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NAS WHITING FIELD
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FINAL REMEDIAL INVESTIGATION FEASIBILITY STUDY PLANNING DOCUMENT WORK PLAN VOLUME 1 OF 3 NAS WHITING FIELD FL

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REMEDIAL INVESTIGATION/FEASIBILITY STUDY
PLANNING DOCUMENT

NAVAL AIR STATION WHITING FIELD

MILTON, FLORIDA

UIC: N60508

VOLUME I

WORK PLAN

JUNE 1990

Contract N62467-88-C-0382

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EXECUTIVE SUMMARY

This three volume set presents the planning document for undertaking a Remedial Investigation/Feasibility Study (RI/FS) at the Naval Air Station (NAS) Whiting Field, Milton, Florida.

The purpose of the NAS Whiting Field RI/FS is to identify a range of remedial alternatives that address identifiable risks to public health and the environment posed by contaminants present due to past waste disposal or spill sites. To achieve this objective, the Remedial Investigation (RI) will collect data sufficient to assess the nature and distribution of contaminants associated with each site. The Feasibility Study (FS) will utilize the data collected in the RI to screen, evaluate, and select remedial alternatives to provide permanent, feasible solutions to environmental contamination at NAS Whiting Field.

The RI/FS conducted at NAS Whiting Field will be consistent with the Navy's Installation Restoration (IR) Program. The preliminary Hazardous Ranking System score for NAS Whiting Field indicates that it will qualify for the National Priorities List. As such, the RI/FS for NAS Whiting Field will also follow the requirements of the National Contingency Plan, as amended by the Superfund Amendments and Reauthorization Act of 1986, and guidance for conducting RI/FS under the Comprehensive Environmental Response, Compensation, and Liability Act, (USEPA, October 1988).

The RI/FS planning document consists of the following plans presented in three volumes:

Volume	Planning Documents Presented
I	Work Plan
II	Sampling and Analysis Plan and Site Management Plan
III	Data Management Plan and Health and Safety Plan

Together the three volumes present the scope of the RI/FS with associated methodology and rationale, quality assurance and health and safety procedures; data storage, handling, and presentation formats; and the project management approach.

The following IR Program sites at NAS Whiting Field are included in the RI/FS process.

Site 1 - Northwest Disposal Area
Site 3 - Underground Waste Solvent Storage Area
Site 6 - South Transformer Oil Disposal Area
Site 9 - Waste Fuel Disposal Pit
Site 10- Southeast Open Disposal Area (A)
Site 11- Southeast Open Disposal Area (B)
Site 12- Tetraethyl Lead Disposal Area
Site 13- Sanitary Landfill
Site 14- Short-Term Sanitary Landfill
Site 15- Southwest Landfill
Site 16- Open Disposal and Burn Area
Site 17- Crash Crew Training Area
Site 18- Crash Crew Training Area

In addition, specific RI/FS activities are slated to delineated the sources of contamination impacting NAS Whiting Field's production wells W-S2 and W-W3.

FOREWORD

The Department of the Navy developed the Installation Restoration (IR) Program to locate, identify, and remediate environmental contamination from the past disposal of hazardous materials at Navy and Marine Corps installations. The Navy IR Program follows the Department of Defenses Environmental Restoration Program as created by the Superfund Amendments and Reauthorization Act of 1986.

The IR Program consists of three phases. Phase one's Preliminary Assessment and Site Inspection identifies the location (site) and presence of pollutants and assess their potential or actual threat to public health and the environment. Phase two and three are initiated based on the degree of threat and the need for remediation of the contamination. Phase two's Remedial Investigation and Feasibility Study analyzes the sites contamination and determines the optimum remediation solution. Phase three is the implementation of the solution.

Phase one results for NAS Whiting Field were inconclusive as to whether a past release to the environment has taken place at many of the sites. As such, Phase one's recommendation is to perform a Remedial Investigation that will address the nature and extent of contamination at the sites. Southern Division, Naval Facilities Engineering Command (NAVFACENGCOM) will assist NAS Whiting Field in implementing that recommendation.

Questions regarding this report should be addressed to the Commanding Officer, NAS Whiting Field, or to Southern Division, NAVFACENGCOM, Code 11515, at AUTOVON 563-0571 or (803) 743-0571.

ACKNOWLEDGEMENTS

In the execution of the effort required to generate this report, the Remedial Investigation Team commends the unwavering support, assistance and cooperation provided by the personnel at NAS Whiting Field and Southern Division, Naval Facilities Engineering Command. In particular, the team gratefully acknowledges the outstanding effort, dedication and professionalism provided by the following people in the preparation of this report.

NAME	TITLE	POSITION	LOCATION
Ted Campbell	Engineer	Engineer in Charge	Southern Division
Cindy W. Black	Engineer	Environmental Coordinator	NAS Whiting Field

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LIST OF ACRONYMS

ACL	Alternate Contaminant Level
AFFF	Aqueous Film Forming Foam
AIC	Acceptable Intake-Chronic
AIMD	Aircraft Intermediate Maintenance Department
AIS	Acceptable Intake-Subchronic
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BAT	Bengt-Arne Torstensson
BLS	Below Land Surface
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CIP	Caucus Inorganic Protocol
CLP	Contract Laboratory Program
cm	centimeter
COP	Caucus Organic Protocol
CRL	Central Regional Laboratory
CRP	Community Relations Plan
CWA	Clean Water Act
DMP	Data Management Plan
DQO	Data Quality Objectives
EDB	Ethylene Dibromide
EIC	Engineer in Charge
EMSL-LV	Environmental Monitoring Systems Laboratory, Las Vegas

LIST OF ACRONYMS (Cont.)

EP	Extraction Procedure
EPIC	Environmental Photographic Interpretation Center
ERA	Expedited Response Action
ESI	Expanded Site Investigation
FAC	Florida Administrative Code
FDER	Florida Department of Environmental Regulation
FIT	Field Investigation Team
FS	Feasibility Study
FSP	Field Sampling Plan
GAC	Granulated Activated Carbon
GC	Gas Chromatograph
GFAA	Graphite Furnace Atomic Adsorption
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSE	Ground Support Equipment
HASO	Health and Safety Officer
HASP	Health and Safety Plan
HEA	Health Effects Assessment
IAS	Initial Assessment Study
ICP	Inductive Coupled Plasma
IRP	Installation Restoration Program
IRIS	Integrated Risk Information System
Lead Agency	The agency, either the EPA, Federal agency, or appropriate State agency having primary responsibility and authority for planning and executing the remediation at a site.
LOEL	Lower Observed Effect Level
MCL	Maximum Contaminant Level, established under the Safe Drinking Water Act.

LIST OF ACRONYMS (Cont.)

MCLG	Maximum Contaminant Level Goal, established under the Safe Drinking Water Act.
MEK	Methyl Ethyl Ketone
mg/l	milligrams per liter
MIBK	Methylisobutyl ketone
MPR	Monthly Progress Report
MPRSA	Marine Protection Research and Sanctuaries Act
NAAQS	National Ambient Air Quality Standards
mm	millimeters
m	meter
mg/kg	milligrams per kilogram
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NCR	NEESA Contract Representative
NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum of 1929
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OLF	Outlying Landing Field
OMD	Operations Maintenance Division
OMS	Operation Maintenance Service
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response

LIST OF ACRONYMS (Cont.)

PA	Preliminary Assessment
PCB	Polychlorinated Biphenyl
PCPT	Piezocone Penetrometer Test
PHE	Public Health Evaluations
PM	Program Manager
ppb	parts per billion
POL	Petroleum, Oil, and Lubricants
PrM	Project Manager
PRP	Potentially Responsible Party
PWD	Public Works Department
q_1*	Cancer potency factor
QA	Quality Assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD/RA	Remedial Design and Remedial Action
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RO	Regional Officer
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986.
SAS	Special Analytical Services

LIST OF ACRONYMS (Cont.)

SDWA	Safe Drinking Water Act
Southern Division	Southern Division, Naval Facilities Engineering Command
SI	Site Inspection
SITE	Superfund Innovative Technology Evaluation
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SPHEM	Superfund Public Health Evaluation Manual
SWDA	Solid Waste Disposal Act
TAT	Technical Assistance Team
TBC	To Be Considered
TCL	Target Compound List
TD	Technical Director
TDM	Technical Directive Memorandum
TRAWING FIVE	Training Wing Five
TRB	Technical Review Board
TSCA	Toxic Substances Control Act
UST	Underground Storage Tank
USEPA	U.S. Environmental Protection Agency
VOA	Volatile Organic Analytes
VOC	Volatile Organic Compounds
WPRR	Work Plan Revision Request

1.0 INTRODUCTION

E.C. Jordan Co. (Jordan), under contract to the Department of Navy, is submitting this Remedial Investigation/Feasibility Study (RI/FS) planning document to the Department of Navy, Southern Division, Naval Facilities Engineering Command (Southern Division) for Naval Air Station (NAS) Whiting Field located in Milton, Florida. The RI/FS planning document was completed under contract number N62467-88-C-0382. Upon Southern Division's approval of this document and written Notice to Proceed, Jordan is prepared to implement the RI/FS at NAS Whiting Field.

1.1 PURPOSE. The purpose of the NAS Whiting Field RI/FS is to identify a range of remedial alternatives to address any identified risks to public health and the environment posed by contaminants present due to past waste disposal or spill sites. To achieve this objective, the RI must collect data sufficient to assess the nature and distribution of contaminants associated with each site. The Feasibility Study (FS) will use the data collected in the Remedial Investigation (RI) to screen, evaluate, and select remedial alternatives (RA) to provide permanent, feasible solutions to environmental contamination problems at NAS Whiting Field.

The RI/FS conducted at NAS Whiting Field will be consistent with the Navy Installation Restoration (IR) Program. The preliminary Hazardous Ranking System score for NAS Whiting Field indicates that it will qualify for the National Priorities List (NPL). As such, the RI/FS for NAS Whiting Field will also follow the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and guidance for conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA, October 1988).

Federal facility requirements specified under Section 130 of CERCLA include:

REQUIREMENT	TIMETABLE
Federal Agency Hazardous Waste Docket	Updated every 6 months
Preliminary Assessment (PA) if facility is on the docket and Site Inspection (SI), if appropriate	April 1988
Propose Federal Facility Site for the NPL	April 1989
Commence RI/FS	6 Months after promulgation on the NPL
Enter into inter-agency agreement	180 days after completion of the RI/FS

Implement Remedial Action	No later than 15 months after completion of the RI/FS
Annual Report to Congress	As decided by the Federal agency

1.2 PLANNING DOCUMENT OVERVIEW

The RI/FS planning document consist of the following plans presented in three volumes:

Volume	Planning Documents Presented
I	Work Plan
II	Sampling and Analysis Plan and Site Management Plan
III	Data Management Plan and Health and Safety Plan

Together the three volumes present the scope of the RI/FS with associated methodology and rationale; quality assurance and health and safety procedures; data storage, handling, and presentation formats; and the project management approach.

Volume I - Work Plan. Volume I presents a review of existing facility information gathered during previous investigations, a preliminary evaluation of risk and remedial alternatives, and the scope and supporting rationale for the RI/FS. Additionally, the schedule and management approach for the RI/FS is presented. The specific sections of Volume I and a brief description of the contents of each section are provided below.

- Section 1.0 is an introduction which presents the contractual background, purpose, and overview of the RI/FS planning documents.
- Section 2.0 describes the NAS Whiting Field's facility location, operational history, physical setting, and a summary of the problems.
- Section 3.0 presents results of scoping activities performed to assess the objectives of the RI/FS and includes:
  - a discussion of risk assessment issues,
  - an identification of potential remedial alternatives, and
  - an initial identification of applicable or relevant and appropriate requirements (ARARs).
- Section 4.0 addresses the data quality objective established for the RI/FS at NAS Whiting Field.
- Section 5.0 presents a detailed Task Plan for the RI and FS.

- Section 6.0 addresses the project management approaches for schedule and deliverables for the project.

Volume II - Sampling and Analysis Plan (SAP). Volume II describes in detail the methods and procedures to be employed during the RI field investigations. The SAP consists of two parts: (1) the Quality Assurance Project Plan (QAPP) which describes the policy, organization, activities, and quality assurance and quality control (QA/QC) protocols necessary to achieve the project's Data Quality Objectives (DQOs); and (2) the Field Sampling Plan (FSP) which provides guidance for field work by detailing the data-gathering methods proposed for the project. The SAP, as presented in Volume II of this document, does not contain the laboratory QAPP. Upon award of the subcontract for laboratory services, this QAPP will be submitted for review and approval. A section by section description of the contents of the SAP are presented in the introduction section of Volume II.

The SAP presented in Volume II of the RI/FS planning documents consists of four pertinent components: (1) the Site Management Plan (SMP) which details the organizational structure and responsibilities of individuals involved in the RI field investigation; (2) the FSP which details the field program by task and by specific sites; (3) the field investigation QAPP which presents standard operating procedures for conducting field sampling; and (4) the Site-Specific Quality Assurance Plan Addendum which presents specific details applicable to the RI field investigation that are not included in the field investigation QAPP.

Volume III - Data Management Plan and Health and Safety Plan. Volume III consists of two plans: (1) the Data Management Plan (DMP) and (2) the Health and Safety Plan (HASP). The DMP presents procedures used to inventory, store, retrieve, evaluate, and present the data collected during the RI. The HASP presents Jordan's corporate health and safety policies along with site-specific health and safety aspects for undertaking the RI field investigation.

The Community Relations Plan (CRP). The CRP is submitted as a stand alone document separate from the three volume RI/FS planning document and is the last plan to be submitted prior to undertaking the RI/FS for NAS Whiting Field. The CRP presents the community relations history and the issues of concern to the community surrounding NAS Whiting Field. This CRP is designed to ensure that the residents and community officials of Milton and Santa Rosa County, Florida have access to information about site conditions and actions, and that the proper mechanisms are in place to provide interested community members the opportunity to become involved in the remediation decision-making process.

The RI/FS planning document for NAS Whiting Field is, by design, dynamic document which will change to reflect the investigative direction of the project. In keeping with Navy and CERCLA guidance, a phased approach has been developed for the RI/FS at NAS Whiting Field. These documents present in detail the scope, objectives, methodology, and schedule for Phase I of the RI and describe known and potential activities to be conducted under Phase II of the RI. The main objective of the investigations to be conducted during the Phase I RI is to provide the additional data necessary to verify the presence of chemicals in the soils, sediments, surface water, and groundwater. Based on the results of the

Phase I RI, recommendations will be made for one of the following courses of action:

- interim remedial action, or
- additional study in a Phase II RI,
- no further action,
- monitoring only.

Interim remedial action will be recommended for any site where existing environmental contamination represents an immediate and unacceptable risk to human health or the environment.

Additional study will be recommended for sites where laboratory analytical results and investigative observations indicate that chemicals exist in the environment and their concentrations exceed local, State, or Federal regulatory standards and, therefore, pose a threat or risk to human health or the environment. If additional studies are recommended and approved, the RI/FS planning document will be revised or amended to present the scope, methodology, and schedule for a Phase II RI.

A no further action record of decision (ROD) will be recommended for sites where no source area can be delineated and no release to the environment has been verified. A monitoring only ROD will be proposed for sites where either contaminant concentrations are below applicable or relevant and appropriate requirements (ARARs) and, therefore, pose no risk, or where contaminant release has not been verified but a potential exists for a release to the environment.

2.0 FACILITY BACKGROUND AND SUMMARY OF EXISTING DATA

This section summarizes and presents existing data pertaining to site description, past and present base operations, chemical waste management, and waste characterization. Additionally, a summary statement on the current understanding of the environmental problems at NAS Whiting Field is presented.

Due to the multi-site nature of the NAS Whiting Field RI/FS project, existing site-specific chemical data is presented in section 5.3.3. This logistical presentation provides a more comprehensive understanding of the results of previous investigations immediately prior to discussing the scope and rationale for the Phase I RI for each site.

The facility-specific data summarized in the following section has been developed during previous site investigations. Although this summary is lengthy in nature, it provides invaluable insight into the types and quantities of materials that were used and ultimately disposed of at the facility. This information was a key factor in the development of the investigative approach proposed in this Work Plan.

2.1 FACILITY LOCATION. NAS Whiting Field is located in Florida's northwest coastal area approximately 7 miles north of Milton and 20 miles northeast of Pensacola (Figure 2-1). It is divided into two air fields. The North Field is used for fixed-wing training and the South Field is used for helicopter training (Figure 2-2). NAS Whiting Field provides support services and facilities for flight and academic training.

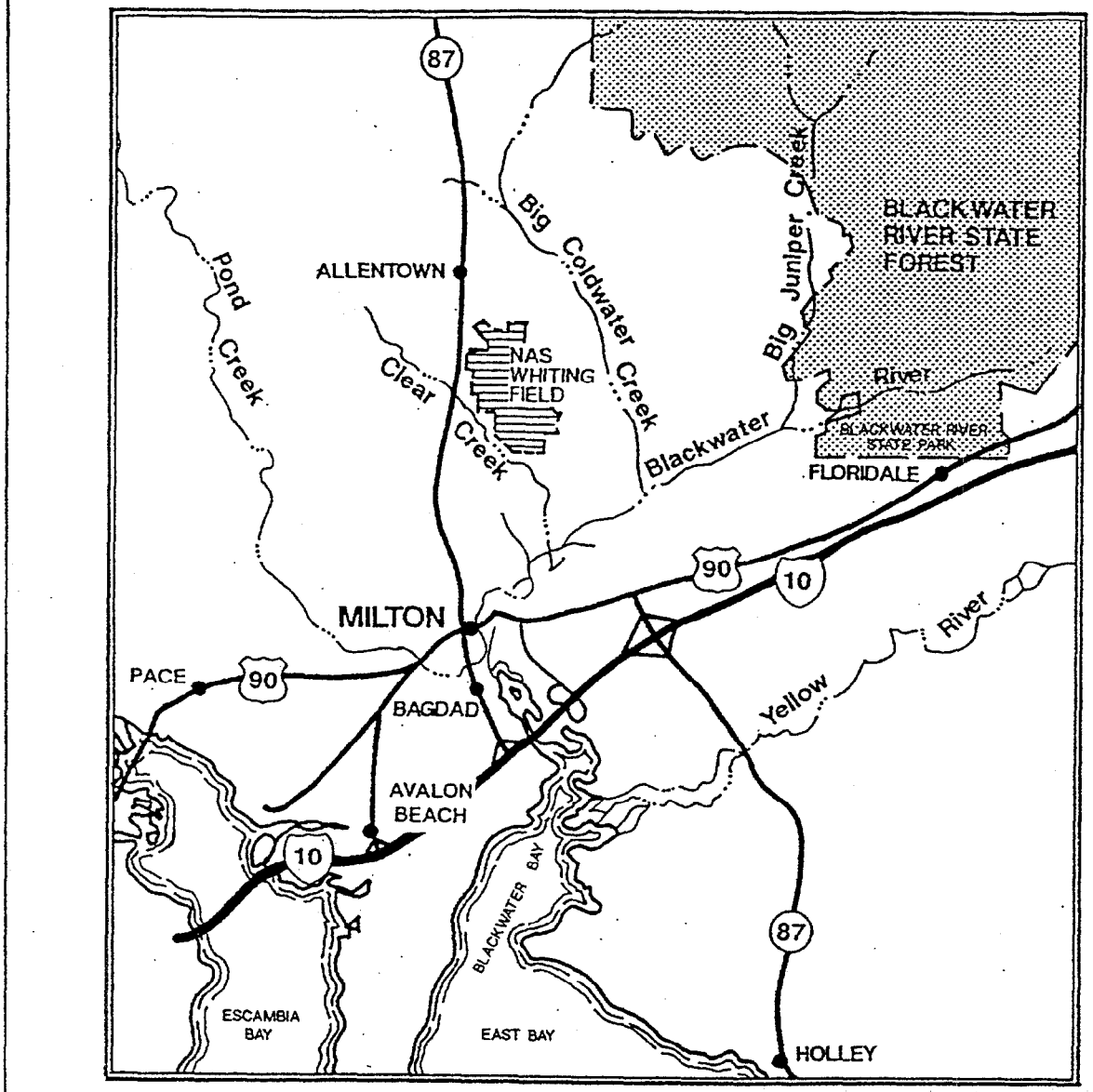
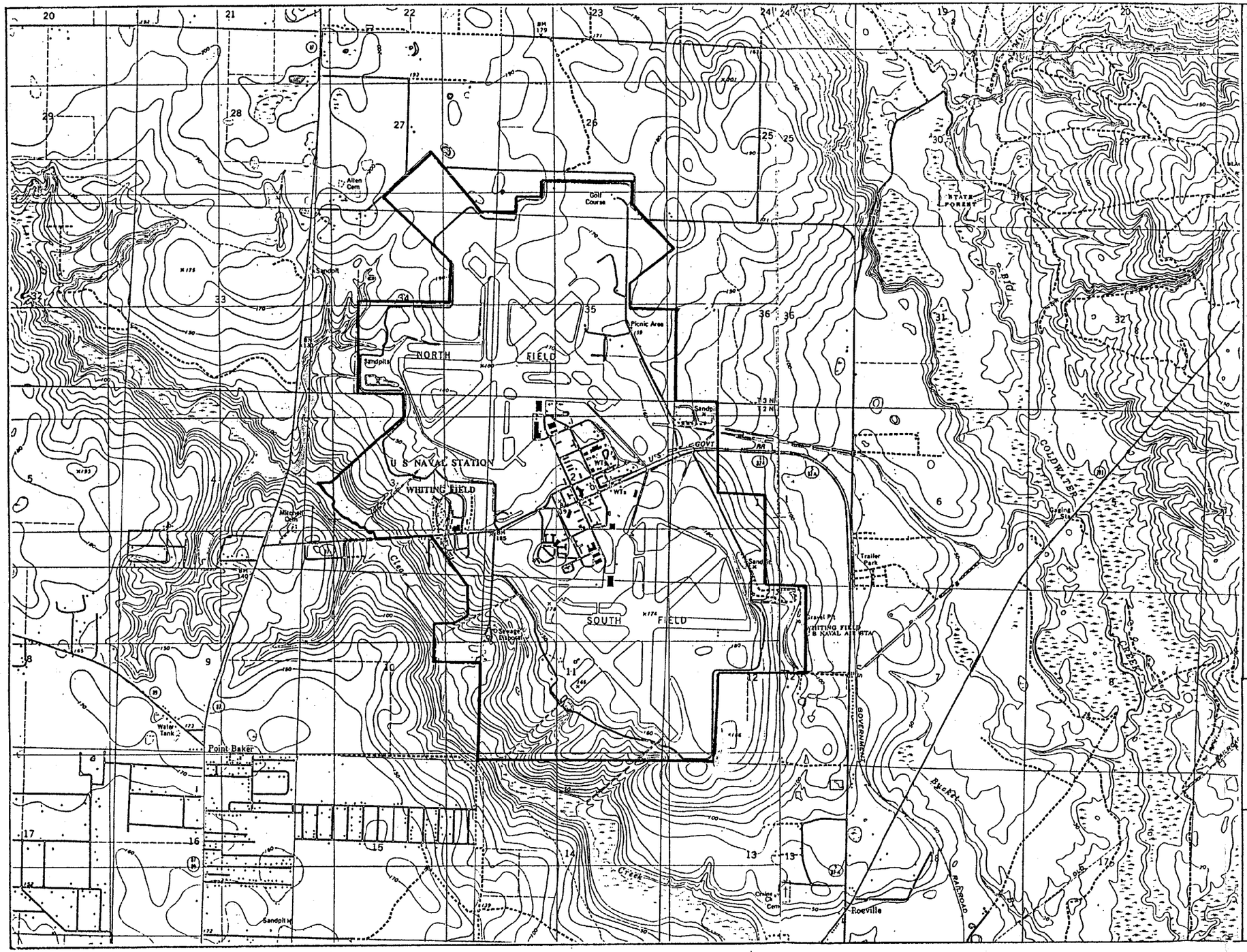


FIGURE 2-1

FACILITY LOCATION MAP

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA



SOURCE:
USGS QUADRANGLE MILTON NORTH, FLORIDA
PHOTOREVISED 1987
AND USGS QUADRANGLE HAROLD, FLORIDA 1973.

