, 1999	2 days	June 11, 1999
	Site 12 Draft Final SRI Report Submittal	-----	-----	June 12, 1999
	SWMUs 137, 144, and 2 Draft Final SI Project Plans Submittal	-----	-----	June 15, 1999
	Site 5 Draft Final Proposed Plan Submittal	-----	-----	June 21, 1999
July 1999	Site 13 Revised Draft SRI Report Submittal	-----	-----	July 5, 1999
	Draft Final Master Project Plans – Regulatory/Public Review	May 11, 1999	60 days	July 9, 1999
	Final Master Project Plans Submittal	-----	-----	July 24, 1999
	Site 12 Draft Final SRI Report – Regulatory/Public Review	June 13, 1999	45 days	July 27, 1999
	SWMUs 137, 144, and 2 Draft Final SI Project Plans – Regulatory/Public Review	June 16, 1999	45 days	July 30, 1999
August 1999	Site 11 Draft SRI Report Submittal	-----	-----	August 3, 1999
	Site 13 Revised Draft SRI Report – Navy Review	July 6, 1999	30 days	August 4, 1999
	SWMUs 137, 144, and 2 Final SI Project Plans Submittal	-----	-----	August 6, 1999
	Site 12 Final SRI Report Submittal	-----	-----	August 11, 1999
	Sites 7, 9, and 10 Long-Term Monitoring Letter Report Submittal	-----	-----	August 22, 1999
	Site 5 Draft Final Proposed Plan Report – Regulatory/Public Review	June 22, 1999	45 days	August 23, 1999
	Draft SMP FY 2000 – 2004 Submittal	-----	-----	August 28, 1999
SWMUs 137, 144, and 2 Sampling and Installation Activities	August 7, 1999	25 days	August 31, 1999	
September 1999	Site 11 Draft SRI Report – Navy Review	August 4, 1999	30 days	September 2, 1999
	Site 13 Draft Final SRI Report Submittal	-----	-----	September 3, 1999
	Site 5 Final Proposed Plan Report Submittal	-----	-----	September 6, 1999
	Draft SMP FY 2000 - 2004 – Navy Review	August 29, 1999	21 days	September 18, 1999
	Draft Final SMP FY 2000 – 2004 Submittal	-----	-----	September 29, 1999

5.0 Remedial Actions and Removal Actions

Remedial actions (RAs) are conducted to prevent a potential release of contaminants and/or further migration of contaminants. Removal actions are taken to prevent immediate and substantial harm to human health. Examples include the removal of drums or tanks, or removal of contaminated soils.

Historic and proposed remedial and removal actions that have been conducted or identified at NAB Little Creek sites are presented below, listed according to site. The Navy will continue to identify possible remedial and removal actions as SIs proceed.

5.1 Historic Remedial Actions and Removal Actions

5.1.1 Site 7—Amphibious Base Landfill

In October 1994, best management practices (BMPs) were implemented at Site 7. Bare areas of the landfill were covered with a 6-inch topsoil layer. Access restrictions were also instituted for the site.

Remedial actions (RAs), proposed at Site 7 in the final FS, were completed on June 3, 1998. The remedy included removing 610 cy of debris along the shoreline of Site 7 and installing a new chain link fence along Amphibious Drive and Helicopter Road. Twenty thousand cubic yards of cover soil and topsoil were added to the site's open areas and the areas were revegetated. Erosion-prone areas of the site on each side of the canal crossing on the west side of the site were reinforced. A gravel access road and two entrances were constructed across the landfill and caution and restricted access signs were placed around the perimeter of the site.

Semi-annual groundwater, surface water, and sediment monitoring as described in Section 3.3.1 was proposed for 5 years. Semi-annual monitoring commenced at Site 7 in June 1998 (Round 1). The site will also be monitored to ensure the vegetation becomes established at the site. Further actions planned for the site are discussed in Sections 3.2.2 and 3.3.1.

5.1.2 Site 11—School of Music Plating Shop

A removal action to remove an underground tank and soil contaminated with plating wastes was completed in 1995. The action consisted of excavation of the neutralization tank, piping, and surrounding soil. An Interim Removal Action Draft Final Closeout Report was issued in May 1996, and was finalized without additional comments. Further actions planned for the site are discussed in Section 3.2.6.

5.1.3 Site 16—PCB Capacitor Spill, Pole No. 425

A removal action consisting of excavation and disposal of PCB-contaminated soil was completed in 1995 and the site was formally closed with the submittal of Draft Final Closeout Report in June 1996. The Closeout Report was reviewed by EPA and VDEQ and was finalized without additional comment. No further actions are planned for the site.

5.2 Proposed Remedial Actions and Removal Actions

5.2.1 Site 13—Public Works PCP Dip Tank and Wash Rack

The removal action at Site 13 has been proposed to minimize to the extent practical, the risk posed by PCP and PAH contaminated soil at Site 13 and to prevent further migration of PCP from the soil to the groundwater.

The removal action recommended in the *Draft Final Engineering Evaluation/Cost Analysis (EE/CA)* consists of the excavation, characterization, and disposal of the contaminated soil. Approximately 178 cy of contaminated soil with PCP and other contaminants detected above the industrial soil RBCs and soil leaching levels are to be excavated from the area of the former PCP dip tank. The collection of characterization soil samples will take place prior to the excavation. Confirmatory samples will also be collected from the remaining soils at the sides and bottom of the excavated area to determine if cleanup goals have been met. Once the cleanup goals have been met, the soils will be treated and disposed of in a RCRA-permitted Subtitle C landfill. The excavated area will be backfilled to the current topography and the area currently paved will be repaved and other areas will be seeded.

The proposed removal action at Site 13 is scheduled for completion in April 1999.

It is also proposed that biodegradation enhancing compounds be applied to the groundwater in the vicinity of the former underground storage tank (UST) after the soil removal has been completed. The purpose of enhancing groundwater biodegradation will be to treat PCP and TPH in the groundwater in the source area via aerobic biodegradation. The addition of biodegradation enhancing compounds will likely be implemented by injecting additives through geoprobe points. The groundwater contamination and conditions near the source area will be monitored to determine the effectiveness of the biodegradation enhancing activities.

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