FIGURE 2-2

NAS WHITING FIELD

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

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2.2 FACILITY HISTORY. A comprehensive investigation of past base operations with regards to hazardous materials and hazardous waste disposal practices was conducted in 1985 as part of the Navy's former Assessment and Control of Installation Pollutants Program (now the Installation Restoration Program). The first phase of this program, the Initial Assessment Study (IAS) (Envirodyne Engineers, 1985), identified past base operations and waste management activities using historical file records, aerial photography, and extensive interviews with long-term employees and retirees. Due to the exhaustive nature of this previous investigation, only minimal record searches and interviews were conducted before the preparation of this RI/FS Work Plan. The following is a historical summary of facility operations and waste management activities as reported in the IAS for NAS Whiting Field, Milton, Florida.

NAS Whiting Field, home of Training Air Wing Five (TRAWING FIVE), was constructed in the early 1940's. It was commissioned as the Naval Auxiliary Air Station Whiting Field in July 1943 and has served as a naval aviation training facility ever since. The field's mission has been to train student naval aviators in basic instruments, formation and tactic phases of fixed-wing, propeller-driven aircraft, and in the basic and advanced portions of helicopter training.

Throughout the years of operation, NAS Whiting Field has generated a variety of wastes related to pilot training, the operation and maintenance of aircraft along with ground support equipment, and the station's facility maintenance activities. The remainder of this section provides information on the various shops and base operations that produced waste materials as reported in the IAS. A brief discussion of the types of operations, locations and dates of the operations, and types and quantities of wastes produced and base disposal practices have been identified when the information was available. It should be noted that most of these operations and activities at NAS Whiting Field are now performed by private contractors. The IAS study team found very few personnel available who could provide detailed information on disposal practices prior to 1980. They found that many of the key, long-term personnel who worked in those areas have taken new assignments in different geographic areas or have retired. However, based on the information that is available, the IAS report concluded that it can reasonably be assumed that prior to the establishment of hazardous waste management programs and programs to recycle waste oil, most of the hazardous wastes generated at the base were disposed of on the facility. Waste materials were disposed either in dumpsters that were eventually emptied into one of the eight operating disposal areas, or it went into waste oil bowsers that were probably used for fire fighting training. Past operations are discussed below as completely as possible. In addition, more recent operations are also discussed in an attempt to enhance the understanding of past practices.

2.2.1 Industrial Operations NAS Whiting Field's training mission is supported by minor to intermediate aircraft repairs and maintenance operations but does not involve heavy industrial or production type activities. Until about 1980, aircraft requiring complete overhaul or rework were sent to NAS Pensacola. The principal industrial functions were performed by an aircraft maintenance department, the squadrons, and the Public Works Department at NAS Whiting Field. The IAS determined that the departments, shops, and tenant activities that have been the major generators of hazardous wastes at the base include:

Aircraft Intermediate Maintenance Department (AIMD),
Operation Department,
Public Works Department (PWD),
North Field Aircraft Maintenance Operations,
South Field Aircraft Maintenance Operations,
Naval Aerospace and Regional Medical Center,
Photo Detachment, and
Auto Hobby Shop.

- Aircraft Intermediate Maintenance Department. The AIMD, Building 2941, performed intermediate maintenance on aircraft and ground support equipment for the NAS Whiting Field's training squadrons after 1968. Prior to 1968, AIMD type operations were performed within the hangars. In 1983, all of the aircraft service shops, except Ground Support Equipment (GSE), were awarded to contractors due to the phase-out of the T-28 aircraft. Prior to this, the AIMD's support shops included: airframes, avionic, battery, calibrations, electric, ground support equipment, hydraulic, power plants, and painting. Five of the AIMD shops generated industrial wastes: the Airframes Shop, the Power Plant Shop, the Ground Support Equipment Shop, the Paint Shop, and the Battery Shop. These shops generated wastes such as cleaning solvents, acids, hydraulic fluids, engine oils, paints, and thinner along with stripping compounds. Table 2-1 summarizes waste generation from the AIMD.

Airframes Shop. Airframes performed metal repairs and fabrication of aircraft structural components. This shop generated about 30 gallons per month of wastewater containing paint stripping compounds which were disposed in the underground stripper storage tanks located on the south end of Hangar Building 2941. Between 1968 and 1980, when the tanks became full, waste material was pumped out of the tanks and disposed of in one of the open disposal areas located at the air station. After 1980, the waste material was taken off-site for treatment. A sample of the waste material generated by the shops operation was collected in 1984. Table 2-2 provides the results of the chemical analysis of the sample.

Power Plant Shop. Engine tear-down and build-up was conducted by this shop along with engine testing. The wastes generated by this shop were from engine maintenance and the test cells. Cleaning of aircraft engine components generated some 50 gallons of PD-680 cleaning solvent per month. Freon used at the engine test cell generated about 40 gallons of waste per month. These wastes were reportedly poured into an underground waste oil storage tank located at the southwest corner of Hangar Building 2941. It was reported that the materials were then removed from the base by a contractor for reprocessing or disposal.

Ground Support Equipment. The GSE shop was responsible for the scheduled and unscheduled maintenance on all ground support equipment (JG-75 tow tractors, aircraft jacks, and maintenance stands). The operation moved from Hangar Building 2941 to the Central Hangar, Building 1454, in the early 1970's. The shop routinely generated an estimated 30 gallons of PD-680 cleaning solvent per month and about 15 gallons of aircraft cleaning compound per month. Other waste materials generated by GSE included lubricating oil (20 gallons per month), antifreeze (9 gallons per month) hydraulic fluid (25 gallons per month), and transmission fluid (6 gallons per month). All of the wastes were disposed either in a bowser or the

TABLE 2-1
AIMD WASTE GENERATION RATES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Airframes Shop	Paint stripping compounds	360	1968-1980	On-station landfill.
			1980-1983	Underground storage, off Navy property treatment.
Power Plant Shop	PD-680	600	1968-1983	Waste oil storage tank, off Navy. property storage by contractor.
	Freon	500	1968-1983	Waste oil storage tank, off Navy property by contractor.
Ground Support Equipment Shop	PD-680	360	1968-1984	Waste oil bowser, waste oil storage tank, off Navy property by contractor.
	Aircraft cleaning compound	180		
	Lubricating oil	240		
	Hydraulic fluid	300		
	Transmission fluid	70		
	Antifreeze	100		
Paint Shop	Mixed paint stripping wastewater	24,000	1968-1980	Drums, on-station landfill.
		18,000	1980-1983	Underground storage tanks, off Navy property treatment.
		6,000	1983-1984	Drums, DPDO.
Battery Shop	Battery acid	180	1968-1983	Neutralization dry well.
		180	1983-1984	Drums, DPDO.

Source: Envirodyne Engineers (1985)

TABLE 2-2
CHEMICAL ANALYSIS OF WASTE SAMPLE
AIMD PAINT STRIPPING OPERATION (30 MARCH 1984)
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

PARAMETERS	RESULTS (mg/l)*
1,1,1-Trichloroethane	1,670
Methylene chloride	4,110
Toluene	20,600
Xylene	18,800
Methyl isobutyl ketone	1,200
Total organic carbon, percent	30
Total Phenols	9.2
Arsenic	8.7
Barium	14.1
Cadmium	1.0
Chromium	80
Lead	100
Mercury	0.002
Selenium	0.021
Silver	0.06

Source: Envirodyne Engineers (1985)

NOTE: * milligrams per liter (mg/l) unless otherwise noted.

underground waste oil storage tank located north of Building 1454. It was reported that this tank was emptied by a contractor on a routine basis for off Navy property reprocessing or disposal.

Paint Shop. The AIMD Paint Shop was responsible for the repainting of aircraft and helicopter structural components. The application of paint strippers and parts cleaning agents prior to painting were major steps in the operation. Stripping paint from aluminum and aluminum alloy components constituted roughly 80 percent of the work load and stripping paint from magnesium, titanium, and stainless steel parts comprised the remainder of the load. The stripping process involved the application of a compound by brush or by dipping of the parts into a solution. One bin contained a boric acid solution for stripping steel parts and another contained a prepared solvent solution for stripping the aluminum and aluminum alloy parts. The tanks each contained about 15 gallons of stripping agent. After a period of time, the stripper and paint slime were removed from the aircraft part with copious amounts of rinse water into an open top catch tank. This step was often followed by the application of a zinc chromate coating solution (alidine) to the stripped component. This material was also rinsed into the catch tank.

Prior to about 1980, the wastewater generated by this operation was pumped into 55-gallon drums for transport to an operating on-station landfill. The waste was then poured onto materials at the landfill site and the drums reused. Around 1980, the catch tank was connected to two underground metal holding tanks (used bottled gas tanks), approximately 500 gallons each, located just south of Building 2941. When the open top catch tank was full, a valve was manually opened to drain the wastewater into the underground holding tanks. The holding tanks were emptied, as required, for treatment and disposal off Navy property. Depending on the work load, this operation generated from 500 to 2,000 gallons per month of rinse water containing epoxy, paint stripper, mineral spirits, lacquer thinner, toluene, methyl isobutyl ketone (MIBK), 1,1,1-trichloroethane, xylene, isopropyl alcohol, and alidine.

Battery Shop. Maintenance activities of the shop include the repair, testing, flushing, and charging of lead-acid batteries used by the squadrons. This operation has been conducted in Building 1478 from the mid-1960's. The waste battery acid generated by this shop, approximately 180 gallons per year, was routinely poured down a slop sink drain and flushed with rinse water to dilute the acid solution. The waste solution subsequently discharged to a lime rock (neutralization) dry well located on the west side of the shop. This disposal method was used from the 1960's until early 1984. When this disposal technique was discontinued, the sink was connected to the sanitary sewer for disposal of the dilute rinse water only. The waste acid has subsequently been drummed and handled as hazardous waste and disposed off Navy property by the PWD. Battery cases are given to the DPDO for off Navy property disposal or resale.

- Operations Department. The Operations Department runs the airfield, provides support services and limited maintenance on the assigned aircraft, and conducts fire fighter training exercises through the fire department.

Only the Operations and Maintenance Division generates hazardous wastes, although the Crash/Fire Division consumed some of the wastes generated by the other shop operations. Wastes generated by this department are given in Table 2-3.

Operations Maintenance Division. The Operations Maintenance Division (OMD), Hangar Building 1454, has provided line maintenance on transient aircraft and the daily upkeep and maintenance of several assigned aircraft since the 1940's. The activities of the division typically generate less than 5 gallons per month of mixed waste paint and stripper, MIBK, methyl ethyl ketone (MEK), toluene, and naphtha. Waste oil generated by engine oil changes was placed either in a bowser or an underground waste oil storage tank adjacent to Building 1454 prior to off Navy property disposal by a contractor. Approximately 400 gallons of waste oil were disposed annually in this manner. Waste fuel, about 100 gallons per year, is placed into drums for use by the Fire Department's fire training exercises.

Crash/Fire Division. This division is responsible for all crash and structural fire protection included fire fighter training activities. The fire station is located in Building 2983. Until the early 1970's, all fire division activities were performed solely by military personnel. Since then, these responsibilities have been shared by civilian and military groups. The fire fighter training area has been located on the west side of North Field for the past 25 years or more. Two main sites are used to conduct the training exercises. Flight schedules dictate which site is used for any particular session. During each session, contaminated fuel is poured into a shallow earthen depression, ignited, and subsequently extinguished using Aqueous Film Forming Foam (AFFF) or other similar extinguisher agent.

The contaminated fuel (JP-4, JP-5, or AVGAS mixed with oily wastes) is obtained from the squadrons and shop areas. Materials arrive primarily by truck and are pumped into 55-gallon drums for temporary on-site storage. The military group assigned to the station uses about 500 gallons per month of waste petroleum products for their training sessions and the two civilian platoons consume around 800 gallons each month.

- Public Works Department. The NAS Whiting Field PWD performs a wide variety of services through an organization of divisions including: facilities planning, design, programming, and construction; real estate management; facilities inspection; maintenance, repair, minor construction, alteration, and equipment installation; facility disposal; transportation operations and maintenance including weight-handling equipment; housing administration; along with environmental control and conservation programs. RCA/Operations Maintenance Service (OMS) assumed the operation responsibilities of the PWD on a contractual basis on 1 October 1982. They are specifically responsible for the maintenance and operations at NAS Whiting Field of grounds, utilities, sewage treatment, potable water, transportation, telephone and messenger services, and building maintenance. Two divisions, Transportation and Utilities, generate most of the hazardous wastes from this department. Table 2-4 presents a summary of the wastes generated by the PWD.

TABLE 2-3
OPERATIONS MAINTENANCE DIVISION WASTE GENERATION RATES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year*)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Operations Maintenance Division	Mixed waste and paint thinners	60	1960-1984	Drums, fire fighter training.
	Waste fuels	100	1960-1984	Drums, fire fighter training.
	Waste oils	400	1960-1984	Waste oil bowser, or waste oil storage tank, off Navy property by contractor.
Crash/Fire Division	Mixed fuel and Waste oils	15,000**	1950-1984	Burned in fire training pits (partially combusted hydrocarbon residue).
	AFFF	3,000**	1960-1980	Fire fighter training pits and crash sites.
	PCP-dry Chemical extinguisher agent	3,000** pounds	1980-1984	Fire fighter training pits and crash sites.

Source: Envirodyne Engineers (1985)

NOTE: * Rate in gallons except as otherwise noted.
** Indicates amount of material used by this operation.

TABLE 2-4
PUBLIC WORKS DEPARTMENT WASTE GENERATION RATES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Transportation Division Shop	Dry cleaning solvent	50	1950-1980	On-station landfill.
	PD-680	30	1980-1982	On-station landfill.
			1982-1984	Off Navy property by contractor.
	Waste oil, brake and hydraulic Fluid	120	1950-1984	Off Navy property by contractor.
Utilities Division Shop	Mixed boiler waste treating chemicals	--	1940-1984	Sanitary sewer.

Source: Envirodyne Engineers (1985)

Transportation Division. This division, located in Building 1429, is responsible for the maintenance of all transportation, construction, material-handling, and material moving equipment. They also provide motor vehicles and operators of heavy equipment for the on-station landfills. Maintenance and repair activities typically generate approximately 30 to 50 gallons of cleaning solvent per year. The main waste from the transportation division is waste oil. Approximately 10 gallons are generated each month.

Utilities Division. The main function of the division is to operate the station's steam/hot water plant, potable water treatment and distribution system, and wastewater treatment and disposal system. Other responsibilities of the division include maintenance and repair of power distribution lines and other utility equipment. The facility, built in the 1940's, is located in Building 1429. The division uses a wide variety of boiler water treating chemicals, such as sodium hydroxide, sodium sulfite, sodium hexametaphosphate, and other miscellaneous testing reagents. Exact quantities of each chemical used were not recorded. The wastewater containing these chemicals is discharged to the sanitary sewer.

Electric Shop. The electrical operations have been conducted in Building 1437 since the 1940's. The shop is responsible for maintenance, minor repairs, installations, modifications, and alterations to electrical and electronic equipment and systems on the station. Transformer repair performed by this shop included cleaning of bushing gaskets, repair and replacement of windings, and repainting of cases. The repairs were conducted at several locations on-station over the years. Prior to about 1960, some of this work was performed in Building 1478, which later became the Battery Shop. Typically, the transformers were hauled from the shop to the ditch behind the Central Hangar, drained of oil, rinsed with kerosene, and brought back to the shop area for rework. Transformer rework was also performed at the Electric Shop, Building 1437, until the mid-1970's. Transformers reworked at Building 1437 were normally hauled to an on-station landfill to dispose of the oil. During the 1960's and 1970's, some minor repairs were also performed on transformers at the North Pump House, Building 1479, but reportedly no oil was disposed at this location.

Polychlorinated biphenyls (PCBs) were used in dielectric fluid in capacitors and power transformers throughout NAS Whiting Field. It was reported (Envirodyne Engineers, 1985) that PCB-containing dielectric fluid may have been disposed on site at the landfills prior to the initiation of the present collection and disposal program. Quantities and exact dates of PCBs disposal on site were not recorded. Currently no PCB containing devices are located at NAS Whiting Field.

Pesticide Shop. Pesticide (including herbicide and insecticide) operations are conducted out of Building 1485C at the PWD compound. Golf course pesticide storage and mixing facilities are located at the Golf Maintenance Shop, Building 2877. Pesticide inventories are maintained at a level to meet application requirements based on past records. A comparison of the types and quantities of pesticides applied during 1971 and 1977 are given

TABLE 2-5
ESTIMATED ANNUAL PESTICIDE USAGE COMPARISON
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

PESTICIDE	TARGET PEST**	1971	1977
Actidione Suspension*	Turf disease (F)	-	880 gals
Ammate-X Solution	Weeds (H)	600 gals	1,250 gals
Anticoagulant Baits (0.025%)	Rats/mice	15 lbs	50 lbs
ARS Emulsion*	Broadleaf weeds (H)	-	1,650 lbs
Balan Granules (2.6%)*	Weeds (H)	-	400 lbs
Baygon Emulsion (1.1%)*	Roaches (I)	-	50 gals
Bromacil Suspension*	Vegetation (H)	-	1,150 gals
Carbaryl Solution*	Leaf chewer (I)	-	1,100 gals
Chlordane Emulsion (2%)	Ants (I)	20 gals	-
Chlordane Granules/Dust (10%)*	Ants (I)	-	370 lbs
Cycloheximide Suspension	Turf disease (F)	-	330 gals
Dalapon Suspension	Vegetation (H)	-	110 gals
Diazinon Emulsion (1%)*	Roaches (I)	370 gals	270 gals
Dicamba Emulsion*	Weeds (H)	-	110 gals
Dicamba Granules (0.35%)*	Weeds (H)	-	50 lbs
Dimethyl-phosphonate Suspension (0.8%)*	Leaf chewer (I)	-	300 gals
Diuron/Ammate Suspension	Vegetation (I)	1,150 gals	-
2,4-D Granules*	Weeds (H)	-	50 gals
2,4-D Emulsion	Weeds (H)	-	330 gals
Kepone Baits (0.15%)	Ants (I)	520 gals	-
Malathion Solution (7%)	Mosquitos (I)	700 gals	800 gals
Malathion Emulsion (0.18%)*	Leaf chewer (I)	3,650 gals	5,850 lbs
Methyl Bromide (98%)*	Nematodes (SF)	-	10 lbs
Mineral Oil Solution (100%)*	Mosquitos (I)	5 gals	-
OOR-Proxol Solution*	Leaf chewer (I)	-	4,600 gals
Pyrethrum Solution*	Mites (I)	-	1 gal
Thirum Suspension (11%)*	Turf disease (F)	-	3,900 gal
Silvex*	Weeds (H)	-	20 lbs

Source: Envirodyne Engineers (1985)

NOTE: * Golf Course Maintenance
** (F) = Fungicide; (H) = Herbicide; (I) = Insecticide;
(SF) = Soil Fumigate
- Pesticide not in use

in Table 2-5. The 1980 Pest Management Plan (Southern Division, 1984) for Whiting Field presents a list, given in Table 2-6, of the chemicals normally used by PWD to control pests. The list presented in Table 2-7 presents the quantities normally kept on hand at the Golf Course to meet their needs.

The only wastes the two pest control shops generate are out-of-date pesticides and empty containers. Spray tank rinsates are either used as make-up water for subsequent applications or applied to the job site and, thus, do not constitute a waste. Disposal of empty pesticide containers was conducted as follows. The liquid pesticide containers were triple rinsed, punctured to make them unusable, and placed in a specified dumpster for disposal at an on-site landfill. Containers for dry pesticides, such as bags and fiber drums, were made unusable by crushing or tearing, placed in the dumpster and also landfilled.

- North Field Aircraft Maintenance Operations. The North Field of NAS Whiting Field provided primary flight training during the 1940's through the efforts of Basic Training Unit-One A (BTU-1A). In the spring of 1949, the Navy's first jet training unit (JTU-1) was brought to North Field. By the mid-1950's, the nine cylinder radial engine T-28 "Trojan" aircraft came to NAS Whiting Field. This aircraft was used exclusively for training operations until the late 1970's when the T-34C "Turbo Mentor" was introduced. During this transition period, both T-28s and T-34Cs were used by the training squadrons. As of April 1983, North Field had about 40 T-28s and about 172 T-34Cs in service for the training mission. It was not until late 1983 that the last of the T-28s were taken out of service. Minor repair operations included stripping and touch-up painting for corrosion control along with engine maintenance and routine aircraft washing. These activities typically generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids.

  With the introduction of the T-34Cs in the late 1970's, contractual services were initiated to provide full administrative, maintenance, and logistics support for the aircraft assigned to the three fixed-wing squadrons (VT-2, VT-3, and VT-6) of Air Wing Five. This contract continues to provide comprehensive maintenance services. The depth of maintenance performed by the station's contractor includes line, shop, intermediate, and depot level.

  Aircraft Maintenance. As part of the maintenance activities, oil changes were routinely performed on the aircraft. The oil was changed in the T-28s about every 250 hours and required approximately 10 gallons of oil. Therefore, assuming that the 350 planes stationed at the field during the early 1970's flew, on average, about 50 hours per month, the IAS concluded that they would have generated about 700 gallons per month of waste engine oil. The waste oil was reportedly poured into the underground waste oil storage tank located adjacent to Hangar 2941. The oil was routinely pumped from the tank by the contractor for off Navy property disposal. The waste oil volume was dramatically reduced following the introduction of the T-34Cs in the late 1970's. Waste oil volumes were reduced to about 1,500 to 2,000 gallons per year. Table 2-8 summarizes the types and quantities of wastes generated during aircraft maintenance operations.

TABLE 2-6
PUBLIC WORKS DEPARTMENT PESTICIDE INVENTORY
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

TYPE	QUANTITY
Insecticides:	
Carbaryl, 80% WP	20 pounds
Chlordane, 10% Granular	350 pounds
Diazinon, 2% Dust	150 pounds
Dimethoate, 23.4% EC	1 gallon
Kelthane, 18.5% EC	19 gallons
Malathion, 57% EC	75 gallons
Malathion, 95% concentrate	200 gallons
Petroleum oil, 97% EC	21 gallons
Propoxur, 13.9% EC (Baygon)	20 gallons
Pyrethrum, 1.9%	3 gallons
Herbicides:	
Ammonium Sulfamate (Ammate-X), 95% Crystals	840 pounds
Bromacil, 2 pounds per gallon EC	700 gallons
Dalapon, 84.5% SP	700 pounds
Diuron, 80% WP	110 pounds
2,4-D, 4 pounds per gallon Amine	10 gallons
2,4,5-T, 4 pounds per gallon LVE	25 gallons
Miscellaneous:	
Avitrol, 0.5% Whole Corn	9 pounds
Captan, 50% WP	50 pounds
Nemacur, 15% Granules	40 pounds
Spreader/Sticker	64 gallons

Source: Envirodyne Engineers (1985)

TABLE 2-7
GOLF COURSE PESTICIDE INVENTORY
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

TYPE	QUANTITY
Insecticide:	
Carbaryl, 50% WP	110 pounds
Methyl Bromide, 98%	10.5 pounds
Proxol, 80% SP	98 pounds
Herbicides:	
Balan, 2.5% granules	480 pounds
MSMA, 35.33% EC	5 gallons
MSMA 47.8% EC	48 gallons
MSMA, 51.19% EC	60 gallons
2,4-D, MCPP (Weedicide II)	35 pounds
2,4-D, 2.2 pounds per gallon; MCPP 1.1 pound per gallon; Dicamba, 0.22 pounds per gallon (Trimec)	31 gallons
Miscellaneous:	
Kromad, 27.5% WP	24 pounds
Nemacur, 15% Granules	150 pounds
Spreader	14 gallons
Thiram, 75%; Cycloheximide, 0.75%	155 pounds

Source: Envirodyne Engineers (1985)

TABLE 2-8
NORTH FIELD WASTE GENERATION RATES
RI/FS WHITING FIELD
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Aircraft Maintenance	Waste oil	8,400 2,500	1940-1978 1978-1984	Waste oil tank/off Navy property by contractor.
	Mineral spirits	1,320	1978-1984	Waste oil tank/off Navy property by contractor.
	Methyl ethyl ketone	360	1978-1984	Waste oil tank/off Navy property by contractor.
	Isopropyl alcohol	180	1978-1984	Waste oil tank/off Navy property by contractor.
	Mixed paint and Thinner wastes	50	1978-1984	Drums/fire fighter training.
Aircraft Washing	Aircraft cleaning solution	4,200	1942-1972 1972-1984	Storm sewer Sanitary sewer

Source: Envirodyne Engineers (1985)

Aircraft Washing Operations. Aircraft washing was performed on a 14-day cycle for each plane. The aircraft cleaning solution was consumed at a rate of about 4,200 gallons per year. Prior to 1972, the wastewater from this operation was discharged to the storm sewer which ultimately discharged to Big Coldwater Creek. Since, the cleaning rack has been connected to the sanitary sewer system and the wastewater is treated at the 1972, air on-station's sewage treatment plant.

South Field Aircraft Maintenance Operations. The first squadron assigned to the South Field started conducting training exercises in July of 1943. The mission was carried out by Basic Training Unit-One B (BTU-1B) from the 1940's until the early 1950's. The T-28 served as the principal training aircraft at South Field until the early 1970's. From 1972, two helicopter training squadrons, HT-8 and HT-18, have been stationed at the South Field to provide basic and advanced helicopter training to student pilots. This reorganization necessitated the transfer of Training Squadron Three (VT-3) to North Field. Basic helicopter flight training was performed using the Bell TH-57A "Sea Ranger" and the advanced training phase was accomplished with the Bell H-1 "Huey" helicopter. As of August 1983, there were approximately 36 Sea Ranger helicopters assigned to HT-8, while HT-18 had about 92 Hueys. The Hueys were phased out in early 1984 and replaced with about 80 TH-57C series helicopters. The operation and maintenance activities prior to the introduction of this helicopter were reportedly similar to those conducted at North Field.

NAS Whiting Field has used two contractors since the 1970's to provide maintenance for the helicopters at South Field. The one contractor's mission is to expedite routine and special maintenance for the TH-57s. These activities, housed in Building 2992, include the service of nickel-cadmium (NICAD) batteries used in the helicopters along with the supply of spare parts to support the Navy TH-57 helicopter training program of HT-8. Sufficient parts were maintained on station to provide daily support on a routine basis.

Battery Locker. The battery locker is used to recharge, service, and dispose of the 28-volt batteries used in the helicopters. Each battery is routinely serviced every 50 hours. The operation generates very small amounts of waste potassium hydroxide electrolyte, 1 to 2 gallons annually. The spent electrolyte is poured into a small can and disposed off Navy property. Waste batteries are also disposed off Navy property by DPDO.

Helicopter Maintenance. A second contractor provides complete organizational maintenance services for all of the H-1 and TH-57C aircraft at NAS Whiting Field from Hangar Building 1406. The activities of this contractor include all levels of maintenance service that generate waste engine oil, cleaning solvents, and some paint stripping wastes. The engine oil, approximately 1 gallon per helicopter, is drained at 200-hour intervals. Therefore, with roughly 50 hours logged on each aircraft per month, this amounts to approximately 350 gallons of waste annually. All waste oil is poured into the underground waste oil storage tank adjacent to the wash rack of Hangar 1406. The waste oil is removed by contractor for off Navy property disposal. Other wastes generated by the maintenance operations include: mineral spirits, MEK, Lacolene, APU thinner, and paint stripper. Contaminated fuel obtained during the collection of fuel samples is placed

in the line shack tank or in 55-gallon drums. The fuel is routinely collected by the fuels contractor and hauled to the Fire Fighter Training Area for use in fire drills. A summary of the estimated quantities and ultimate disposition of these wastes is presented in Table 2-9.

Helicopter Washing. The helicopter wash rack is used daily to clean aircraft on a 14-day cycle. Around 1972, the rack was disconnected from the storm drain and connected to the sanitary sewer system. Approximately ten helicopters are cleaned each day by the squadrons. This operation generates about 100 gallons of wastewater per aircraft. The aircraft cleaning compound is consumed at about 10 gallons per day.

- Naval Aerospace and Regional Medical Center. NAS Whiting Field's Naval Aerospace and Regional Medical Center was located in Building 1416 from the 1940's until 1976 and provided emergency and outpatient care. The facility has been located in Building 2985 since then. Liquid waste chemicals, such as reagents generated by the facility, are generally poured down the sink. Concentrated test acids are diluted with tap water while being poured into the laboratory sink. Solid wastes, like syringes, etc., are first autoclaved and then placed in the dumpster for disposal. The X-ray processing wastes have been passed through a silver recovery unit prior to sewer discharge since the late 1970's. The silver sludge (Table 2-10) is sent to DPDO for resale to salvage companies.

  Dental Clinic. This branch, also located in Building 1416 until 1976, provided complete dental health care for active duty personnel. The clinic was moved to Building 2985 in 1976. This facility generates approximately 12 pounds per year of mercury amalgam wastes used for dental fillings. This waste has been sent to DPDO for disposal since the late 1970's. Silver recovery wastes from the X-ray film processing operation have also been disposed by DPDO since the 1970's. The types and quantities of wastes generated are given in Table 2-10.

- Photo Lab. The photo lab, located in Building 1426 since the 1940's, provides photographic services at NAS Whiting Field for both black and white and color still photography plus color transparencies. Processing chemicals routinely used included developer (50 pounds), fixer/hardener (50 gallons), and replenisher (30 pounds). The lab generated about 10 gallons per month of waste materials. The spent silver recovery unit waste has been sent to DPDO for resale to salvage companies since the 1970's. Waste generation is summarized in Table 2-10.

- Auto Hobby Shop. This shop, located in Building 1404, generates waste solvents (PD-680) from a small parts cleaning tank. The tank is cleaned out as required, which varies according to the level of use. It was reported (Envirodyne Engineers, 1985) that about one 55-gallon drum every 2 months is used by this operation. The spent solvent is poured into the waste oil sump and stored until it is pumped out about once every 3 months. This material is disposed off Navy property. Waste generation is summarized in Table 2-10.

TABLE 2-9
SOUTH FIELD WASTE GENERATION RATES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Aircraft Maintenance	Waste oil	8,450 2,500	1940-1972 1978-1984	Waste oil tank/off Navy property by contractor.
Helicopter Maintenance	Waste oil	1,500	1972-1984	Waste oil tank/off Navy property by contractor.
	Mineral spirits	240	1972-1980	Drums/fire fighter training.
	Methyl ethyl ketone	240	1980-1984	Drums, off Navy property by contractor.
	APU-thinner	180	1980-1984	Drums, off Navy property by contractor.
	Paint stripper	12	1980-1984	Drums, off Navy property by contractor.
	Contaminated fuel	3,000	1972-1984	Drums/fire fighter training.
Helicopter Washing	Aircraft cleaning compound	3,650	1940-1972 1972-1984	Storm sewer Sanitary sewer

Source: Envirodyne Engineers (1985)

TABLE 2-10
MISCELLANEOUS WASTE GENERATION RATES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE SOURCE	WASTE TYPE	ESTIMATED WASTE GENERATION RATE (gallons per year*)	PERIOD OF GENERATION	TREATMENT/DISPOSAL LOCATION
Medical Clinic	Silver sludge		1976-1984	DPDO
Dental Clinic	Mercury amalgam	12 lbs	1970-1984	DPDO
	Silver sudge		1970-1984	DPDO
Photo Lab	Mixed/photo processing chemicals wastewater	120	1940-1984	Sanitary sewer
	Silver sludge		1980-1984	DPDO
Auto Hobby Shop	PD-680	300	1970-1984	Off Navy property by contractor
	Waste oil	500	1970-1984	Off Navy property by contractor

Source: Envirodyne Engineers (1985)

NOTE: * Rate in gallons/year except as otherwise noted.

2.2.2 Material Handling Operations (Storage and Transportation) In addition to the descriptions of the various shops and base operations that produce hazardous wastes, the IAS also provided a brief description of the material handling (storage and transportation) operations for NAS Whiting Field. A brief review of the main storage areas and their capacities are provided below in an attempt to further define the types and quantities of materials that have been used at the base during its years of operation.

Petroleum, oil, and lubricants (POL) have been the most widely used materials stored and used at NAS Whiting Field over the years. The main POL products used were AVGAS, JP-4, heating fuel oil, vehicle ready fuel, diesel fuel, and aviation lube oil (AVLUBE). The storage capacities for these products are shown in Table 2-11. Most of these products are brought inside the station by truck. AVGAS was delivered by rail to the fuel storage area, but rail delivery was discontinued in the mid- to late 1970's. Since that time, fuel operations have been handled by private contractors. The six main storage areas are discussed below.

- AVGAS Aqua System - Main Source. The two main AVGAS storage tanks were rubber lined, reinforced concrete, with a 250,000 gallon capacity. AVGAS was brought to the main storage area by rail or truck, where it was off-loaded and pumped into the storage tanks. From here it was distributed to the North Field for use by the T-28 trainers or the South Field for storage. Because the jet helicopters and the T-34C Trainers do not use AVGAS, most of the north and south field tanks were filled with water and taken out of use. The main storage tanks operated on the Aqua System principle. This system used potable water to displace gasoline. Water was used to lift the AVGAS level above the pump suction inlet pipe for distribution by pumping to either field. When the storage tanks were refilled, water was displaced over the weir to the drain and discharged, untreated, into the "P" drainage ditch which flows into Coldwater Creek. Approximately 6.2 million gallons of water per year was discharged from this operation. This discharge was monitored and permitted under the National Pollution Discharge Elimination System (NPDES).

- North Field AVGAS Aqua System. The North Field AVGAS Aqua System consisted of six underground steel AVGAS tanks and two aviation lube oil tanks. Each tank had a 23,900 gallon capacity. AVGAS was distributed to the aircraft refueling pits by water pressure through the Aqua System. Aircraft refueling was done on the concrete aprons from the refueling pits.

- South Field AVGAS Aqua System. The South Field AVGAS Aqua System consisted of six underground steel tanks and two aviation lube oil tanks. Flight operations at South Field changed from AVGAS burning airplanes to JP-4 burning helicopters, consequently the tank farm was used solely for back-up storage during the fuel shortage in 1973. AVGAS was pumped to these tanks from the main storage area where it returned as needed under water pressure.

- JP-4 Off-Load, Storage, and Pumping Facility. The helicopters at South Field are jet engine powered and burn JP-4. JP-4 is delivered by commercial tank truck and pumped into two 230,000-gallon capacity, aboveground, steel storage tanks. The trucks park on the concrete off-

TABLE 2-11
FUEL STORAGE CAPACITY
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

TYPE FUEL	TYPE STORAGE	NUMBER OF TANKS	TOTAL CAPACITY (gallons)
JP-5	Aboveground steel tanks	2	402,040
Heating fuel oil	Underground steel tanks	4	100,000
Vehicle ready fuel	Underground steel tanks	3	25,000
Diesel	Underground steel tanks	1	25,000

Source: E.C. Jordan Co. (1989)

load apron and filled the tanks. JP-4 was pumped from the tanks to the truck-fill stand.

- AVGAS and JP-4 Truck-Fill Stand. The AVGAS and JP-4 truck-fill stand is located at North Field just south of Building 2941. The helicopters at South Field are fueled from tank trucks by a contractor. Also, AVGAS was truck-loaded here to refuel transient aircraft. AVGAS was pumped to the truck-fill stand by water pressure from the North Field tank farm, while JP-4 was pumped from the storage tanks by pipeline.

- Boiler Plant Fuel Oil Storage. The main heating plant at NAS Whiting Field has always been located in Building 1429 in the Public Works area. The boilers normally burn natural gas; however, fuel oil is used on a standby basis. Fuel oil is stored in four 25,000-gallon underground steel tanks. Also in storage are 10,000 gallons of diesel fuel in an underground steel tank for the emergency diesel-powered electrical generator.

Chemicals are also stored on-site. These materials are stored in drums and small containers at various locations throughout the facility depending upon their use as previously described. These materials include such things as solvents, stripping and cleaning agents, paints, electrolyte, and photographic developing chemicals.

The last types of material that will be discussed in this section are ordnances. Live ordnance is not used for pilot training at NAS Whiting Field. Consequently, the only ordnance storage is for small arms ammunition such as that used by station police. Ordnance is used in small quantities and stored in two ammunition bunkers, 1YC-1 and 1YC-2. Building 1488 is used for storage of small arms ammunition and pyrotechnics. The total storage area is only approximately 400 square feet.

2.3 FACILITY DESCRIPTION. NAS Whiting Field is comprised of the Naval Air Station and off-station housing areas: Owens Court, Magda Village, and Berryhill. There are 14 outlying landing fields (OLF) that are part of the Whiting Field Complex: Barin, Holley, Santa Rosa, Spencer, Silverhill, Summerdale, Wolf, Site 6, Evergreen, Brewton, Pace, Harold, Site 8, and Saufley.

NAS Whiting Field provides primary flight training for 76 percent of all Naval aviators. Navy and Marine Corps helicopter pilots complete all flight training at NAS Whiting Field.

NAS Whiting Field lies in central Santa Rosa County, Florida, approximately 7 miles north of the city of Milton. The 14 OLFs are located in 5 counties in Florida and Alabama and are within a 50-mile radius of NAS Whiting Field. The property holdings for the station and the 14 OLFs, including land owned, leased, and in easements, totals 10,699.75 acres.

In October 1987, the combined military and civilian base population for NAS Whiting Field was 4,017. Of the total, 2,740 were military personnel, 444 were civilians, and 833 were contract personnel. The total base population projected for NAS Whiting Field for 1991 is 4,218 (Naval Facilities Engineering Command, 1988).

Lands bordering NAS Whiting Field consist primarily of agricultural lands to the northwest, residential and forested areas to the south and southwest, and forested lands around the remaining borders (City of Milton, 1978). Santa Rosa County primarily consists of forested area (64.5 percent), with a large amount of agricultural land (13.2 percent), and only a small amount of developed land (4.0 percent) (Southern Division, 1983).

Eglin Air Force Base, located approximately 10 miles southeast of NAS Whiting Field, occupies about 10 percent of the county's area (Southern Division, 1983). Residential areas nearby include Point Baker (approximately 1.5 miles southeast), the City of Milton (approximately 5 miles south), and Allentown (approximately 2 miles north). The Blackwater River State Forest, which occupies an area of approximately 60,000 acres, is located about 6 miles northeast of Whiting Field.

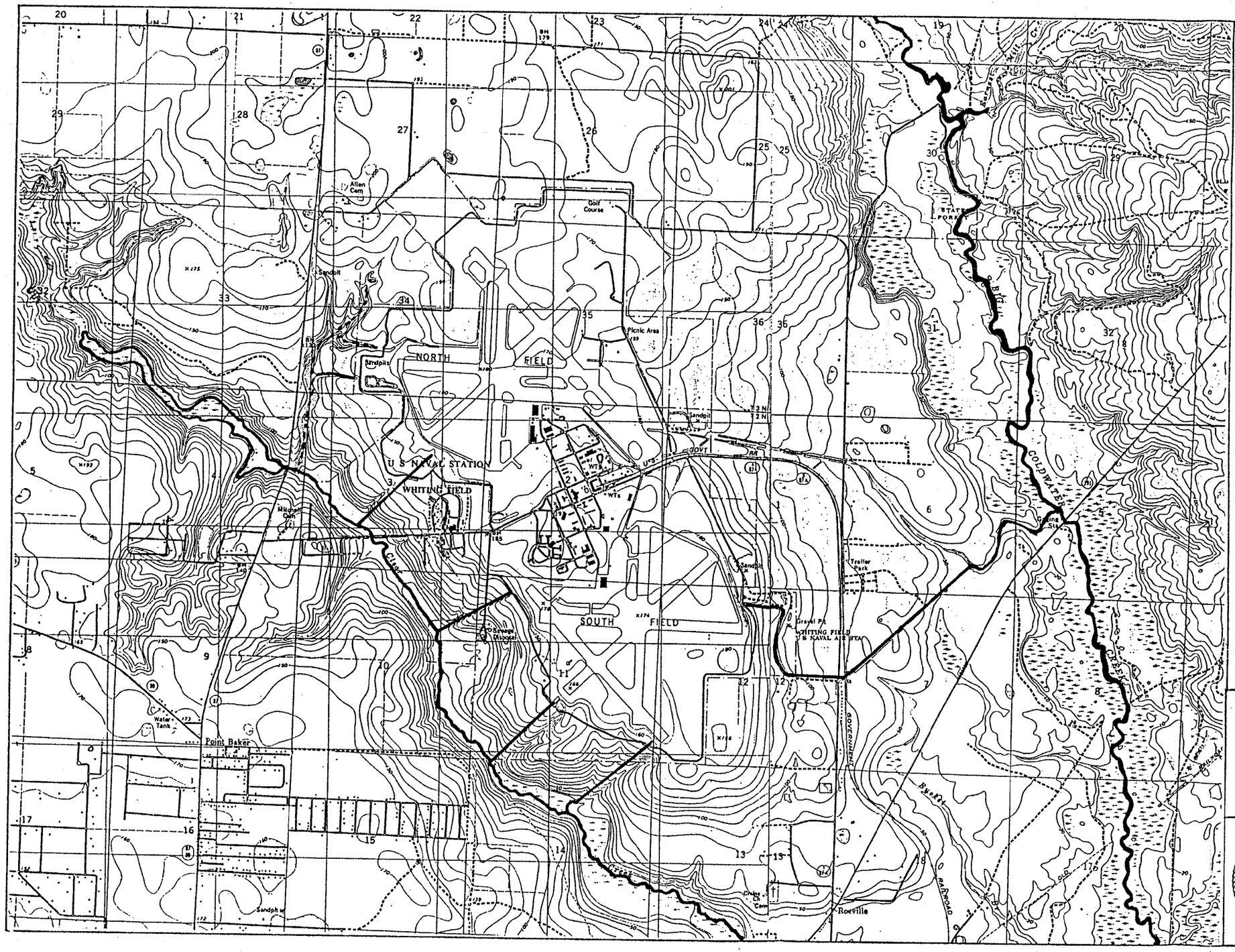
2.3.1 Topography, Surface Water, and Drainage Santa Rosa County lies within the Coastal Plain Province. The county is divided into two main physiographic divisions, the Western Highlands and the Gulf Coast Lowlands. Most of Santa Rosa County, including NAS Whiting Field, lies within the Western Highland which can be characterized as a well drained southward sloping plateau with numerous streams.

The Gulf Coast Lowlands is located in southern Santa Rosa County and is characterized as relatively undisected, nearly level plains. The area is low-lying with elevations ranging from sea level to 30 feet above sea level.

NAS Whiting Field is located on an upland area with elevations ranging from 150 to 190 feet above sea level. The facility is bounded by receiving waters, Clear Creek to the west and south, and Big Coldwater Creek to the east. These two creeks are tributaries to the Blackwater River located to the south. Clear Creek and Big Coldwater Creek are classified by the Florida Department of Environmental Regulation (FDER) as Class III Surface Waters and the Blackwater River is classified as an Outstanding Florida Water. Outstanding waters are considered to be of exceptional recreational and ecological significance.

Because of the relatively steep valley walls and the 100+/- foot drop in elevation between NAS Whiting Field and the receiving creeks, erosion became a serious problem when the land was disturbed for construction of the base. Soil conservation measures in the form of extensive contouring and construction of large paved ditches were instituted to control surface runoff from the upland area of the base. This system of ditches and storm sewers conveys surface water runoff to Clear Creek and Big Coldwater Creek. These and other surface water drainage features are shown in Figure 2-3.

2.3.2 Geology The region is located in the Coastal Plain Province which consists primarily of unconsolidated sands, silts, limestones, and clays of Cretaceous to recent age. The geologic sequences (Marsh, 1966) found in the



SOURCE:
USGS QUADRANGLE MILTON NORTH, FLORIDA
PHOTOREVISED 1987
AND USGS QUADRANGLE HAROLD, FLORIDA 1973.

FIGURE 2-3

DRAINAGE FEATURES

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

00181B022

NAS Whiting Field area are illustrated in Figure 2-4. A geologic cross-section through NAS Whiting Field is shown in Figure 2-5.

2.3.3 Soils The soils at NAS Whiting Field are sandy with a loamy subsoil and belong to the Troup-Dothan-Bonifay map unit. They are characterized as gently sloping to strongly sloping, well-drained soils. This map unit covers about 27 percent of Santa Rosa County and consists of 53 percent Troup soils, 15 percent Dothan soils, 12 percent Bonifay soils, and 20 percent soils of minor extent. A detailed soils map of NAS Whiting Field as well as an in-depth description of the various soil types identified in the soils map can be found in Section 4.5.4 of the IAS (Envirodyne Engineers, 1985).

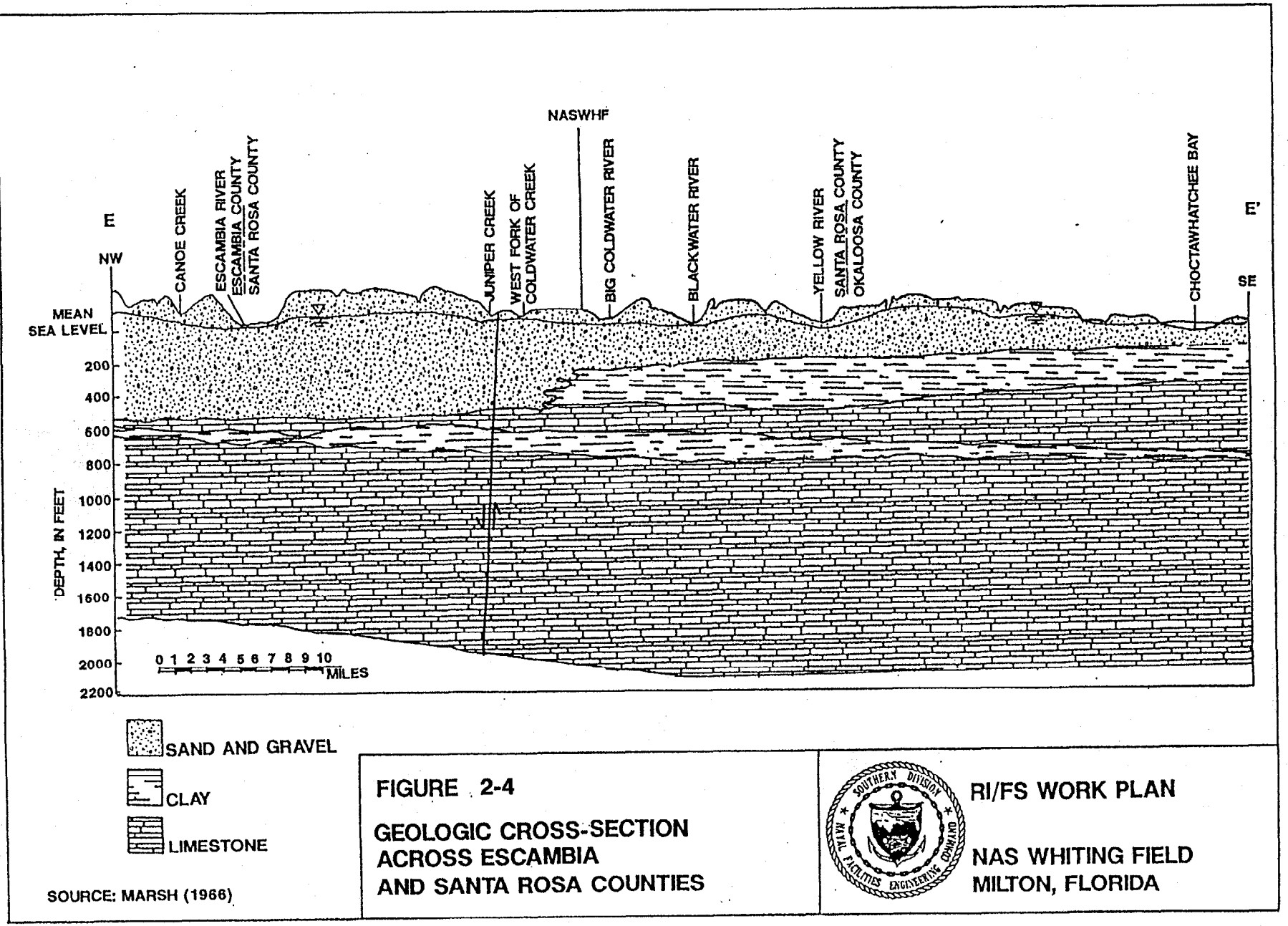
2.3.4 Hydrogeology There are three major groundwater aquifers within the region. The first is a shallow aquifer which is both artesian and non-artesian (sand and gravel aquifer) and the two others are deep artesian aquifers (upper Floridan limestone aquifer and lower Floridan limestone aquifer). Virtually all groundwater withdrawn in Escambia and Santa Rosa Counties comes from the surficial sand and gravel aquifer. Descriptions of the aquifers (Geraghty & Miller, 1985) are presented below.

- Sand and Gravel Aquifer. The uppermost sediments, extending to a depth of about 350 feet, comprise the sand and gravel aquifer, which is subdivided into two units. The water table or upper part of the sand and gravel aquifer does not constitute a source for large water supplies; however, its primary importance is to recharge the lower more productive zone of the aquifer. According to an aquifer test in the Milton area, the clayey sand confining unit separating the upper and lower aquifer zones is very leaky. Most large capacity wells in the area, such as the NAS Whiting Field supply wells, are screened into the lower part of the aquifer from about 180 to 330 feet below land surface (BLS).

  The sand and gravel aquifer includes the upper Miocene coarse clastics, the Citronelle Formation, and marine terrace deposits. These three units have similar hydraulic properties and sometimes are indistinguishable. The aquifer consists of poorly sorted, fine to coarse sands with gravel and lenses of clay, which may be as much as 60 feet thick. In some areas, the formation also contains wood fragments of all sizes, including whole tree trunks, occurring mostly in layers which may be as much as 25-feet thick (Marsh, 1966). However, boring logs of wells drilled on base do not indicate the presence of wood fragments.

  The formation contains lensatic zones within the sand that are cemented by iron-oxide minerals. The lenses, known locally as hardpans, have lower permeabilities and, along with the clay lenses, are responsible for the occurrence of perched water tables and semi-artesian conditions in the aquifer. In the NAS Whiting Field area, clay lenses occur in the uppermost 30 feet and in the depth interval of approximately 100 to 170 feet BLS (elevation 10 to 70 feet above mean sea level). Although the clays appear to be continuous, they may contain permeable zones or windows.

  The water from the sand and gravel aquifer is considered to be of excellent quality. Total dissolved solids and total hardness are generally less than



SOURCE: MARSH (1966)

FIGURE 2-4

GEOLOGIC CROSS-SECTION ACROSS ESCAMBIA AND SANTA ROSA COUNTIES

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

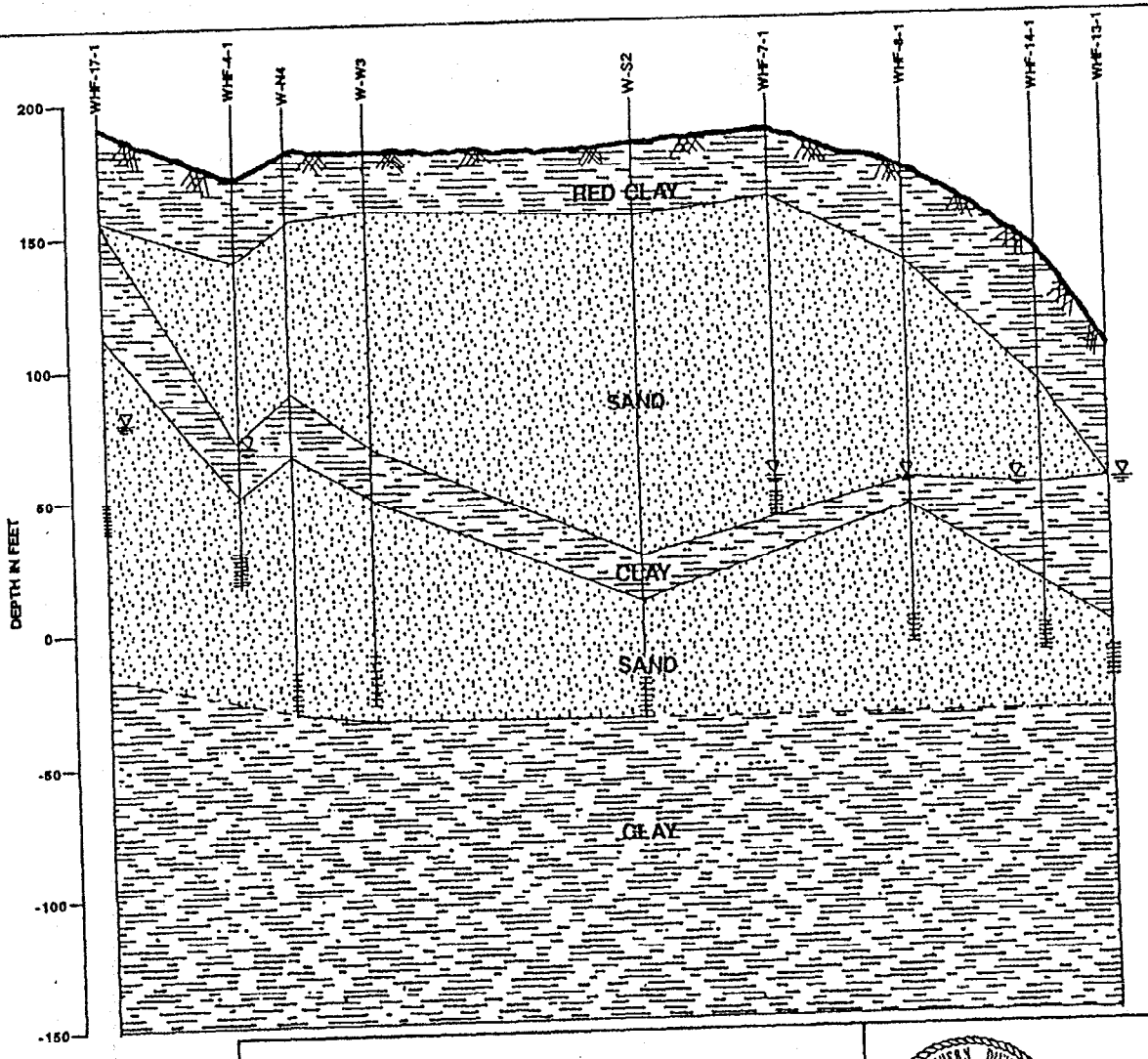


FIGURE 2-5

GEOLOGIC CROSS-SECTION
ACROSS NAS WHITING FIELD

SOURCE: GERAGHTY AND MILLER (1986)

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

50 milligrams per liter (mg/l). However, because of high levels of dissolved carbon dioxide, the water is acidic with an ambient pH as low as 5.0 and locally it may contain high concentrations of iron.

- Floridan Aquifer. Underlying the sediments of the sand and gravel aquifer is a thick (300+/- feet), relatively impermeable Pensacola Clay, below which are thick layers of limestone and shale to a depth of nearly 2,000 feet.

  The limestone layers constitute the regionally extensive Floridan aquifer which, in this area, is divided into an upper and lower part separated by the Bucatunna Clay. The upper Floridan aquifer is an important source of water in areas east of Santa Rosa County. However, toward the west, it is increasingly mineralized and is generally not used as a water supply. The lower Floridan aquifer is highly mineralized in the NAS Whiting Field area and is, in fact, designated for use as a waste disposal injection zone. The Floridan aquifer receives little or no recharge from the sand and gravel aquifer because of the Pensacola Clay confining unit. The potentiometric surface of the Floridan aquifer in the NAS Whiting Field area is about 50 to 55 feet above mean sea level and the direction of flow is southeast.

2.3.5 Water Supply Essentially all potable and industrial water supplies in the NAS Whiting Field vicinity are obtained from the sand and gravel aquifer, which extends from the surface to an approximate elevation of 150 feet below the National Geodetic Vertical Datum (NGVD) of 1929. Screened intervals for most production wells are at a depth of about 150 to 350 feet BLS, depending on surface elevation and the occurrence of clay lenses which lie at somewhat erratic depths. An inventory of wells within 1 mile of the waste disposal sites at NAS Whiting Field is presented in Table 2-12.

Potable water on base is currently supplied by three wells: the north (W-N4), south (W-S2), and west (W-W3) production wells; however, these are only the latest in a sequence of wells which have been replaced because of insufficient capacity or poor water quality. When the base was built in 1943, three production wells were drilled: the original north (W-N1), south (W-S1), and west (W-W1) wells. In 1951 these wells were abandoned and replaced by new wells (W-N2, W-S2, and W-W2) within 75 feet of the original wells. The new wells were probably constructed to deliver increased yields.

The west and north wells, however, contained objectionable levels of iron and were replaced by W-W3 in 1965 and W-N3 in 1975. The replacement north well, which was drilled as a test well, was also found to have an unacceptable iron concentration and was subsequently abandoned and replaced by the currently used north production well (W-N4). The locations of the active Navy wells are shown in Figure 2-6 (Appendix A). Current average pump capacities from the wells at NAS Whiting Field are: north well, 600 gallons per minute (gpm) and west well, 700 gpm. Flow from the two active supply wells is treated before entering the distribution system. Treatment consists of chlorination, pH adjustment, and addition of a sequestering agent to reduce iron precipitation. In addition, production well W-W3 has a granulated activated carbon (GAC) filter unit attached to reduce the trichloroethene concentration in the groundwater.

TABLE 2-12
INVENTORY OF WELLS WITHIN ONE MILE OF DISPOSAL SITES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WELL DESIGNATION	OWNER	DATE INSTALLED	CASING DIAMETER (inches)	SURFACE ELEVATION (ft msl)	BOTTOM OF WELL ELEVATION (ft msl)	SCREENED INTERVAL (ft msl)	GRAVEL PACK INTERVAL (ft msl)	STATUS
W-N1	Navy	1943						Abandoned 1951
W-N2	Navy	1951	16	168.1	(-256.4)	(-1.4)-(-31.4)	60-(-31)	Not in use
W-N3	Navy	1975		171.5	(-58.5)	36.5-(-23.5)		Abandoned 1975
W-N4	Navy	1975	6/12	180.0	(-38)			In use
W-W1	Navy	1943						Abandoned 1951
W-W2	Navy	1951		197.6	(-157.4)	14.1-(-47.0)		Abandoned 1965
W-W3	Navy	1965		180.0	(-35.0)	10.0-(-30.0)	80-(-30)	In use
W-S1	Navy	1943						Abandoned 1951
W-S2	Navy	1951		181.5	(-52.0)	12.0-(-33.0)	17-(-33)*	No use
P-3	Point Baker Water System	1978		200**	(-20)**			In use
P-4	Point Baker Water System	1983						In use
USGS	U.S. Geological Survey	1974	6	125.0	(-1165)	cased to (-860)		Monitor well

Source: Geraghty & Miller (1986)

NOTE: * - Assumed
** - Estimated
ft msl - feet mean sea level

At the request of FDER, supply well W-S2 was shut down on 28 August 1986, due to concentrations of benzene exceeding the Florida drinking-water standard of 1 ug/l (micrograms per liter) in the groundwater. Supply well W-W3 was also shut down on 25 September 1986 due to concentrations of trichloroethene greater than 3 ug/l in the water (Table 2-13).

NAS Whiting Field operated with service from only the north production throughout most of 1987. Tests began on 3 November 1987 of an activated carbon adsorption filtration system to treat water from the west well (W-W3) for trichloroethene removal. Upon completion of these operational tests on 1 December 1987, the west well was returned to service. The south production well, W-S2, is slated for an activated carbon filtration system in early 1990.

Water for the City of Milton is supplied by five wells, for East Milton by two wells, and for the Point Baker-Allentown area by three wells, all of which are screened in the sand and gravel aquifer and all of which are outside of the 1-mile radius of NAS Whiting Field. Two of the Point Baker wells (P-3 and P-4) are within 2 miles of NAS Whiting Field. Average pumpage from these two wells is about 500 gpm for P-3 and about 200 gpm for P-4. Water from the Point Baker system is available to residences east and north of NAS Whiting Field, and water from the Milton system is available to those east of NAS Whiting Field.

2.4 RESULTS OF PREVIOUS INVESTIGATIONS. Based on historical data, aerial photographs, field inspections, and personnel interviews, 16 disposal or spill contaminated sites were initially identified at NAS Whiting Field by the IAS team. These are sites where waste disposal or accidents have occurred in the past. The location of the 16 sites are shown in Figure 2-6 (Appendix A). Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors. Table 2-14 summarizes the information collected on these sites.

The May 1985 IAS concluded that 15 of the 16 sites warranted further investigation, under the Navy's IR Program, to assess potential long-term impacts. Only Site 2, the Northwest Open Disposal Area, was judged to not warrant further consideration. A Confirmation Study, including sampling and monitoring of the sites, was recommended to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems which may exist. The results of the Confirmation Study would then be used to evaluate the necessity of conducting mitigating actions or cleanup operations.

In November 1985, Geraghty & Miller, Inc. prepared for the Navy a plan of Action entitled Naval Assessment and Control of Installation Pollutants, Verification Study, NAS Whiting Field, which was subsequently submitted to the FDER. This plan contained details of the proposed scope of work for the Verification Study. During discussion with FDER in December 1985, two additional sites (17 and 18) were added to the Verification Study. Both sites are active sites where waste oils and fuels are burned in fire fighting training exercises (see Table 2-14).

In addition, during this same time period one of the sites (Site 5 - Battery Acid Seepage Pit) was being studied under Consent Order with the FDER. Data from this investigation has been compiled in a report entitled Detection and Monitoring Program, Battery Shop Site, NAS Whiting Field, Florida, (Geraghty & Miller, November 1985).

TABLE 2-13
ANALYSES OF SAMPLES FROM WATER SUPPLY WELLS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

DATE OF SAMPLE	CONTAMINANT	ANALYST
South Well (W-S2)		
1 November 1985	4 ug/l[1] Trichloroethylene[2]	Pioneer Lab
21 March 1986	4 ug/l Benzene	Pioneer Lab
21 April 1986	2 ug/l Benzene	Pioneer Lab
14 September 1986	29 ug/l Benzene	DHRS[3]
1 October 1986	14 ug/l Benzene	Pioneer Lab
1 October 1986	17 ug/l Benzene	Compu Chem
1 October 1986	6 ug/l Benzene[4]	Pioneer Lab
1 October 1986	7.4 ug/l Benzene[4]	Compu Chem
6 October 1986	11.9 ug/l Benzene	DHRS
6 October 1986	Trace Total Xylenes	DHRS
9 December 1986	4.96 ug/l Benzene	DHRS
5 January 1987	7.82 ug/l Benzene	DHRS
West Well (W-W3)		
14 September 1986	7.9 ug/l Trichloroethylene	DHRS
1 October 1986	10 ug/l Trichloroethylene	Pioneer Lab
1 October 1986	6 ug/l Trichloroethylene[4]	Pioneer Lab
1 October 1986	10.5 ug/l Trichloroethylene	DHRS
9 December 1986	Trace Trichloroethylene	DHRS
5 January 1987	Trace Trichloroethylene	DHRS
9 January 1987	Trace Trichloroethylene	DHRS
North Well (W-N4)		
14 September 1986	Trace Toluene	DHRS
1 October 1989	No organics detected	Pioneer Lab
6 October 1986	No organics detected	DHRS
9 December 1986	No organics detected	DHRS
5 January 1987	No organics detected	DHRS
Distribution System		
6 October 1986	Trace Total Xylenes	DHRS
9 December 1986	No organics detected	DHRS
5 January 1987	Trace chlorodibromomethane	DHRS

NOTE: [1] ug/l - micrograms per liter
[2] Trichloroethylene - Trichloroethene or TCE.
[3] DHRS - Florida Department of Health and Rehabilitation Services
[4] Samples taken after treatment by chlorination and stability control

TABLE 2-14
SUMMARY OF DISPOSAL SITE ACTIVITIES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NO.	SITE NAME	LOCATION	PERIOD OF OPERATION	TYPES OF MATERIAL DISPOSED	COMMENTS
1	Northwest Disposal Area	North Field, west side	1943-1965	Refuse, waste paints, thinners, solvents, waste oils, hydraulic fluids	Secondary disposal area during this period; site covers 5 acres
2	Northwest Open Disposal Area	North Field, west side	1976-1984	Construction and demolition debris, tires, furniture	Former borrow pit location, commonly referred to as the "Wood Dump"
3	Underground Waste Solvent Storage Area	North Field, south of Building 2941	1980-1984	Waste solvents, paint stripping residue	Wastes generated by paint stripping operations
4	North AVGAS Tank Sludge Disposal Area	North Field, north of Tow Lane	1943-1968	Tank bottom sludge containing tetraethyl lead	Sludge disposal in shallow holes near tanks
5	Battery Acid Seepage Pit	South Field, near Building 1478	1964-1984	Waste electrolyte solution containing heavy metal	Pits located 110 feet from potable supply well (W-S2)
6	South Transformer Oil Disposal Area	South Field Building 1478	1940's-1964	PCB-contaminated dielectric fluid	Disposal in "0-2" drainage ditch
7	South AVGAS Tank Sludge Disposal Area	South Field, west of Building 1406	1943-1968	Tank bottom sludge containing tetraethyl area	Sludge disposed in shallow holes near tanks
8	AVGAS Fuel Spill Area	South Field, south of Building 1406	Summer 1972	AVGAS containing tetraethyl lead	Fuel spill of about 25,000 gallons on an area of about 2 acres
9	Waste Fuel Disposal Pit	South Field, east side	1950's-1960's	Waste AVGAS containing tetraethyl lead	Fuel disposed in former borrow pit

TABLE 2-4 (Cont.)
SUMMARY OF DISPOSAL SITES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NO.	SITE NAME	LOCATION	PERIOD OF OPERATION	TYPES OF MATERIAL DISPOSED	COMMENTS
10	Southeast Open Disposal Area (A)	South Field, southeast area	1965-1973	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, PCBs, pesticides, herbicides	Secondary disposal area during this period; site covers about 4 acres
11	Southeast Open Disposal Area (B)	South Field southeast area	1943-1970	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, PCBs	Secondary disposal area during this period; site covers about 3 acres
12	Tetraethyl lead Disposal Area	South Field southeast area	May 1, 1968	Tank bottom sludge and fuel filters contaminated with tetraethyl lead	Disposal area posted with warning; site consists of two earth covered mounds, 25 ft. x 25 ft. area
13	Sanitary Landfill	South Field, southeast area	1979-1984	Refuse, waste solvent, paint, hydraulic fluids	Primary sanitary landfill, potentially received hazardous wastes the first year of operation
14	Short-Term Sanitary Landfill	South Field southeast area	1978-1979	Refuse, waste solvent, oils paint, hydraulic fluids	Primary sanitary landfill for brief period; relocated due to drainage problems
15	Southwest Landfill	South Field, southwest area	1965-1979	Refuse, waste paint, oils, solvents, thinners, asbestos, hydraulic fluid	Primary landfill for this time period; covers about 15 acres
16	Open Disposal and Burning Area	South Field, southwest area	1943-1965	Refuse, waste paint, oils, solvents, thinners, PCBs hydraulic fluid	Primary disposal area for this time period; covers about 10 acres
17	Crash Crew Training Area	North Field east side	1951-Present	JP-4	Waste Fuels and some solvents ignited, then extinguished
18	Crash Crew Training Area	North Field east side	1951-Present	JP-4	Waste Fuels and some solvents ignited, then extinguished

Work conducted during the course of the Verification Study began with the collection and assimilation of existing data and literature pertinent to the project and included the findings from the IAS. The field work was performed in May and June of 1986. Sixteen monitor wells were installed at locations around the facility. One surface water, 16 groundwater, and 46 soil samples were then collected for chemical analyses.

2.4.1 Summary Statement of Problem Historical records indicate that throughout the years of operation, NAS Whiting Field has generated a variety of wastes related to pilot training, the operation and maintenance of aircraft along with ground support equipment, and the station's facility maintenance activities. Prior to the establishment of hazardous waste management programs and programs to recycle waste oil, most of the hazardous wastes were disposed of onsite. Waste materials were disposed either in dumpsters that were emptied into onsite disposal areas or it went into waste oil bowsers, which probably were used for fire fighting training. Envirodyne Engineers (1985) estimated that thousands of gallons of wastes including waste paints, paint thinners, solvents, waste oils, waste gasoline, hydraulic fluids, AVGAS, tank bottom sludges, PCB transformer fluids, and paint stripping wastewater were potentially dumped into onsite disposal areas. These disposal areas usually consisted of nothing more than a natural or man-made depression located within the confines of the air station. In addition to the waste materials routinely disposed of onsite in the disposal areas, additional materials were released onsite as the result of accidents or equipment failure.

The Initial Assessment Study (Envirodyne Engineers, 1985) identified 16 past waste disposal or storage sites at NAS Whiting Field (See Table 2-14). Based on this study, 15 sites were recommended for further evaluation; Site 2 (Northwest Open Disposal Area) was judged to warrant no further consideration. In November 1986, Geraghty & Miller, Inc. prepared a Work Plan for a Verification Study for the Navy which was subsequently submitted to the FDER. After discussions with the FDER on 17 December 1985, changes to the Work Plan were made and two additional sites (17 and 18) were added. Both of these crash crew training areas are active sites where waste oils and fuels are burned during firefighting-training exercises. In 1986, a Verification Study was conducted at the 17 sites. Field work for this study included the installation of 16 monitor wells around the air station (associated with study sites). One surface water, 16 groundwater and 46 soil samples were collected for chemical analysis. The results of the Verification Study provided an incomplete assessment of the physical as well as the chemical conditions currently existing at NAS Whiting Field. Groundwater contamination was detected at some sites and not at others. The study concluded that many of the monitoring wells were not located downgradient of the intended study site and that additional work was needed to characterize the hydrogeologic conditions and the chemical contamination conditions that exist at NAS Whiting Field.

Of the 18 sites identified to date, 13 are scheduled for further study under the Navy's IR program. Due to the fact that it only received construction and demolition debris, Site 2, the Northwest Open Disposal Area, was judged to warrant no further consideration early in the IR Program. Site 5, the Battery Acid Seepage Pit, was extensively studied in 1985 (Geraghty & Miller, 1985) in response to a FDER entered Consent Order (84-0253). Results indicated no significant contamination resulting from past activities at the Battery Acid Shop and the Consent Order was recommended to be rescinded on 15 April 1987. However,

the presence of benzene in the existing monitoring wells surrounding the seepage pit does warrant further consideration. As such the investigation of benzene contamination around Site 5 will be coupled with the field and laboratory investigation proposed for production well W-S2. Sites 4, 7, and 8 are slated for investigation and remediation, if necessary, under the Navy's Underground Storage Tank (UST) Program and, therefore, are not incorporated in the Navy's IR Program. Table 2-15 presents a summary of past and anticipated investigative programs for the 18 sites.

3.0 INITIAL EVALUATION

The objectives of the NAS Whiting Field RI are to locate source areas; assess the volumes and distribution of contaminates found in the soil, sediment, surface water, and groundwater; characterize regional and local hydrogeology; evaluate environmental and public health risks presented by the site; and collect sufficient site-specific data to conduct an FS of remedial alternatives. The objective of the FS is to identify a permanent, technically feasible, and cost-effective remedial action that is protective of public health and the environment.

3.1 PRELIMINARY RISK ASSESSMENT. NAS Whiting Field has been in operation since 1943 as a facility for flight and academic training of pilots. The facility has generated a variety of wastes related to the operation and maintenance of aircraft and ground support equipment, and other facility maintenance activities. During an Initial Assessment Study (Envirodyne Engineers, 1985) and a subsequent Verification Study (Geraghty & Miller, 1986), 18 past waste disposal sites at the base were identified. The types of wastes disposed at each of the 18 locations are shown in Table 3-1.

This preliminary risk assessment is a qualitative evaluation of risks for human and ecological receptors posed by contamination at 17 of the identified disposal sites at NAS Whiting Field. The assessment is based on information derived from the 1985 and 1986 studies and one additional report: Detection and Monitoring Program, Battery Shop Site (Geraghty & Miller, 1985). The information available in these reports is limited and does not provide sufficient data for a full quantitative risk assessment. Therefore, part of the purpose of the preliminary risk assessment will be to identify additional information required to fully assess risks.

The assessment consists of a preliminary selection of contaminants of concern, identification of potential receptors (human and ecological), and identification of potential exposure pathways. The final risk analysis portion of the assessment is limited to a qualitative evaluation of the risks associated with exposure to contaminated groundwater, for human receptors, and to soils, for ecological receptors. Although there is potential for exposure to contaminants in surface water and sediments, no data are available to examine these pathways.

TABLE 2-15
SUMMARY OF SITE INVESTIGATIONS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	SITE NAME	IAS	VERIFICATION STUDY	CONSENT ORDER	RI/FS	NAVY'S UST PROGRAM
1	Northwest Disposal Area	*	*		*	
2	Northwest Open Disposal Are	*				
3	Underground Waste Solvent Storage Area	*	*		*	
4	North AVGAS Tank Sludge Disposal Area	*	*			*
5	Battery Acid Seepage Pit	*		*		
6	South Transformer Oil Disposal Area	*	*		*	
7	South AVGAS Tank Sludge Disposal Area	*	*			*
8	AVGAS Fuel Spill Area	*	*			*
9	Waste Fuel Disposal Pit	*	*		*	
10	Southeast Open Disposal Area (A)	*	*		*	
11	Southeast Open Disposal Area (B)	*	*		*	
12	Tetraethyl Lead Disposal Area	*	*		*	
13	Sanitary Landfill	*	*		*	
14	Short-Term Sanitary Landfill	*	*		*	
15	Southwest Landfill	*	*		*	
16	Open Disposal and Burning Area	*	*		*	
17	Crash Crew Training Area		*		*	
18	Crash Crew Training Area		*		*	

NOTES: IAS - Initial Assessment Study
RI/FS - Remedial Investigation/Feasibility Study
UST - Underground Storage Tank

TABLE 3-1
SUMMARY OF AVAILABLE DATA ON CONTAMINATION
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	SITE NAME	MATERIALS DISPOSED	SOIL CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (mg/kg)	GROUNDWATER CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (ug/l)
1	Northwest Disposal Area	Refuse waste paints, paint paint thinner, solvents waste oils, hydraulic fluids	NT			Lead	1/1	1
2	Northwest Open Disposal Area	Construction and demolition debris	NT			NT		
3	Underground Waste Solvent Storage Area	Waste solvents, paint stripping residue, 120 gal. spill	Cadmium	1/2	0.28	1,1,1-TCA	1/2	13
			Chromium	2/2	43	1,1,2-TCA	1/2	111
			Mercury	2/2	0.20	TCE	1/2	18
			Silver	2/2	1.85	Lead	2/2	12
			Zinc	2/2	586	Arsenic	1/2	1
			Phenols	1/2	0.61			
4	N. AVGAS Tank Sludge Disposal Area	Tank bottom sludge with tetraethyl lead	Lead	2/2	27	Benzene	1/1	17
						Toluene	1/1	10
						Lead	1/1	5
5	Battery Acid Seepage Pit	Waste electrolyte solution with heavy metals, waste battery acid	Arsenic	21/26	1.4	Benzene	6/8	26
			Cadmium	12/26	0.55	Aldrin	1/8	0.13
			Lead	19/26	24	g-BHC	1/8	0.02
			Mercury	24/26	0.212	Heptachlor	2/8	0.04
						Antimony	4/8	170
						Cadmium	2/8	3
						Chromium	4/8	20
						Copper	4/8	33
						Lead	4/8	37
						Zinc	7/8	360

Footnotes at end of table

TABLE 3-1 (Cont.)
SUMMARY OF AVAILABLE DATA FOR CONTAMINATION
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	SITE NAME	MATERIALS DISPOSED	SOIL CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (mg/kg)	GROUNDWATER CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (ug/l)
6	S. Transformer Oil Disposal Area	PCB contaminated dielectric fluid.	PCB	0/10	ND	NT		
7	S. AVGAS Tank Sludge Disposal Area	AVGAS with tetraethyl lead.	Lead	2/2	575	Toluene	1/1	43,000
						Benzene	1/1	8,800
						EDB	1/1	23.56
						Lead	1/1	862
						Xylene	1/1	1,000
8	AVGAS Spill Area	AVGAS with tetraethyl lead.	Lead	12/12	27	Benzene	1/1	2
						Toluene	1/1	26
						Lead	1/1	7
9	Waste Fuel Disposal Area	AVGAS with tetraethyl lead.	Lead	12/12	14	Lead	1/1	7
10	Southeast Open Disposal Area (A)	Waste solvents, paints, oil, hydraulic fluids, PCBs, pesticides, herbicides.	NT	--	--	Lead	1/1	6
						Silver	1/1	0.8
11	South Open Disposal Area (B)	Waste solvents, paints, oils, hydraulic fluids, PCBs.	NT	--	--	BEHP	1/1	23
						Lead	1/1	1.5
						Zinc	1/1	50

Footnotes at end of table

TABLE 3-1 (Cont.)
SUMMARY OF AVAILABLE DATA FOR CONTAMINATION
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	SITE NAME	MATERIALS DISPOSED	SOIL CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (mg/kg)	GROUNDWATER CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONC. (ug/l)
12	Tetraethyl Lead Disposal Area	Tank bottom sludge with tetraethyl lead.	Lead	3/3	11	Lead	1/1	2
13	Sanitary Landfill	Refuse, waste solvents, paint, asbestos.	NT			Lead Nickel Zinc	1/1 1/1 1/1	6 60 240
14	Short Term Sanitary Landfill	Refuse, waste solvents, paint, oils, hydraulic fluid.	NT					
15	Southwest Landfill	Refuse, waste solvents, paint, oils, hydraulic fluids.	NT			BEHP Lead Zinc	1/1 1/1 1/1	36 3 30
16	Open Disposal and Burn Area	Refuse, waste paint, oils, solvents, thinners, PCBs hydraulic fluids.						
17, 18	Crash Crew Training Area	JP-4 Fuel	NT					

NOTE: 1 (1/2) - number of samples with detectable levels of contaminant per total number of samples analyzed.

TCA - Trichloroethane
TCE - Trichloroethene
BEHP - Bis(2-ethylhexyl)phthalate
conc - concentration
mg/kg - milligrams per kilogram
NT - Not Tested
ND - Not Detected
EDB - Ethylene Dibromide
ug/l - micrograms per liter
PCB - polychlorinated biphenyls

3.1.1 Preliminary Public Health Assessment

3.1.1.1 Background In a public health risk assessment, site data are interpreted to determine whether chemical contamination originating from a site poses a risk to human health. In order to estimate the probability of potential adverse health effects on individuals exposed to chemicals from a site, a number of steps are essential. These are: (1) selection of contaminants of concern, (2) the exposure assessment, (3) the toxicity assessment, and (4) the risk characterization. These steps are appropriate when the extent of contamination at the site has been fully characterized. At NAS Whiting Field the data are not adequate to complete these steps.

For this preliminary assessment, the available data are only from soil and groundwater samples. No surface water or sediment data are available, although these media may be relevant for human exposure.

The soils data are available for only half the sites of interest at NAS Whiting Field. These are summarized in Table 3-1. The maximum concentration levels of chromium, mercury, zinc, and arsenic detected at these sites are within the range of background levels as determined in the surficial soils collected from 1,318 undisturbed sites in the continental United States (U.S. Geological Survey, 1984). At Site 7, total lead in the top 2 feet of soil was measured at 575 mg/kg. This concentration is above the U.S. Geological Survey (USGS) study's range of background levels in soil. Additional samples are required to determine the extent of lead contamination at this site. There is no information in the USGS study on cadmium and silver, but these two elements were measured at concentrations which are not expected to be of concern. More soils data are needed before a detailed site-specific assessment can be made.

Groundwater data at NAS Whiting Field is available for both the monitoring wells and the production wells in the sand and gravel aquifer, the shallowest of the three aquifers identified in the area. These data are summarized in Table 3-1 and Table 3-2. As part of the 1986 Verification Study, monitoring wells were installed at 16 of the 17 sites. NAS Whiting Field's potable water is supplied exclusively from the three onsite production wells: the north well (W-N4), the west well (W-W3), and the south well (W-S2) (currently not in service).

The following discussion considers only the groundwater data because, at this time, the only known point of human exposure are the production wells which provide the sole potable water supply for NAS Whiting Field. This preliminary assessment compares the concentration levels of the chemicals found in the groundwater to the available ARARs. Other potential exposure pathways are defined, but must be reexamined when data from the soils, surface water, and sediments are available.

3.1.1.2 Contaminants of Concern The selection of contaminants of concern is a screening process that is performed to narrow the group of detected chemicals at the sites to those that have the greatest potential to cause harm to public health or which are representative of site conditions. In cases where adequate data are available, contaminants of concern are selected by considering the distribution and frequency of detection, factors related to their mobility and persistence, and their relative toxicity.

TABLE 3-2
SUMMARY OF AVAILABLE INFORMATION ON CONTAMINATED
POTABLE WATER SUPPLIES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WELL	CHEMICAL	FREQUENCY OF DETECTION[1]	MAXIMUM CONCENTRATION MEASURED (ug/l)	MEAN CONCENTRATION MEASURED (ug/l)
W-N4 North Well	Xylenes	1/5	1.80	--
W-S2 South Well	Benzene	10/11	29.6	10.5
	Trichloroethene	1/11	4.0	--
	Mercury	1/11	3	--
	Zinc	1/11	20	--
W-W3 West Well	Trichloroethene	38/39	27	15.3

NOTE: This table represents a summarization of data by Geraghty & Miller (1986) and information provided by Public Works Department, NAS Whiting Field on the West Well (November 1987 to December 1988).

[1] (1/5) - Number of samples with detectable levels of contaminant per total number of samples.
ug/l - micrograms per liter

For the purposes of this assessment, contaminants of concern could not be chosen in this manner due to a lack of information. Therefore, all contaminants detected in soils and groundwater from the sites (see Table 3-1) were considered to be preliminary contaminants of concern to be evaluated in the remedial investigation risk assessment. The actual contaminants of concern to be evaluated in the remedial investigation's risk assessment will be chosen as described before upon review of analytical information from the Remedial Investigation.

Chemicals of special concern for risks to public health are those detected in potable water supply wells on the base (see Table 3-2). Of these chemicals, trichloroethene and benzene are consistently found in samples from the west and south supply wells, respectively. These two chemicals are considered to be contaminants of concern due to their frequency of detection in samples from these wells and their presence in a potable water supply.

3.1.1.3 **Potential Receptors** In a public health risk assessment, human populations which may be exposed to site-related contaminants are identified and characterized. These populations are identified by considering land-use, demography, and the unique hydrogeology of the area. Land use around NAS Whiting Field is described in the IAS as agricultural to the northwest, residential and forested to the south and southwest, and forested in the other areas. The residential areas proximate to NAS Whiting Field include Point Baker, about 1.5 miles to the southeast; the City of Milton, about 5 miles to the southwest; East Milton, about 5 miles to the south; and Allentown, about 2 miles to the north.

The population with direct access to NAS Whiting Field is limited to the individuals who live and work there. The onsite Navy housing located on the west side of the air station provides housing for the personnel who work at NAS Whiting Field. Thus, the population within the NAS Whiting Field boundary is expected to be composed of both adults and children. The air station is entirely surrounded by a physical barrier and thus it is assumed that children have very limited access to the sites. The one exception is the area near Site 15 (the Southwest Landfill, the primary landfill for the period from 1965 to 1979) and Site 16 (Open Disposal and Burn Area, the main disposal area from 1943 to 1965) where the Boy Scouts were given permission in the past to engage in activities at regularly scheduled times.

The NAS Whiting Field sites are located in an area that is bounded to the west and south by Clear Creek and to the east by Big Coldwater Creek. There are concrete drainage ditches which radiate out from the air station to discharge to these two creeks. Both of these streams are classified by Florida as recreational waters and, therefore, are potential areas for human receptors. These creeks provide a natural boundary between the sites and off-site municipal wells because groundwater flow is generally to the southeast and southwest from a higher plateau region at NAS Whiting Field to the lower lying creeks. At this time these off-site municipal wells are not expected to be impacted by site contaminants, thereby representing no threat of exposure to human receptors. However, there is a potential for the existence of residential wells located between the facility and Big Coldwater Creek.

Based on the demography of the area and the hydrogeology, potential human receptors have been identified and include:

- population on the air station property drinking from the production wells;
- workers engaged in construction activities at any of the sites;
- children playing in the creeks surrounding the air station;
- persons fishing in the creeks;
- Boy Scouts using the area near Sites 15 and 16 and Clear Creek; and
- private residential well users.

3.1.1.4 **Exposure Pathways** Four components are necessary to define a complete exposure pathway: (1) a source of chemical release to the environment; (2) an environmental transport medium and transport mechanism; (3) an exposed population; and (4) a route of exposure for the receptor at the exposure point. In Table 3-3, the specific pathways of exposure are presented for each environmental medium. The specific sites on NAS where there is potential for worker exposure due to soil contamination can not be determined until more data are available.

3.1.1.5 **Comparison with ARARs** In this section, the groundwater quality data are compared to the current Maximum Contaminant Levels (MCLs) as a means of identifying compounds which may pose a public health risk. A summary of the frequency of detection and the maximum measured concentration for groundwater is reported in Table 3-4 and for the production wells in Table 3-5.

Table 3-4 compares the contaminant levels in the groundwater samples obtained from the monitoring wells to the Florida drinking water standards. The maximum detected value is reported with a designation of which site was sampled. If there are any other maximum values from other sites which also exceed the MCL, then these are also listed in the table. Twenty-three different contaminants were detected in the monitoring well samples. Only eleven of these have MCLs. Four of these detected chemicals are found to exceed relevant MCLs. These are lead, trichloroethene, benzene, and ethylene dibromide.

Lead was measured at Site 7 at a concentration of 862 ug/l, which is greater than the MCL equal to 50 ug/l. Trichloroethene was found at a maximum concentration of 18 ug/l at Site 3 which is greater than the MCL of 3 ug/l. Benzene is found to exceed the MCL of 1 ug/l at Sites 4, 5, 7, and 8 with maximum reported concentration values at these sites of 17, 26, 8,800, and 2 ug/l respectively. Finally, ethylene dibromide was found at a maximum concentration of 23.6 ug/l at Site 7, which exceeds the MCL of 0.02 ug/l. The remaining chemicals detected in the groundwater were measured at concentration below their respective MCL. The contaminants include 1,1,1-trichloroethane, arsenic, lindane, cadmium, chromium, silver, and mercury.

In Table 3-5, the contaminant levels in the production wells are compared with the Florida MCLs. Of the five detected chemicals, three have MCLs. All three of these contaminants, benzene, trichloroethene, and mercury, exceed the standard in at least one of the production wells. In the south well, the benzene samples showed the maximum concentration to be 29.6 ug/l, exceeding the MCL. Trichloroethene samples were found to exceed the MCL in both the south and west

TABLE 3-3
POTENTIAL EXPOSURE PATHWAYS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ENVIRONMENTAL MEDIUM	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	STATUS
Groundwater	Onsite, three production wells	Ingestion (adults)	NAS Population	Current
Surface Water	Off-site Clear Creek	Dermal absorption & incidental ingestion	Children	Unknown
	Off-site Clear Creek & Big Coldwater Creek	Dermal absorption	Adults (Fishing)	Unknown
Sediment	Off-site Clear Creek	Dermal absorption Incidental Ingestion	Adults	Unknown
	Off-site Clear Creek & Big Coldwater Creek	Dermal absorption	Children	Unknown
Soils	Onsite	Dermal absorption & inhalation	Workers	Unknown
	Onsite Near Site 15 and Site 16	Dermal absorption	Boy Scouts	Unknown
Freshwater Fish	Off-site Clear Creek & Big Coldwater Creek	Ingestion	Adults and children	Unknown

TABLE 3-4
COMPARISON OF CONTAMINANT LEVELS IN
GROUNDWATER MONITORING WELLS WITH MCLs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

CONTAMINANT	MAXIMUM VALUE (ug/l) (SITE NUMBER)	FLORIDA MCL (ug/l)
Lead	37 (5), 862 (7)	50
1,1,1-Trichloroethane	13 (3)	200
Trichloroethene	18 (3)	3
Arsenic	1 (3)	50
Benzene	17 (4), 26 (5), 8,00 (7), 2 (8)	1
Lindane (BHC)	0.02 (5)	4
Cadmium	3 (5)	10
Chromium	20 (5)	50
Ethylene Dibromide	23.6 (7)	0.02
Silver	0.8 (10)	50
Mercury	0.6 (18)	2

NOTE: ug/l - microgram per liter
MCL - maximum contaminant level

TABLE 3-5
COMPARISON OF CONTAMINANT LEVELS IN
PRODUCTION WELLS WITH MCLs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

CONTAMINANT	FLORIDA MCL (ug/l)	MAXIMUM CONCENTRATION (ug/l) W-N4	W-S2	W-W3
Benzene	1	BDL	29.6	BDL
Trichloroethene	3	BDL	4.0	27.0
Mercury	2	BDL	3.0	BDL

NOTE: BDL - below detection limit
MCL - maximum contaminant level
ug/l - micrograms per liter

production well. Only the south production well was found to contain mercury at a maximum concentration of 3 ug/l, which exceeds the MCL of 2 ug/l.

3.1.1.6 **Summary** In conclusion, the limited groundwater data suggest that contamination in the production wells could pose a public health risk. More data are needed to determine the extent and magnitude of contamination to the other environmental media at the sites so that associated public health risks can be assessed in the baseline risk assessment.

3.1.2 Preliminary Ecological Risk Assessment

3.1.2.1 **Contaminants of Concern** Due to the limited availability of information on contamination in soils and the lack of information on contamination in surface water and sediments (for site drainage ditches, Big Coldwater Creek, and Clear Creek), the selection of preliminary contaminants of concern for ecological receptors is not possible. For the preliminary assessment all chemicals detected in soils and groundwater (see Table 3-1) during the Verification Study (Geraghty & Miller, 1986) were considered in the assessment and were considered to be preliminary contaminants of concern. Contaminants of concern for ecological receptors will be determined after review of analytical information from the Remedial Investigation.

3.1.2.2 **Potential Receptors** Aquatic habitats previously identified at NAS Whiting Field include Clear Creek to the south and west and Big Coldwater Creek to the east (see Figure 2-3). These streams receive surface runoff from NAS Whiting Field via concrete-lined drainage ditches. Groundwater seepage from NAS Whiting Field is also expected to discharge to these streams. Both Clear Creek and Big Coldwater Creek drain into the Blackwater River. The streams and the river are classified by the State of Florida as Class III waters protected for recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Blackwater River is also designated as an Outstanding Florida Water.

Terrestrial habitats associated with NAS were briefly described in the Initial Assessment Study (Envirodyne Engineers, 1985). These include swamp forests bordering Clear Creek to the west and southwest of the airfield and swamp forest bordering Big Coldwater Creek to the east and southeast. Other habitats at NAS Whiting Field include paved surfaces (runways and roads) surrounded by open grassy fields, pine plantations, and open shrub and scrub areas on the landfills.

Organisms (mammals, birds, reptiles, amphibians and fish) expected to be associated with the aquatic and terrestrial ecosystems at or near NAS Whiting Field were described in the Initial Assessment Study (Envirodyne Engineers, 1985). Of the organisms identified, 40 species were considered to be endangered, threatened or rare by the U.S. Fish and Wildlife Service, the Florida Game and Fresh Water Fish Commission, and the Florida Committee on Rare and Endangered Plants and Animals. These organisms, in addition to aquatic invertebrates in the "Y" ditch, Big Coldwater Creek, Clear Creek, and the Blackwater River, compose the preliminary list of ecological receptors which may be potentially exposed to site contamination.

3.1.2.3 **Exposure Pathways** Potential routes of exposure to contamination for the receptors at each of the 17 identified sites were evaluated by examining:

- potential migration pathways for contamination from source to receptor,
- extent of contamination in soils and groundwater (see Table 3-1),
- the potential for contamination of surface water and sediments, and
- the proximity of suitable habitat for receptors.

The exposure evaluation is summarized in Table 3-6. Aquatic receptors may be exposed to contamination in surface water or sediments via direct contact or ingestion. Aquatic receptors on-base are limited to fish and invertebrates inhabiting the unlined "Y" drainage ditch and other unlined drainage ditches. Potential off-base aquatic receptors include those inhabiting Big Coldwater Creek and Clear Creek. Information is not available to determine if contamination is migrating to the sediments and surface waters of these streams; therefore, potential exposures are not predictable. Contamination may also be migrating to the Blackwater River via surface transport from the streams or groundwater recharge from the base sites.

Terrestrial receptors (birds, mammals, reptiles, and amphibians) are potentially exposed to contamination in soils by direct contact or ingestion. At most sites the presence of soil contamination has not been characterized; however, lead contamination of soils is apparent at Site 7. Exposures can not be adequately characterized by the existing information but they are expected to be limited at Sites 4, 5, 6, 7, and 8 where the surrounding vegetation provides potential habitat for only a few species.

Mammals, reptiles, and amphibians are potentially exposed to contamination in surface water by direct contact or ingestion. Exposures are possible for these receptors at NAS Whiting Field as surface drainage tends to pond on some of the landfills and some animals may drink from the surface drainage ditches. Analytical information for surface water is required to further assess the significance of these exposures.

Terrestrial fauna may also be exposed through food sources if chemicals are being accumulated from sediments or surface water by fish or aquatic invertebrates or from soils by terrestrial invertebrates or plants. Information is not available on surface water or sediments to evaluate this exposure pathway. Preliminary data on soils (see Table 3-1) indicate that this may be an important exposure pathway for lead. Lead at high concentrations in soils can be accumulated by soil invertebrates or plants.

3.1.2.4 Assessment of Risks With the information available, a discussion of risk is necessarily limited to a cursory qualitative evaluation of exposures to soil contamination. Lead is the contaminant detected most often in soils at the NAS Whiting Field sites with the highest concentration measured at 575 mg/kg at Site 7. This chemical is potentially toxic and can be accumulated by soil invertebrates. More specific information on receptors and their feeding habits as well as information on typical background exposure levels for metals in soils

TABLE 3-6
POTENTIAL ROUTES OF EXPOSURE FOR ECOLOGICAL RECEPTORS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

MEDIUM OF EXPOSURE	ROUTE OF EXPOSURE	POPULATION EXPOSED	SITES WHERE EXPOSURES ARE EXPECTED	COMMENTS
Soil	Dermal contact with contaminated soil or organic matter.	Burrowing mammals, reptiles, amphibians, and dust-bathing birds.	All sites except Site 3	Exposures will be limited at Sites 5 and 6 where surrounding grassed areas provide habitat for only a few species.
Soil	Ingestion of contaminated soil/organic matter.	Earthworms and insects.	All sites except Site 3	Same as above.
Food	Consumption of animals that have contact with contaminated soil/organic matter.	Mammals and birds	Sites with high concentrations of lead or other such persistent chemicals.	
Surface Water	Dermal contact with contaminated water.	Fish, reptiles, amphibians, and aquatic invertebrates.	Big Coldwater Creek	Potential surface drainage from sites 9, 10, 11, 12, and 14.
	Dermal contact with contaminated water.	Fish, reptiles, amphibians, and aquatic invertebrates.	Clear Creek	Potential surface drainage from sites 1, 15, 16, 17, and 18.

TABLE 3-6 (Cont.)
POTENTIAL ROUTES OF EXPOSURE FOR ECOLOGICAL RECEPTORS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

MEDIUM OF EXPOSURE	ROUTE OF EXPOSURE	POPULATION EXPOSED	SITES WHERE EXPOSURES ARE EXPECTED	COMMENTS
	Dermal contact with contaminated water.	Fish, reptiles, amphibians, and aquatic invertebrates.	"Y" Drainage Ditch	Runoff from Sites 12 and 14.
	Dermal contact with contaminated water.	Reptiles and amphibians.	"E" Ditch	Runoff from Site 1.
Surface Water	Ingestion of contaminated water.	Mammals	All drainages previously listed and ponded areas	Runoff and groundwater infiltration from all sites.
Sediments	Dermal contact with or ingestion of contaminated sediment or organic matter.	Aquatic invertebrates, fish, reptiles, and amphibians.	Big Coldwater Creek	Potential surface from Sites 9, 10, 11, 12, and 14.
	Dermal contact with or ingestion of contaminated sediments or organic matter.	Aquatic invertebrates, fish, reptiles, and amphibians.	Clear Creek	Potential surface drainage from Sites 1, 15, 16 and groundwater discharge from Sites 15, 16, 17 and 18.

TABLE 3-6 (Cont.)
POTENTIAL ROUTES OF EXPOSURE FOR ECOLOGICAL RECEPTORS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

MEDIUM OF EXPOSURE	ROUTE OF EXPOSURE	POPULATION EXPOSED	SITES WHERE EXPOSURES ARE EXPECTED	COMMENTS
	Dermal contact with or ingestion of contaminated sediments or organic matter.	Aquatic invertebrates, fish, reptiles, and amphibians.	"Y" Ditch	Runoff from Sites 12 and 14.
Sediments	Ingestions of sediment-dwelling aquatic invertebrates.	Fish	Exposures possible for fish in areas where persistent sediment contamination is present	No sediment data is currently available to evaluate this exposure route.
Food	Ingestion of fish contaminated as above.	Predatory fish, birds, and mammals.	Exposures possible in areas where persistent chemicals are found in sediments or surface water.	Sediment/surface water data is not adequate to evaluate this exposure route.

are required to estimate the potential doses of lead and other chemicals (e.g., amount of soil ingested and absorption) and subsequent risk for ecological receptors.

It is not possible to evaluate risks for aquatic receptors (amphibians, reptiles, fish, and aquatic invertebrates) in Clear Creek, Big Coldwater Creek, and the Blackwater River resulting from contamination that may be transported from the NAS Whiting Field sites by surface transport or groundwater due to the lack of available data. Analytical information on sediments and surface water from these streams and the river is necessary to determine risks.

3.2 INITIAL IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS. Applicable Federal and State public health and environmental regulatory requirements must be identified and complied with when developing and implementing CERCLA remedial actions. Section 121 of CERCLA, as amended by SARA, requires that CERCLA-mandated hazardous waste remedial actions comply with not only applicable requirements, but also relevant and appropriate requirements. While not legally applicable, these relevant and appropriate requirements address situations sufficiently similar to those encountered at a site so that their use is well-suited to the particular site. ARARs include Federal requirements and those State requirements that are more stringent, legally enforceable, and consistently enforced statewide. The USEPA has developed procedures for Superfund compliance with ARARs.

ARARs are defined by the USEPA as follows.

- Applicable Requirements: Cleanup standards, standards of control, or other substantive environmental requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance at a CERCLA site. An example of an applicable requirement is the use of MCLs, promulgated under the Safe Drinking Water Act (SDWA), for a site where groundwater contamination is entering a public water supply.

- Relevant and Appropriate Requirements: Federal- and State-promulgated cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations that, while not legally applicable, can be applied if, in the decision-maker's best professional judgment, site circumstances are similar to jurisdictionally covered situations, and use of the requirement makes good sense. The term "relevant" is included so that requirements initially screened out as non-applicable because of jurisdictional restrictions can be reconsidered. For example, MCLs would be relevant and appropriate requirements for use at a site where groundwater contamination could affect a potential, as opposed to an actual, drinking water source. Under CERCLA, relevant and appropriate requirements should be given the same weight for consideration as applicable requirements.

- To Be Considered Materials (TBCs): Federal and State non-promulgated advisories or guidance documents that do not have ARAR status. If there are no specific ARARs for a chemical or situation, or if existing ARARs are not deemed sufficiently protective, then guidance or advisory criteria

should be identified and used to better ensure public health and environmental protection.

ARARs may be characterized as chemical-, location-, or action-specific. Chemical-specific requirements are used to determine the remedial action objectives because they set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, and contaminants. They govern the extent of site remediation by providing either actual clean-up levels or a basis for calculating such levels.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Site features governed by location-specific ARARs may include natural features such as wetlands, floodplains, and sensitive ecosystems. In addition, places of historical or archeological significance may also be governed by regulatory requirements.

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular activities that are selected to accomplish a remedial action. These action-specific requirements do not in themselves determine the remedial action; rather, they indicate how a selected remedial action must be achieved.

ARARs will be considered at the following six decision points during the RI/FS.

- Field Investigation: consider ARARs when determining the data to be collected in the field investigation.
- Public Health Evaluation: consider ARARs during the analysis of risk to public health and the environment.
- Development of Remedial Response Objectives: consider ARARs when developing target clean-up levels.
- Identification of Technologies and Development of Alternatives: identify ARARs so that alternatives developed will be consistent with ARARs, meet target clean-up levels, and consider site conditions and features.
- Initial Screening of Remedial Alternatives: consider ARARs when assessing the effectiveness of an alternative, as defined in 40 CFR 300.68(f)(3).
- Detailed Analysis of Remedial Alternatives: evaluate each alternative to the extent it attains or exceeds ARARs, as defined in 40 CFR 300.68-h(2)(iv).

Preliminary ARARs have been identified for NAS Whiting Field and take into account the following factors:

- chemicals suspected to be on site,
- types of media to be sampled,
- potential transport mechanisms, and
- remedial alternatives that will be considered for the site.

The preliminary list of chemical-specific ARARs is presented in Table 3-7 and Table 3-8. The ARARs are listed by the medium potentially requiring remedial action. Because treated groundwater could be discharged to surface water as part of a remedial alternative or there could be air emissions, ARARs for such discharges are also listed. Table 3-9 lists the preliminary location-specific ARARs by site features that may be potentially affected by remedial actions (i.e., wetlands). A list of action-specific ARARs that apply to potential remedial actions will be developed as part of the remedial alternatives screening process (Task 9 - Section 5.9).

3.3 PRELIMINARY IDENTIFICATION OF REMEDIAL RESPONSE OBJECTIVES. Additional data is needed for NAS Whiting Field to fully define any current threat to public health, welfare, and the environment. However, several preliminary remedial response objectives have been defined based on data previously collected from the 13 sites. Preliminary remedial response objectives identified for NAS Whiting Field include:

- limit any present and future risks to humans due to exposure to contaminated groundwater, surface water, soils, and sediments;

- prevent degradation of Clear Creek, Coldwater Creek, and the Blackwater River due to the discharge of contaminated groundwater and surface runoff into these waters; and

- meet applicable Federal and State regulations, standards, and criteria.

3.4 PRELIMINARY IDENTIFICATION OF REMEDIAL RESPONSE ACTIONS. Remedial response actions have been identified for NAS Whiting Field that meet the preliminary objectives outlined in Section 3.3. Based on the existing site data, the remedial response actions for the 13 sites fall into four general categories.

- no action,
- treatment of contaminated groundwater,
- groundwater migration control, and
- soil and sediment treatment or containment.

Groundwater samples collected from monitoring wells at Sites 3 and 7 and production wells W-S2 and W-W3 at NAS Whiting Field show that groundwater contamination exists. It is anticipated that further contamination may be detected at other sites during the RI. Although existing data does not indicate off-site contamination, based on the groundwater flow directions and the proximity of several sites to the NAS Whiting Field property boundaries, a possibility exists for the migration of contaminated groundwater off site.

TABLE 3-7
PRELIMINARY CHEMICAL-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS AND CONSIDERATIONS IN THE RI/FS
GROUNDWATER	
Federal ARARs	
Safe Drinking Water Act (SDWA) - Maximum Contaminant Levels (MCL) (40 CFR 141.11 - 141.16)	MCLs have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, and are considered relevant and appropriate for groundwater aquifers used for drinking water. When the risks to human health due to consumption of groundwater are assessed, concentrations of contaminants should be compared to their MCLs. MCLs will be used to set target clean-up levels.
SDWA - Maximum Contaminant Level Goals (MCLG)	MCLGs are health-based criteria that are relevant and appropriate for drinking water sources, under SARA, when extraordinary risks exist and may be considered relevant and appropriate for remedial actions. These goals are available for a number of organic and inorganic contaminants.
Federal Ambient Water Quality Criteria (AWQC)	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic and noncarcinogenic compounds. AWQC should be used in characterizing human health risks due to contaminant concentrations in groundwater. Under SARA, AWQC should be considered an ARAR.
Resource Conservation and Recovery Act (RCRA) - Subpart F Groundwater Protection Standards	RCRA Maximum Concentration Limits, background concentrations, and alternate contaminant levels (ACLS) are three possible standards available under Subpart F for setting a cleanup level for remediating groundwater contamination from a RCRA facility. The standards may be relevant and appropriate and may be used to identify appropriate cleanup levels.

TABLE 3-7 (Cont.)
PRELIMINARY CHEMICAL-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS AND CONSIDERATIONS IN THE RI/FS
State ARARs	
Florida Administrative Code (FAC) Chapter 17-3 Water Quality Standards; Chapter 17-550 Drinking Water Standards, Monitoring and Reporting	These standards apply to the protection of groundwater and drinking water. Although they appear to parallel Federal regulations, there are standards for some chlorinated solvents and benzene which are lower than Federal standards. These standards will be used to set appropriate target clean-up levels and to assess the effectiveness of potential remedial alternatives.
FAC, Chapter 17-770, State Underground Petroleum Environmental Response	Although these clean-up standards apply to transportation tanks, the standards specified could also be applied to any petroleum clean-up within the State.
Federal Advisories and Guidance To Be Considered	
Health Advisories (USEPA Office of Drinking Water)	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider noncarcinogenic effects only. They are to be considered in the public health and environmental assessment.
USEPA Risk Reference Doses (RfDs)	RfDs are dose levels developed by USEPA for noncarcinogenic effects. They are used to characterize risk due to exposures to contaminants in groundwater, as well as other media. They are to be considered in the public health and environmental assessments.

TABLE 3-7 (Cont.)
PRELIMINARY CHEMICAL-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS AND CONSIDERATIONS IN THE RI/FS
USEPA Risk Reference Assessment Group Potency Factors	Potency Factors are developed by USEPA from Health Effects Assessments (HEA) or evaluations by the Carcinogen Assessment Group. USEPA Carcinogenic Potency Factors are used to complete the individual incremental cancer risk resulting from exposure to contaminants. They are to be considered in the public health and environmental assessments.
Acceptable Intake - Chronic (AIC) and Subchronic (AIS) - USEPA Health Assessment Documents	AIC and AIS values are developed from RfDs and HEAs for noncarcinogenic compounds, and are used to characterize the risk due to several noncarcinogens in various media.
USEPA Office of Water Guidance Water Related Fate of 129 Priority Pollutants (1979)	This guidance manual gives transport and fate information for 129 priority pollutants and will be used to assess the transport and fate of a variety of contaminants.
DISCHARGE TO SURFACE WATER	
Federal Guidance and Criteria To Be Considered	
Federal Ambient Water Quality Criteria	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic compounds. AWQC may be used for setting limits for discharge to surface water.

TABLE 3-7 (Cont.)
PRELIMINARY CHEMICAL-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS AND CONSIDERATIONS IN THE RI/FS
State ARARs	
FAC, Chapter 17-3, Water Quality Standards	The Water Quality Standards apply to all discharges into surface waters. The rules set forth procedures classifying water bodies and assigning water quality standards throughout the state.
SOILS	
Federal Guidance and Criteria To Be Considered	
Toxic Substance Control Act (TSCA) (15 USC 2601)	
PCB Requirements (40 CFR 761)	This portion of TSCA sets allowable limits for the concentration of PCBs in soils. TSCA may set cleanup limits for PCBs found in soils.
TSCA Health Data, Chemical Advisories and Compliance Program Policy	This portion of TSCA contains health data and chemical advisories for contaminants which may be found at the site. These advisories and health data will be considered in the public health assessment.

TABLE 3-8
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
VOLATILE ORGANIC COMPOUNDS							
Chloromethane				0(0.19)			
Bromomethane				0(0.19)			
Vinyl Chloride	2	0		0(2.0)			3
Chloroethane			IND	IND			
Methylene Chloride			11,000[a]	0(0.19)			
Acetone							
Carbon Disulfide							
1,1-Dichloroethene	7	7	11,600[a]	0(0.003)	7	7	
1,1-Dichloroethane							
1,2-Dichloroethene (total)		70	IND	IND	70	70	
Chloroform	100		1,240[b]	0(0.19)			
1,2-Dichloroethane	5	0	20,000	0(0.94)			3
2-Butanone							
1,1,1-Trichloroethane	200	6,200	18,000[a]	18,400			200
Carbon Tetrachloride	5	0	35,200[a]	0(0.4)			3
Vinyl Acetate							
Bromodichloromethane	100		11,000[a]				
1,2-Dichloropropane		6	5,700[b]	IND	5	0	

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
VOLATILE ORGANIC COMPOUNDS (Cont.)							
Trans-1,3-Dichloropropene			244[b]	87			
Trichloroethene	5	0	21,900[b]	0(2.78)			3
Dibromochloromethane	100		11,000[a]	0(0.19)			
1,1,2-Trichloroethane			9,400[b]	0(0.6)			
Benzene	5		5,300[a]	0(0.66)		1	1
Cis-1,3-Dichloropropene			244[b]	87			
2-Chloroethylvinyl ether							
Bromoform	100		11,000[a]				
4-Methyl-2-Pentanone							
2-Hexanone							
Tetrachloroethene		0	840[b]	0(0.80)	5	0	3
1,1,2,2-Tetrachloroethane			9,320[a]	0(0.17)			
Toluene	200		17,500[a]	18,300	2,000	2,000	
Ethylbenzene		680	32,00[a]	14,000	700	700	
Chlorobenzene		60	50[b]	488	100	100	
Styrene		140			5	0	
Xylenes (Total)		440			10,000	10,000	

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
INORGANIC COMPOUNDS							
Aluminum			87[e]	146			
Antimony			1,600[b]				
Arsenic	50	50	190[e]	0.0022	0	30	50
Barium	1,500	1,000		1,000	5,000	5,000	1,000
Beryllium			5.3[b]	0(0.0068)			
Cadmium	10	5	1.1[c]	10	5	5	10
Calcium							
Chromium	50	12			100	100	50
Chromium VI	50	12	11	50			
Chromium III			210[c]	170,000			
Cobalt							
Copper		1,300	12[c]	1,000[f]			1,000
Iron			1,000				300
Lead	50	20	3.2[c]	50	5	0	50
Magnesium							
Manganese				50			50
Mercury	3	2	0.012[e]	0.144	2	2	2
Nickel			160[c]	13.4			
Potassium							
Selenium	45	10	5[e]	10	50	50	10
Silver	50		0.12[e]	50	90		50
Sodium							
Thallium			40[b]	13			
Vanadium							
Zinc			110[c]	5,000[f]			5,000

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
SEMIVOLATILE ORGANIC COMPOUNDS							
3-Nitroaniline				0.0028			
Acenaphthene			520[b]	70			
2,4-Dinitrophenol							
4-Nitrophenol							
Dibenzofuran							
2,4-Dinitrotoluene				0(0.11)			
Diethylphthalate				434,000			
4-Chlorophenyl-phenylether							
Fluorene				0.0028			
4-Nitroaniline							
4,6-Dinitro-2-methylphenol							
N-Nitrosodiphenylamine				0(4.9)			
4-Bromophenyl-phenylether							
Hexachlorobenzene			50[b]	0.021			
Pentachlorophenol		220	13[e]	1010	200		
Phenanthrene				0.0031			
Anthracene			6.3[d]	0.0031			
Di-n-butylphthalate				34,000			
Fluoranthene			3,980[a]	42			
Pyrene				0.0028			
Butylbenzylphthalate							

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
3,3'-Dichlorobenzidine				470			
Benzo(a)Anthracene				0.0028			
Chrysene				0.0028			
bis(2-Ethylhexyl)phthalate			3[b]				
Di-n-octylphthalate							
Benzo(b)Fluoranthene				0(0.0028)			
Benzo(k)Fluoranthene				0(0.0028)			
Benzo(a)Pyrene				0(0.0028)			
Indeno(1,2,3-cd)pyrene				0(0.0028)			
Dibenz(a,h)anthracene				0(0.0028)			
Benzo(g,h,i)perylene				0(0.0028)			
Phenol			2,560[b]	3,500			
bis(2-Chloroethyl)ether				0(30 ng/l)			
2-Chlorophenol			2,000[b]	0.1[f]			
1,3-Dichlorobenzene	750	750	763[b]	400	75	75	
1,4-Dichlorobenzene			763[b]	400			
Benzyl alcohol							
1,2-Dichlorobenzene		620	763[b]	400	600	600	
2-Methylphenol							
bis(2-Chloroisopropyl)ether				34.7			
4-Methylphenol							
N-Nitroso-di-n-propylamine							
Hexachloroethane			5,850[b]	0(1.9)			
Nitrobenzene			27,000[a]	19,800			

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
Isophorone			117,500[a]	5,200			
2-Nitrophenol							
2,4-Dimethylphenol			2,120[a]	400[f]			
Benzoic acid							
bis(2-Chloroethoxy)methane							
2,4-Dichlorobenzene			763[b]	3,090			
Naphthalene			920[b]	IND			
4-Chloroaniline							
Hexacholorobutadiene			9.3[b]	0(0.45)			
4-Chloro-3-Methylphenol			30[a]	3,000			
2-Methylnaphthalene				0.0028			
Hexachlorocyclopentadiene			5.2[b]	206			
2,4,6-Trichlorophenol			970[b]	0(1.8)			
2,4,5-Trichlorophenol				2,600			
2-Chloronaphthalene			IND	IND			
2-Nitroaniline							
Dimethylphthalate				350,000			
Acenaphthylene				0.0028			
2,6-Dinitrotoluene							

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
PESTICIDES/PCB COMPOUNDS							
alpha-BHC			100[a]	0.073			
beta-BHC				0.0233			
delta-BHC			IND	IND			
gamma-BHC (lindane)	4	0.2		0.0174	0.2	0.2	4
Heptachlor			0.0038[e]	0.0011	0.4	0	
Aldrin			3.0[d]				
Heptachlor epoxide		0			0.2	0	
Endosulfan I			0.056[d]	138			
Dieldrin			0.0019[d]	0(1.1 ng/l)			
4,4'-DDE			1,050[a]				
Endrin	0.2		0.0023[d]	1			0.2
Endosulfan II							
4,4'-DDD							
Endrin Aldehyde			0.001[d]				
Endosulfan sulfate							
4,4'-DDT			0.001[d]	0(1.2 ng/l)			
Methoxychlor	340	100			400	400	100
Endrin ketone							
alpha-Chlordane		0	0.0043[d]	0(0.022)	2	0	
gamma-Chlordane		0		0(0.022)			
Toxaphene	5	0	0.0002[a]	0(0.026)	5	0	5

Footnotes at end of table

TABLE 3-8 (Cont.)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	FEDERAL MCL[1] (ug/l)	FEDERAL MCLG[1] (ug/l)	FEDERAL AWQC AQUATIC ORGANISMS[2] (ug/l)	FEDERAL AWQC HUMAN HEALTH[3] (ug/l)	FEDERAL PROPOSED MCL[4] (ug/l)	FEDERAL PROPOSED MCLG[4] (ug/l)	FLORIDA DRINKING WATER MCL[5] (ug/l)
PESTICIDES/PCB COMPOUNDS (Cont.)							
PCBs (as decachlorophenol)							
Aroclor-1016				0(>0.0126)	0.5	0	
Aroclor-1221				0(>0.0126)			
Aroclor-1232				0(>0.0126)			
Aroclor-1242				0(>0.0126)			
Aroclor-1248				0(>0.0126)			
Aroclor-1254				0(>0.0126)			
Aroclor-1260				0(>0.0126)			
PCBs (total)			0.014[e]				

NOTE: MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
SMCL - Secondary Maximum Contaminant Level
AWQC - Ambient Water Quality Criteria
IND - Insufficient data

[1] - Taken from USEPA (October 1987).
[2] - AWQC for the protection of aquatic life - lowest available number is presented (USEPA, May 1986)
[3] - AWQC for the protection of human health - from effects through ingestion and contaminated aquatic organisms (USEPA, May 1986)
[4] - Proposed MCL, MCLGs and SMCLs as reported in FR May 1989
[5] - Chapter 17-550, FAC
[a] - Acute lowest observed effect concentration (LOEL)
[b] - Chronic LOEL
[c] - Hardness based criteria (based on 100 mg/l as CaCO3)
[d] - Acute criteria
[e] - Chronic criteria
[f] - Organoleptic, criteria based on odor and taste, not health. No health-based criteria available.

TABLE 3-9
PRELIMINARY LOCATION-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS AND CONSIDERATIONS IN THE RI/FS
Federal ARARs	
National Environmental Policy Act (NEPA) 40 CFR 6 Appendix A	Appendix A, Wetlands Executive Order, requires that wetlands assessment be incorporated into the analysis of remedial alternatives. An alternative located in a wetland may not be selected unless a determination is made that no practicable alternative exists outside the wetland.
Endangered Species Act (16 USC 1531, 50 CFR Parts 81, 225, and 402)	The Initial Assessment has determine that endangered and threatened species could occur at the site. Work conducted at the site may have to consider the habitats occupied by endangered and threaten species.
Fish and Wildlife Coordination Act (16 USC 661 Note)	The Fish and Wildlife Coordination Act requires that the U.S. Fish and Wildlife Services and other related State agencies be consulted before wetlands are modified.
Fish and Wildlife Conservation Act (16 USC 2901, 50 CFR Part 83)	The Fish and Wildlife Conservation Act requires that U.S. Fish and Wildlife Services and other related State agencies be consulted before wetlands are modified.
Fish and Wildlife Improvement Act (16 USC 742)	The Fish and Wildlife Improvement Act requires that the U.S. Fish and Wildlife Services and other related State agencies be consulted before wetlands or other habitats are modified.
Protection of Archaeological Resources (32 CFR Part 229, 229.4; 43 CFR Part 107, 171.1 - 171.500)	Any excavations on the site must address archaeological resources found during the excavation.

TABLE 3-9 (Cont.)
PRELIMINARY LOCATION-SPECIFIC ARARs
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ARARs	REQUIREMENT SYNOPSIS/CONSIDERATION IN THE RI/FS
State ARARs	
FAC, Chapter 17-4, Permits	Permits from the Florida Department of Environmental Regulation may be required if work is to be conducted within wetland areas of the site.
FAC, Chapter 17-30, Hazardous Waste	If hazardous waste is generated during any site operations the handling, transport, and treatment or disposal of the waste must be in compliance with these regulations.
FAC, Chapter 40 A-3, Regulation of Wells	The installation of monitoring wells must be permitted by the Northwest Florida Water Management District. Construction details for the wells are approved at this time.

Groundwater treatment and migration control may be proposed both as a preventive measure and remediation alternative.

Migration of contaminated soils and sediments off the NAS Whiting Field property is possible by sediment transport via the stormwater drainage ditches. Sites exist where surface soil contamination is suspected and uncontrolled stormwater runoff could cause suspension and transport of these soils. Treatment of contaminated soils, sedimentation of stormwater, and erosion control are possible remedial alternatives to prevent migration of contaminated soils and sediments off site.

Contaminated subsurface soils may act as a source of groundwater contamination by dissolving into percolating stormwater or into the fluctuating groundwater table. Removal of soils as a source may be achieved by treatment of the soils *in situ* employing biological, chemical, physical treatment technologies; excavation and treatment; or capping with an impermeable material to prevent infiltration of precipitation through the contaminated soil.

Possible remedial response actions and their ability to achieve the response objectives are discussed in the following paragraphs. A summary of the remedial actions available for the sites at NAS Whiting Field is presented in Table 3-10.

No Action. The no-action alternative may include fencing of the site, deed and land use restrictions, and long-term environmental monitoring. The no-action alternative requires obtaining further information to assess groundwater contamination, to define present and future groundwater uses, and to assess the risk to the public health and the environment prior to being proposed as a viable alternative.

Groundwater Treatment. Groundwater treatment alternatives include both pump and treat and *in-situ* technologies. *In-situ* treatment technologies include both biological and chemical or physical methods. Pump and treat alternatives may employ either passive collection systems, such as subsurface trenches, or extraction well systems. Based on the depth to groundwater, the extraction well alternative is more likely to be proposed for use at NAS Whiting Field.

Groundwater Migration Control. To prevent migration from the contamination source, vertical barriers, impermeable caps, and hydraulic controls may be proposed in combination with other remedial options. Containment of sources within the areas of high concentration may be a feasible method of controlling contaminant migration toward supply wells or surface water bodies.

Soil and Sediment Containment or Treatment. The location and remediation of contaminated soils may be proposed at NAS Whiting Field to prevent contamination of groundwater and surface water. Potential remedial actions for the sites at NAS Whiting Field include excavation and treatment or disposal, containment, and *in-situ* treatment.

If contaminated sediments are discovered in the drainage ditches, treatment may include dewatering and treatment or disposal with soils from other sites at NAS Whiting Field. In addition, water removed from the sediments may be tested and released or treated with groundwater from other sites, as appropriate.

TABLE 3-10
PRELIMINARY SCOPING OF REMEDIAL ACTIONS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

POTENTIAL REMEDIAL ACTIONS	ATTAINMENT OF PRELIMINARY RESPONSE OBJECTIVES
No Action	- No further attainment of response objectives would be gained with the "no action" alternative.
Source Control Actions	
Containment	- Minimizes public exposure to contaminants in soils and wastes.
	- Reduces leaching of contaminants from source to groundwater; minimizes. public exposure to groundwater
	- Reduces contamination of surface runoff.
Removal (followed by disposal or treatment actions)	- Prevents public exposure to contaminants in soil and waste.
	- Reduces public exposure to contaminated groundwater.
	- Prevents the off-site migration of contaminants via groundwater.
	- Prevents contamination of surface runoff.
In-situ treatment	- Reduces public exposure to contaminants in soil and waste.
	- Reduces the off-site migration of contaminants via groundwater and surface water flow.
	- Reduces contamination of surface runoff.

TABLE 3-10 (Cont.)
PRELIMINARY SCOPING OF REMEDIAL ACTIONS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

POTENTIAL REMEDIAL ACTIONS	ATTAINMENT OF PRELIMINARY RESPONSE OBJECTIVES
Migration Management	
Containment	- Minimizes or prevents off-site migration of contaminated groundwater. - Reduces contamination of surface runoff. - Reduces public exposure to contaminated groundwater.
Removal (followed by on-site treatment action)	- Reduces off-site migration of groundwater contaminants to off-site areas. - Reduces public exposure to contaminated groundwater.
Diversion (runon/runoff control)	- Reduces public exposure to contaminated groundwater. - Minimizes off-site migration of contaminants via surface runoff.
Institutional controls	- If implemented for groundwater or surface runoff use, can prevent public exposure to contaminated groundwater or surface runoff.

3.5 ADDITIONAL DATA REQUIREMENTS TO EVALUATE REMEDIAL TECHNOLOGIES. To assist in the selection of appropriate remedial technologies for the individual sites at NAS Whiting Field, existing data for each site has been evaluated. Based on this evaluation, additional data requirements for each site have been formulated. Due to the similarities in the type and quantity of data that currently exists for each site, the additional data needs for the 13 individual sites were also found to be very similar. These data requirements have been summarized below.

Additional data requirements for each of the sites can be grouped into four general needs. The first need is sufficient data to determine the nature and extent of the contamination source material and contaminated soils (if any) at each of the sites. The second data requirement is sufficient groundwater sampling data to determine the nature and extent (if any) of groundwater contamination at each of the sites. The remainder of the data requirements center around the need for the collection of physical data at each of the sites. Soil classification data (i.e., type of sand, clay, etc.) will be required in order to be used in the remedial action screening process for determining the effectiveness of soil treatment technologies. In addition, groundwater characteristics beneath the sites (flow direction, transmissivity of the aquifer, etc.) will also be required. This data will be used in determining what groundwater pumping and treatment technologies are applicable for the sites.

As a preliminary step, potential remedial technologies for the NAS Whiting Field have been identified and are presented in Table 3-11. In addition to the Target Compound List (TCL) constituents, potential data requirements to evaluate the various remedial technologies are presented in Table 3-12. Both lists will become more refined as information is gained throughout the RI process.

3.6 RI/FS OBJECTIVES. The objectives of the NAS Whiting Field RI are to locate source areas; assess the volumes and distribution of contaminants found in the soil, sediment, surface water, and groundwater; characterize regional and local hydrogeology; evaluate environmental and public health risks presented by the site; and, finally develop sufficient site-specific engineering data to conduct an FS of remedial alternatives.

The objective of the NAS Whiting Field FS is to develop and evaluate remedial alternatives that allow the Navy to select a remedial action that meets the nine evaluation criteria established by USEPA (see Section 5.10).

4.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) are based on the concept that different data uses may require different quality data. Data quality is the degree of certainty with respect to precision, accuracy, reproducibility, completeness, and comparability of a data base. DQOs are qualitative and quantitative statements specifying the quality of data required to support RI/FS activities (including field screening, characterization, and risk assessment) and to support remedial alternatives evaluation and selection decisions and enforcement. Five general levels of analytical options to support data collection are identified by CERCLA. The Navy has adopted three of the analytical levels as QC requirements. They are D, C, and E, which correlate with Levels 3, 4, and 5 described in Data Quality

TABLE 3-11
IDENTIFICATION OF PRELIMINARY REMEDIAL TECHNOLOGIES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

TYPE OF MATERIAL	REMEDIAL ACTION	APPLICABLE REMEDIAL MEASURES: SOURCE CONTROL	APPLICABLE REMEDIAL MEASURES: MANAGEMENT OF MIGRATION
Soil	Containment	Cap	--
	Removal	Excavate grading	--
	Disposal	On-site landfill	--
		Off-site landfill	--
	In-situ treatment	Vitrification	--
		Biological	
		Soil flush	
		Solidification	
	On-site treatment	Thermal treatment	
		Biological	
		Soil wash	
		Solidification	
	Institutional Controls	Land Use Restrictions	Land Use Restrictions
	Diversion	--	Dikes Ditches and Trenches
	No action	No action	No action
Groundwater	Containment	--	Barriers
	Removal	--	Collect/Pump
	Disposal	--	Off-site Deepwell Injection
	Treatment	--	On-site chemical treatment On-site physical treatment On-site biological treatment Off-site chemical treatment Off-site physical treatment Off-site biological treatment
	Institutional controls	--	Water use restrictions
	No action	No action	No action

TABLE 3-12
DATA REQUIRED TO EVALUATE REMEDIAL TECHNOLOGIES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

TECHNOLOGY		TOC	pH	BD	SG	HHV	BOD	GS	DIOXINS	BC
Soil	- Capping									
	Excavation				X			X		
	Landfill	X	X	X	X			X	X	
	Vitrification	X	X	X	X	X		X	X	
	In-situ biological treatment	X	X	X	X			X	X	X
	In-situ soil flush	X	X	X	X			X	X	
	Soil wash	X	X	X	X			X	X	
	Thermal treatment	X	X	X	X	X		X	X	
	Biological	X	X	X	X			X	X	X
	Solidification	X	X	X	X			X	X	
	Dikes									
	Ditches									
Ground water	- Barriers									
	Water collection/pump	X								
	Deep well injection	X		X					X	
	Treatment - Chemical	X		X					X	
	- Physical	X		X					X	
	- Biological	X		X			X		X	

TECHNOLOGY		BC	pH	TOC	BD	HHV	BOD	GS	DIOXINS
Waste	- Capping								
	Excavation							X	
	Landfill		X	X	X			X	X
	Vitrification		X	X	X	X		X	X
	In-situ biological treatment	X	X	X	X			X	X
	In-situ soil flush		X	X	X			X	X
	Soil wash		X	X	X			X	X
	Thermal treatment		X	X	X	X		X	X
	Biological	X	X	X	X			X	X
	Solidification		X	X	X			X	X
	Dikes								
	Ditches								

NOTE: TOC - Total organic carbon
pH - pH
BD - Bulk density
SG - Specific gravity
HHV - High heating value
BOD - Biological oxygen demand
GS - Grain size
BC - Bacteriologic Count

Objectives for Remedial Response Activities Development Process by the USEPA (March 1987). These levels are based on the type of site to be investigated, the level of accuracy and precision required, and the intended use of the data. Analytical requirements for USEPA Levels 1 and 2 have not yet been defined by the Navy.

A brief description (as presented in Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, Oak Ridge Gaseous Diffusion Plant, June 1988) of each level is provided below.

USEPA Level I - Field Screening. This level of data quality is the lowest, but provides the most rapid results. It is used to assist in the optimization of sampling locations and for health and safety support. Data generated provides information on the presence or absence of certain constituents and is generally qualitative rather than quantitative.

USEPA Level II - Field Analysis. This level of data quality is characterized by the use of analytical instruments that are carried in the field and the use of mobile laboratories. Depending on factors such as instrumentation and environmental matrix, data may be either qualitative or quantitative.

Navy Level C QC. A site requiring Level C QC would be a site near a populated area, not on the National Priorities List (NPL), and not likely to be undergoing litigation. Level C QC includes review and approval of the laboratory QA and the site work plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports (MPRs) on QA. The laboratory that performs Level C QC must have passed the performance sample furnished by the Superfund Contract Laboratory Program (CLP) in the past year. The laboratory does not need to be receiving CLP bid lots of samples. Level C allows the use of non-CLP methods but requires that the methods be accepted USEPA methods or be equivalent to USEPA methods. The Navy audit and performance sample are required in addition to any specified by the USEPA Superfund Program.

Navy Level D QC. Level D QC is to be used for sites that are on or about to be on the NPL. These sites are typically near populated areas and are likely to undergo litigation. Level D QC includes review and approval of the laboratory QA plan, the site work plan, and the field QA plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. These activities will be administered and evaluated by the NEESA Contract Representative. This audit and the analysis performance sample are in addition to those related to the USEPA Superfund Program. The laboratory that performs Level D QC must have passed the performance sample furnished through the Superfund CLP and must be able to generated CLP deliverables. For a Level D site, CLP methods are used and the CLP data package generated. The Navy audit and performance sample are required in addition to any specified by the USEPA Superfund Program.

Navy Level E QC. A site requiring Level E QC will be located away from a populated area, will not be an NPL site, and will have a low probability of litigation. Level E QC includes review and approval of the laboratory QA plan and the site work plan. The laboratory must successfully analyze a performance

sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. For Level E, the laboratory is not required to have passed a CLP performance sample. Level E allows the use of non-CLP methods but requires that the methods be accepted USEPA methods. All methods used must be USEPA or equivalent.

Specifics regarding QA/QC, validation, and uses of each level of data are described in the Navy's Sampling and Chemical Analysis Quality Assurance Requirements For The Navy Installation Restoration Program (Oak Ridge Gaseous Diffusion Plant, June 1988) and USEPA Office of Emergency and Remedial Response and Office of Waste Programs Environmental Enforcement Guidance, Data Quality Objectives for Remedial Response Activities (USEPA, March 1987).

At NAS Whiting Field the reporting requirements for legally defensible data is not necessary because the Navy is taking the necessary steps, under its IR Program, to rectify past Navy and Marine Corps waste disposal practices. Data Quality Level C is intended for most of the sample analysis with 10 percent replication of the various analyses at Data Quality Level D. This will allow for timely reporting of analytical results and provide data verification through duplicate analysis.

Table 4-1 summarizes the analytical parameters, data quality objectives, and data use for each task to be undertaken during RI activities at NAS Whiting Field.

5.0 RI/FS TASKS

The proposed work for the NAS Whiting Field RI/FS has been divided into 12 individual tasks. Of these 12 tasks, 8 are considered part of the RI and 4 are included in the FS.

The following tasks comprise the RI.

- Task 1 - Project Planning
- Task 2 - Community Relations
- Task 3 - Field Investigation
- Task 4 - Sample Analysis and Validation
- Task 5 - Data Evaluation
- Task 6 - Baseline Risk Assessment
- Task 7 - Treatability Study or Pilot Testing
- Task 8 - Remedial Investigation Report

TABLE 4-1
DATA QUALITY OBJECTIVES (DQOs) FOR EACH SAMPLING TASK
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

		DATA QUALITY OBJECTIVE	
ACTIVITY	OBJECTIVES	QC LEVEL	RATIONALE
Downhole geophysical logging	Data will be used for evaluation of alternatives.	II	Data necessary for site characterization and engineering design.
PCPT Exploration	Data will be used for evaluation of alternatives.	II	Data necessary for site characterization and engineering design.
BAT Analysis	Data will be used to characterize extent of groundwater contamination.	C (10% D)	Data necessary to support Risk Assessment and Feasibility Study.
Aquifer Testing	Data will be used for evaluation of alternatives.	II	Data necessary for transport characterization Feasibility Study and Risk Assessment.
Groundwater Analysis	Data will be used to characterize and define extent of groundwater contamination.	C (10% D)	Data necessary for Risk Assessment and Feasibility Study.
Surface Water Sediment Analysis	Data will be used to identify environmental impact.	C (10% D)	Data will support Risk Assessment.
Soil Analyses	Data will be used to evaluate exposure potential (Phase I and II) and remedial action volume calculations (Phase II).	C (10% D)	Data necessary for Risk Assessment and Feasibility Study.
Receptors Survey	Data will be used to establish potential receptors.	II	Data mandatory for Risk Assessment.
Air Survey	Monitor breathing space	I	Health and Safety.

The remaining tasks comprise the FS.

- Task 9 - Remedial Alternatives Screening
- Task 10 - Remedial Alternatives Evaluation
- Task 11 - Feasibility Study Report
- Task 12 - Post RI/FS Support

Sections 5.9 through 5.12 provide a detailed description of the FS tasks. The remainder of this section provides a detailed description of the RI tasks.

5.1 TASK 1 - PROJECT PLANNING. The Project Planning task primarily includes activities involved with the preparation of project plans. The project approach and associated technical scope of work were formulated based on detailed reviews of existing information, a site reconnaissance, and lengthy discussions with Southern Division's Engineer in Charge (EIC) and NAS Whiting Field personnel.

The preparation of project plans includes draft and final versions of a Work Plan, a HASP, a DMP, and a SAP. The SAP is further broken down into three subsections:

- Site Management Plan (SMP),
- Field Sampling Plan (FSP), and
- Quality Assurance Program Plan (QAPP).

The SAP will include the following types of information:

- The SMP includes a brief site description, an operations plan outlining the site team organization and responsibilities, and the field operations schedule. This plan also addresses site security and control of access by unauthorized personnel.

- The FSP includes sampling and analytical objectives and the number, type, and location of all samples to be collected during the field investigation.

- The field investigation QAPP includes the Standard Operating Procedures and the Quality Assurance/Quality Control Objectives and Procedures for the field sampling program.

Task 1 will be completed with the approval of the Work Plan, Health and Safety Plan, Data Management Plan, and Sampling and Analysis Plan.

5.2 TASK 2 - COMMUNITY RELATIONS. As part of the NAS Whiting Field RI, a CRP is being developed and will be submitted under separate cover for review and approval. The purpose of the CRP will be to address the needs of the public who are interested in or impacted by the presence and planned remediation of hazardous waste contamination at NAS Whiting Field.

The plan is designed to ensure that residents and community official have access to information about site conditions and actions and that mechanisms are in place to allow interested community members the opportunities to become involved in the decision making process. The plan is divided into the following sections:

- capsule site description;
- community background
- community relations plan development, and
- appendices listing interested parties, key contacts, meeting locations, information repository, and descriptions of selected community relations activities.

This CRP is intended to guide community relations activities through the lengthy period of RI and FS.

5.3 TASK 3 - FIELD INVESTIGATION. The field investigation program developed for the NAS Whiting Field RI/FS is designed to provide the data necessary to complete the risk assessment and FS. The objectives of the field investigation are as follows:

- locate contaminant source areas;
- assess the nature and distribution of contaminants found in the soil, sediment, groundwater and surface water;
- characterize regional and local hydrogeology;
- provide a data base for the risk assessment; and
- obtain data for evaluating remedial alternatives.

The individual site investigations have been planned using the existing site data as a basis for the numbers and locations of explorations. Adjustments to the proposed investigations may be made during the RI as additional data becomes available. Such adjustments would result from discussions among the Project Manager (PrM), the Project Technical Director (TD), and Southern Division's Engineer-in-Charge (EIC).

The RI field investigation will be conducted in two phases. The intent of Phase I activities will be to verify the existence or absence of groundwater contamination emanating from the 13 sites and to develop a comprehensive understanding of the sand and gravel aquifer underlying NAS Whiting Field.

It is anticipated that the course of action for any one of the 13 sites will follow one of five scenarios after completion of the Phase I RI. These potential courses of action are outlined in Table 5-1 and summarized in the following paragraphs.

Scenario 1 applies to sites where no release to the environment is currently documented but a potential does exist for such a release to take place at some future date. In addition, the potential source area is of an unmanageable size. Under this scenario, the potential course of action for such a site is to propose a monitoring only record of decision (ROD).

Scenario 2 applies to sites fitting the criteria for Scenario 1 sites except the source area is manageable in size. Under this scenario, sites will be proposed as accelerated operable units. Site 12, Tetraethyl Lead Disposal Area, and Site 14, Short-Term Sanitary Landfill, are potential Scenario 2 sites.

TABLE 5-1
PHASE II
POTENTIAL COURSES OF ACTION
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

1. Scenario: No contamination found and an unmanageable source area
   Action: Risk Assessment → ROD → Monitoring Only

2. Scenario: No contamination found and a manageable source area
   Action: Focused Feasibility Study (AOU) → ROD → RD/RA

3. Scenario: Contamination found at concentrations less than ARARs
   Action:

   Risk Assessment → FS → ROD → RD/RA
   Risk Assessment → ROD → Monitoring Only

4. Scenario: Contamination found at concentrations greater than ARARs
   Action: Phase II RI → FS → ROD → RD/RA

5. Scenario: No contamination found and no source area delineated
   Action: ROD → NFA

NOTE: ROD - Record of Decision
AOU - Accelerated Operable Unit
RD - Remedial Design
RA - Remedial Action
NFA - No further action

Scenario 3 sites are sites where a contaminant release has been documented but concentrations in the environmental media are less than established ARARs. Under such a scenario and depending upon the outcome of the risk assessment, two potential course of action are possible. The first potential course of action is for sites where contaminant release results in concentration in an environmental medium being close to established ARARs. Under such a condition sites will be proposed for the full RI/FS process. For Scenario 3 sites where concentrations in an environmental medium are at a level that poses no risk, a monitoring only ROD will be proposed. Potential sites that fit the criteria for a Scenario 3 site include Site 1, Northwest Disposal Area; Site 9, Waste Fuel Disposal Area; Site 10, Southeast Open Disposal Area (A); Site 11, Southeast Open Disposal Area (B); Site 15, Southwest Landfill; and Site 16, Open Disposal and Burn Area.

Scenario 4 sites consist of sites where a release to the environment has been documented and concentrations associated with the release exceed established ARARs. Under this scenario sites will undergo the full RI/FS process to reach a proposed ROD. Sites that may potentially fit the criteria for a Scenario 4 site include Site 1, Northwest Disposal Area; Site 3, Underground Waste Solvent Storage Area; Site 13, Sanitary Landfill; Site 15, Southwest Landfill; Site 16, Open Disposal and Burn Area; and Sites 17 and 18, the Crash Crew Training Areas.

The last scenario, Scenario 5, involves sites where no release to the environment has occurred in that no source area exists. Under this scenario a no further action ROD will be proposed. Based upon information gathered to date, sites which may potentially meet the criteria for a Scenario 5 site include Site 5, Battery Acid Seepage Pit and Site 6, South Transformer Oil Disposal Area.

Based upon the results of the Phase I RI, Phase II investigations will be proposed. Upon approval of the Phase II RI Work Plan, field activities will be undertaken, where necessary, to provide data on the source and extent of contamination, contaminant transport mechanisms, and potential receptors. The investigations anticipated to be conducted during Phase II may include the installation of downgradient monitoring wells, groundwater sampling and analysis, known source area and groundwater contaminant plume delineation and characterization, identifying additional source areas impacting production wells, and identifying potential receptors.

The discussion that follows presents the technical approach, methodology, and supporting rationale to complete the Phase I RI field investigation. Although Phase II activities are anticipated, the exact number of explorations and their placement will not be known until after Phase I activities are completed and the data analyzed. Hence, the discussion of Phase II will be limited to the currently anticipated technical program necessary to complete the Remedial Investigation.

5.3.1 Phase I Remedial Investigation - Technical Approach and Methodology

The underlying premise upon which the technical approach for the Phase I RI is based is the potential that an extensive upper semiconfining to confining clay layer underlies NAS Whiting Field. Boring logs generated by Geraghty & Miller (1986) suggest the existence of such a clay layer at approximately 90 to 110 feet BLS throughout most of the air station.

It is anticipated that if such a clay layer exists the vertical migration of contaminants to the lower zone within the sand and gravel aquifer will be retarded. Analytical results for production wells W-W3 and W-S2 indicate groundwater contamination in the lower aquifer zone by trichloroethene in W-W3 and benzene in W-S2. However, it is likely that close to the sites the highest concentration of contaminants exist in the upper aquifer zone (i.e., above the upper clay layer) or within the upper clay. As such, it would continue to act as a source of contamination to the lower aquifer zone.

The activities to be undertaken in the Phase I RI are designed to ascertain both the presence or absence of the upper clay layer, and if present, the presence or absence of contamination in the upper aquifer zone within the sand and gravel aquifer. As such, existing monitoring wells are scheduled for downhole geophysical logging to refine the understanding of the stratigraphy underlying the sites. Subsequent to downhole geophysical logging of existing wells, six additional monitoring wells and two piezometers will be installed at the sites. Initially these wells will be used to define groundwater flow direction in the vicinity of the sites to aid in subsequent exploration programs.

Based upon the verification of the depth to the clay layer or lens and a clear definition of flow direction at each site grouping, a piezocone penetrometer test (PCPT) exploration will be undertaken at each site to assess the geology and presence of a clay layer downgradient of each site. Concurrent with the PCPT will be groundwater sampling using a Bengt-Arne Torstensson (BAT) System and the subsequent analysis for volatile organic compounds and metals to verify the contamination of groundwater downgradient of each site.

Figure 5-1 presents a decision model for the technical approach discussed above. The decision model demonstrates how specific information gathered during one subtask of the investigation will be evaluated to direct the remaining explorations thereby optimizing the placement and quality of data gathered in subsequent subtasks.

The Phase I subtasks to be conducted in the Task 3 Field Investigation can be divided into two categories as follows:

- Site Specific Explorations, and
- Facility Specific Explorations.

A description of the Phase I site specific subtasks and methodologies with supporting rationale are presented in the following sections.

Facility specific Phase I explorations include surface water and sediment sampling, and production well investigation. Descriptions of these subtasks are presented in Section 5.3.4.

The site specific Phase I RI at 12 of the 13 sites located at NAS Whiting Field will involve six subtasks. These subtasks include:

1. Borehole Geophysics (downhole geophysical logging);
2. Monitoring Well and Piezometer Installation;
3. PCPT and *In-Situ* Groundwater Sampling and Analysis;

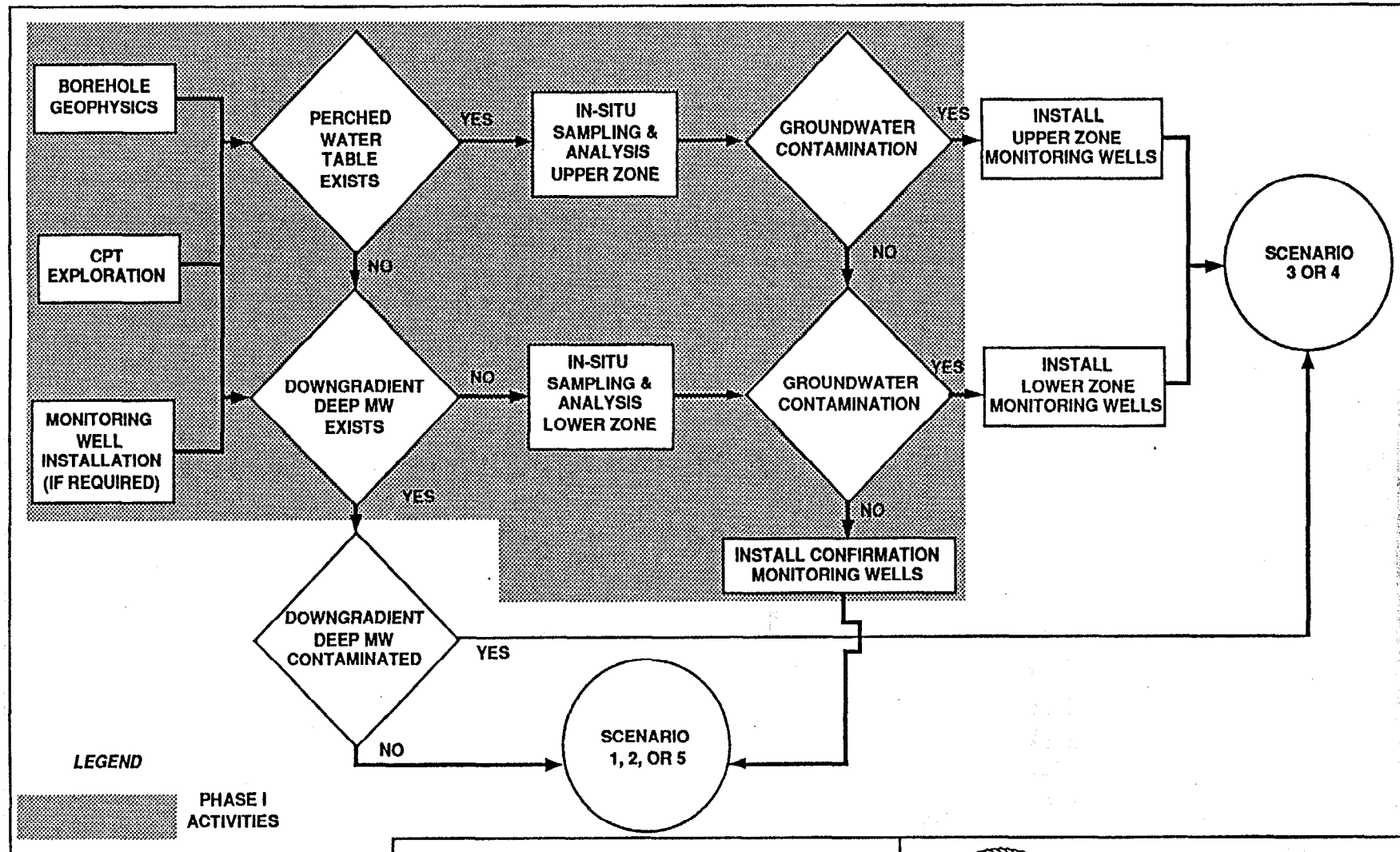


FIGURE 5-1

HYDROGEOLOGIC INVESTIGATION FLOW CHART

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

4. Well Measuring Point Survey;
5. Potentiometric Surface Survey; and
6. Aquifer Hydraulic Properties Testing.

These investigative subtasks and methods were selected based on a site understanding gained through a thorough review of the data from previous investigations at NAS Whiting Field and extensive experience in the sand and gravel aquifer in Escambia and Santa Rosa Counties. Information derived from these subtasks will be used either to provide sufficient data to propose a no further action remedial alternative at sites where groundwater contamination is not detected or provide sufficient information to optimize explorations to delineate the nature and extent of groundwater contamination in a Phase II RI.

Due to the multi-site nature of the RI to be conducted at NAS Whiting Field, the methods of investigation and supporting rationale selected to implement the subtasks will be presented once, in the following sections, to avoid repetition. The following sections discuss, in more detail, the methods of exploration and supporting rationale to be undertaken during the Phase I RI.

5.3.1.1 Borehole Geophysics Gamma and induction logging will be conducted in the 18 existing monitoring wells and three production wells (if accessible) at NAS Whiting Field. Geophysical logs will be used as a qualitative guide for lithologic correlation to govern additional subsurface explorations. Specifically, the depth to clay layers or lenses will be initially defined and correlated to existing boring logs for monitoring wells installed by Geraghty & Miller (1986), logs for the proposed background monitoring wells, and the PCPT exploration logs.

5.3.1.2 Monitoring Well/Piezometer Installation Monitoring wells are scheduled for installation at five sites or site groupings (Table 5-2) around NAS Whiting Field. Due to the position of existing monitoring wells in these areas, groundwater flow direction and hydraulic gradients are not well defined. Prior to the installation of downgradient PCPT explorations at specific sites, it will be necessary to describe flow direction for optimal placement. The placement of monitoring wells and piezometers is intended to achieve this goal.

Due to the depths involved for well placement, boreholes for monitoring well installation will be advanced using mud rotary techniques. Standard penetration tests will be conducted at 5-foot intervals and at stratigraphic unit changes throughout each soil boring. Subsurface soil samples collected with the split-spoon sampler will be logged by the on-site field geologist. Boring logs will be used to ground truth the results of the PCPT and downhole geophysical logging exploration programs.

If an upper confining or semi-confining clay layer is confirmed to be present, Shelby tube samples will be collected within this upper clay layer. Shelby tube samples will be collected in accordance with American Society for Testing and Materials (ASTM) Designation: D1587-83 Standard Practice for Thin-Walled Tube Sampling of Soils, as outlined in Section 6.6.2 in the QAPP (Volume II, Appendix B). Shelby tube samples shall be sent to the geotechnical laboratory for the measurement of hydraulic conductivity using a constant head procedure (USEPA Method 9100) for undisturbed samples. Results from the laboratory permeability tests will be used to approximate the vertical hydraulic conductivity through the upper aquifer zone clay layer.

TABLE 5-2
MONITORING WELL/PIEZOMETER PLACEMENT
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER(S)	WELL NUMBER	TOTAL DEPTH (BLS) IN FEET	SCREEN INTERVAL (BLS) IN FEET	CLAY INTERNAL* (BLS) IN FEET
MONITORING WELLS				
3	WHF-3-3	150	145 - 150	110 - 130
9/10	WHF-9-2	120	115 - 120	75 - 90
11/14	WHF-11-2	150	145 - 150	90 - 125
15/16	WHF-15-2	75	70 - 75	40 - 65
5	WHF-5-OW-1	175	170 - 175	
	WHF-5-OW-2	150	145 - 150	150 - 170
PIEZOMETERS				
5	WHF-5-PZ-1	160		150 - 170
	WHF-5-PZ-2	170		

* Geraghty & Miller (1986)

NOTE: For monitoring wells in high traffic areas, protective pad and posts will be installed.
BLS - below land surface

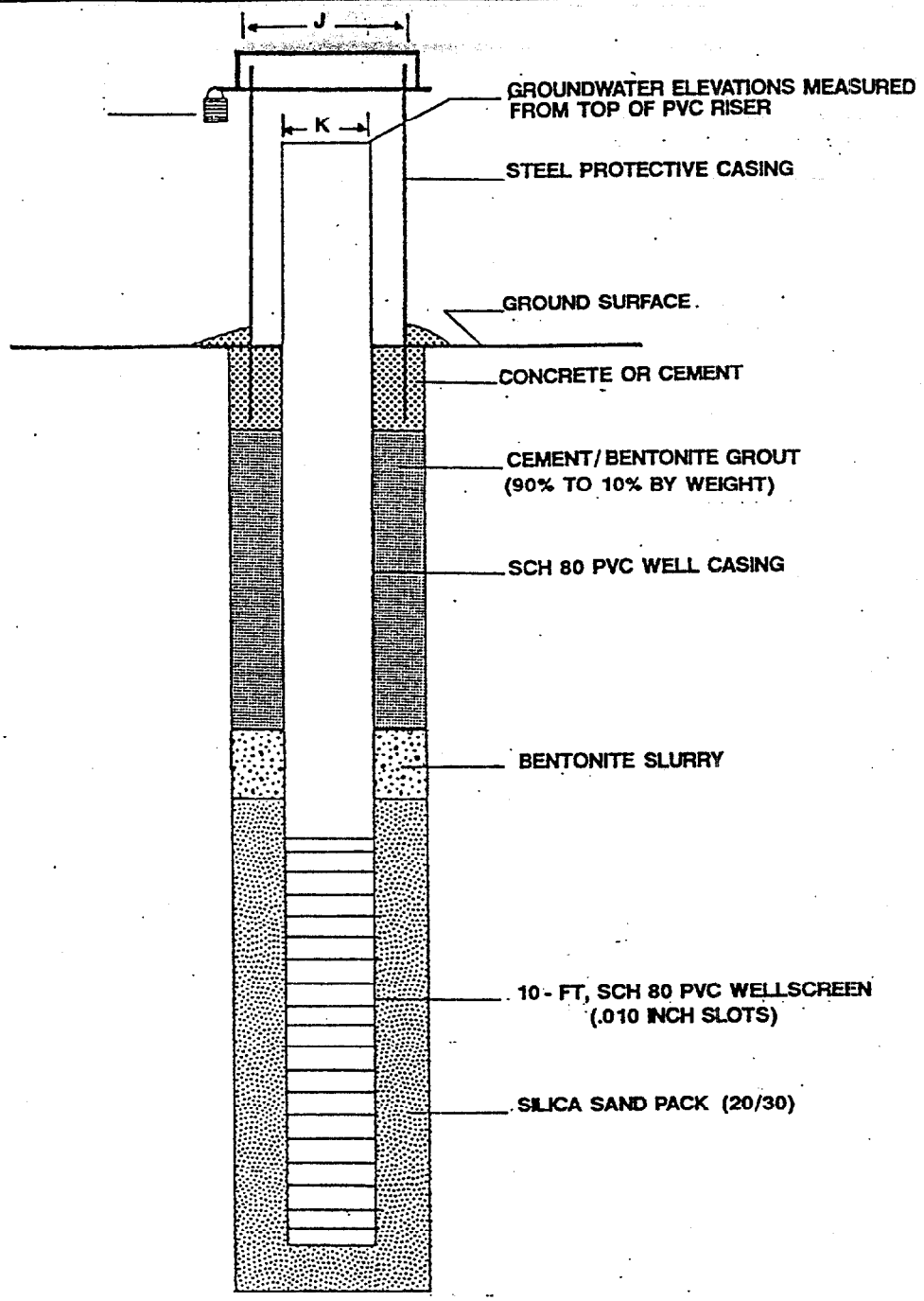
Monitoring well screen placement will be within the screen interval of existing monitoring wells. Specific well screen placement will be determined by geologic conditions encountered.

Figures 5-2A and 5-2B present the typical monitoring well installation details for NAS Whiting Field. The single-cased well (see Figure 5-2A) will be installed at site or site groupings where a confining or semi-confining unit does not exist. Wells will be constructed of 4-inch ID, flush-threaded Schedule 80 PVC with a 10-foot section of machine-slotted PVC well screen (0.01-inch slot size). The annulus around the screen will be sand packed using 20/30 graded silica sand. Both slot size and sand pack grade are typical for the sand and gravel aquifer. The sand pack will be tremied into the annular space to a maximum of 2 feet above the top of the screen. A 2-foot bentonite slurry seal will be tremied above the sand pack. A mixture of Portland cement and bentonite will be tremied into the annular space above the bentonite seal to the surface to eliminate a vertical conduit created by the drilling process. Material and construction of single-cased monitoring wells will conform with Southern Division's Specifications for Groundwater Monitoring Well Installation (3 November 1988) and Chapter 40 A-3, FAC., Regulation of Wells as Enforced by the Northwest Florida Water Management District.

Double-cased wells (see Figure 5-2B) which will be installed at sites underlain by a confining to semi-confining clay unit, will be installed to prevent vertical migration downward of shallow contamination. Construction of double-cased wells will be in accordance with industry standards, Naval Guidance, and Chapter 40 A-3, FAC. The installation of a double-cased well requires the placement of an 8-inch ID (minimum), flush-treaded, Schedule 80 PVC outer casing at least 2 feet into the confining unit. Under no circumstance will the outer casing breach the confining unit. A mixture of Portland cement and bentonite shall be tremie grouted in the annular space surrounding the casing.

Within the outer casing a 4-inch ID, flush-threaded, Schedule 80 PVC monitoring well will be installed to the depth required. The well will consist of a 10-foot section of machine-slotted screen (0.01-inch slot size) and riser pipe. The annulus around the well screen will be tremie filled with 20/30 graded silica sand to a maximum of 2 feet above the screen followed by 2 feet of bentonite slurry. A mixture of Portland cement and bentonite shall be tremie grouted into the remaining annular space to the ground surface to prevent leakage across the confining unit.

Aboveground protective steel casings will be installed and cemented into the ground over all well risers. The steel casings will be equipped with locking covers and keyed-alike brass padlocks. A concrete pad will be placed at ground surface around each protective casing to secure the casing and to prevent surface runoff from entering the borehole. The aboveground portions of both the well riser and protective casing will be vented. Wells will be properly identified, using Southern Division's identification scheme. In vehicular traffic areas protective steel posts will be installed around each monitoring well in



NOTE:

K = 4" INSIDE DIA. SCH 80 PVC.

J = 6" STEEL PROTECTIVE CASING WITH LOCKING COVER

NOT TO SCALE

FIGURE 5-2A

MONITORING WELL INSTALLATION DETAIL SINGLE-CASED WELL

RI/FS WORK PLAN

NAS WHITING FIELD MILTON, FLORIDA

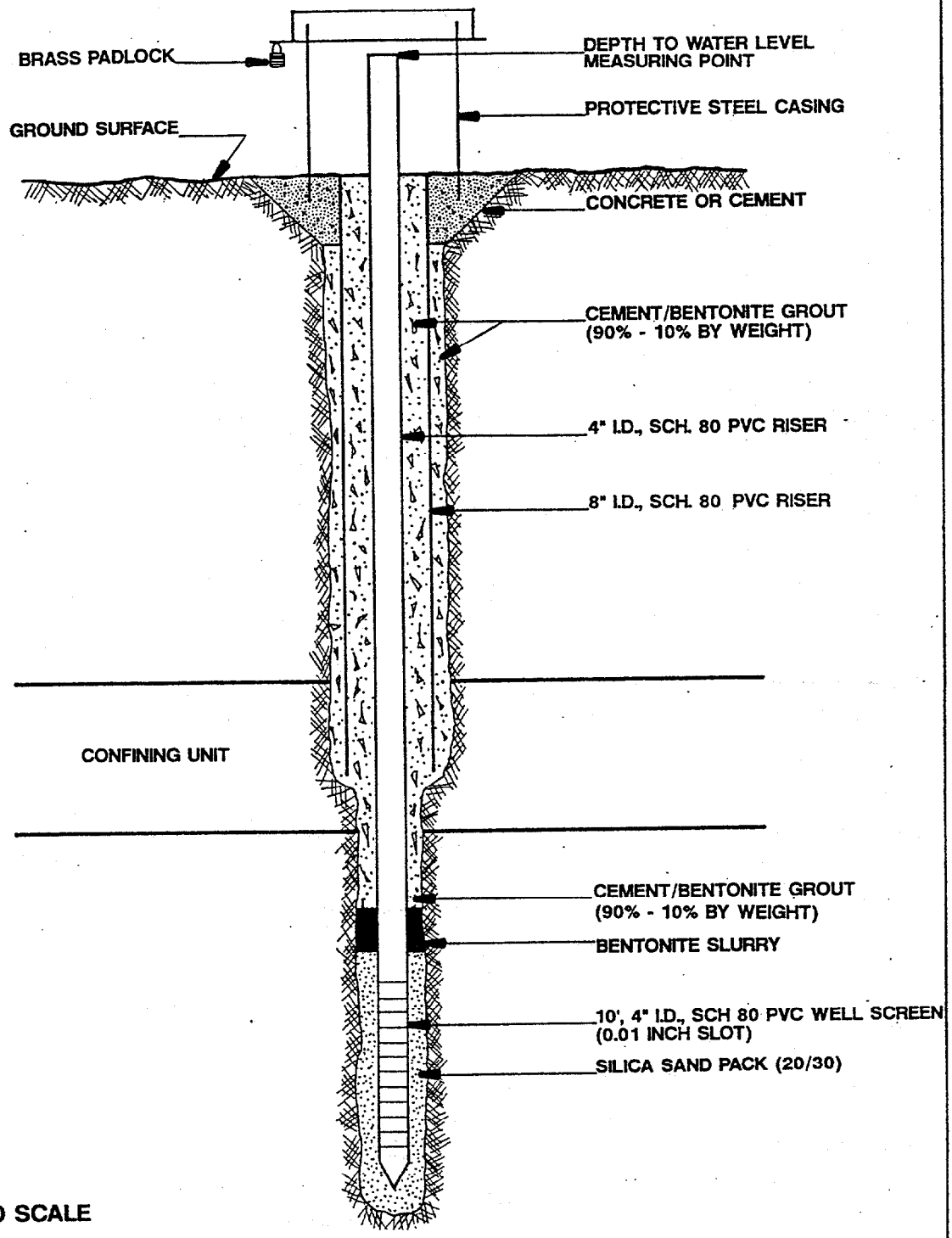


FIGURE 5-2B
MONITORING WELL
INSTALLATION DETAIL
DOUBLE CASED WELL

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

accordance with Southern Division's specifications. Details on monitoring well protective measures are presented in Volume II of this document.

Piezometers (Figure 5-3) are slated for installation in the upper clay layer underlying Site 5. One piezometer each will be installed within both the upper and lower zone of the clay. Water level measurements obtained from each piezometer will be used to calculate the vertical hydraulic gradient across the clay layer which will be used to determine if confining conditions exist in the lower aquifer zone. Water table positions will also be monitored during the pump test to aid in the calculation of the vertical hydraulic conductivity in the upper clay layer.

As depicted in Figure 5-1, it is anticipated that certain sites (i.e., sites where initial Phase I RI data indicate that the site can be proposed for either an accelerated operable unit or a no further action or monitoring only record of decision) will have confirmation monitoring well installed around them at the end of the Phase I RI. Confirmation monitoring wells will be constructed in the manner discussed previously except for sites where a monitoring only ROD will be proposed. In this latter case monitoring wells will be constructed of either type 316 stainless steel or other materials suitable for the groundwater environment.

5.3.1.3 PCPT/<u>In-Situ</u> Groundwater Sampling A PCPT exploration program is scheduled for 12 of the 13 sites located on NAS Whiting Field to provide cost effective stratigraphic data downgradient of each site. PCPT explorations will be done in accordance with ASTM Designation: D3441-86 Standard Test Method for Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soils.

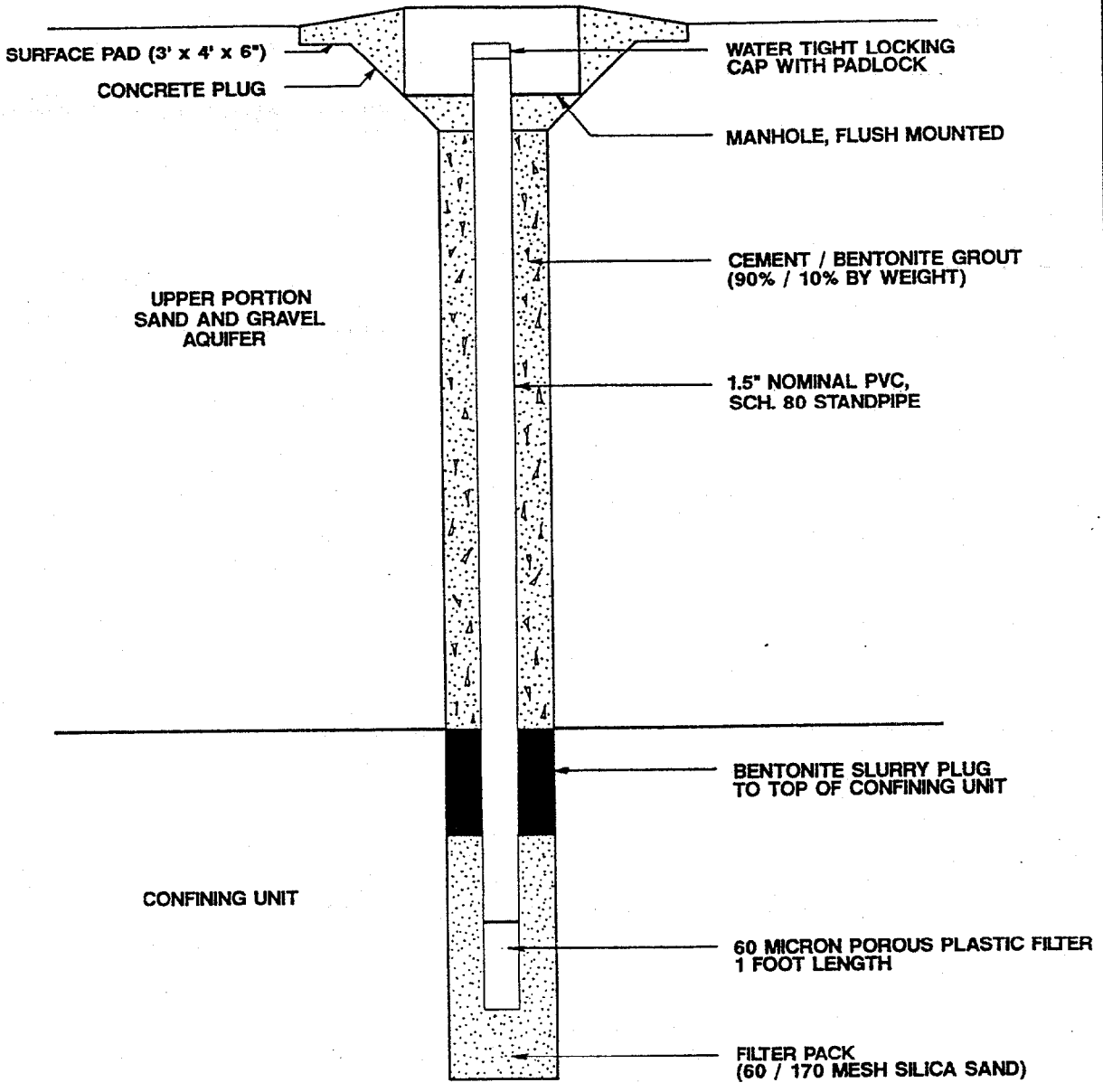
Piezocone soundings at each site will be conducted to a depth corresponding to the lower clay layer (ca. -25 feet NGVD). Measurements of end-bearings resistance, frictional resistance, and pore pressure will be made throughout the sounding to define the geology and locate the water table(s). In addition, inclinometer readings shall be made throughout depth to increase the reliability of the exploration, as it provides a record of the verticality of the rods during penetration.

Analog signals from the four sensors will be digitized for data logging. Analysis of digital data will be done in the field through a commercially available data acquisition system with appropriate software supplied by the subcontractor. Graphical and tabular presentation of PCPT data shall include the following:

1) - measured cone resistance, q_c vs. depth
   q_c = bearing force/bearing area

   - measured sleeve friction stress, f_s vs. depth
   f_s = frictional sleeve force/surface area of sleeve

   - measured pore pressure, u_t vs. depth



NOT TO SCALE

FIGURE 5-3

PIEZOMETER INSTALLATION DETAIL

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

2) - corrected total cone resistance, q_t vs. depth
- corrected total sleeve friction, f_t vs. depth
- measured pore pressure, u_t vs. depth
(including equilibrium water pressures, u_o)

- friction ratio, $(f_t/q_t) \times 100$ vs. depth

- differential pore pressure ratio,
$(u_t - u_o)/(q_t - u_o)$ vs. depth

Stratigraphic information and pore pressure distribution data shall be used to ascertain the following:

- hydrogeologic setting,
- position of upper clay layers or lenses which may be retarding vertical migration of contaminants,
- position, depth, and thickness of perched groundwater body, and
- groundwater sampling elevations for *in-situ* sampling program.

Raw data from at least one PCPT exploration per site grouping will be evaluated by a senior geophysicist using existing boring logs and compared to its corresponding computer generated analysis. This step is intended to assure the quality of information derived from the PCPT explorations. Should questions arise to the validity of the computer data, raw data from all PCPT explorations will be evaluated by the senior geophysicist.

Upon completion of the PCPT exploration program at each site, groundwater samples will be obtained downgradient of each site utilizing the *in-situ* BAT System technique. Should data from the PCPT exploration program indicate that a perched groundwater body or upper aquifer zone exists, a groundwater sample shall be obtained from this water bearing zone. In addition, a groundwater sample will be obtained within the lower portion of the lower aquifer zone. Should no confining or semi-confining layer exist, only one sample will be obtained within the lower portion of the lower aquifer zone. Table 5-3 presents a summary of the PCPT/*in-situ* groundwater sampling program for each site. This table assumes that an upper aquifer zone exists and, therefore, presents the maximum number of samples to be obtained.

Groundwater samples collected during the *in-situ* sampling program will be shipped overnight to the analytical laboratory for the analysis of target compound list volatile organics and target analyte list metals around landfills (see Table 3-8). In that the *in-situ* sampling program is intended as a screening technique for ascertaining the presence or absence of groundwater contamination, samples will be analyzed in accordance with data quality Level C QC objectives.

Due to the depths involved and the potential for the existence of a confining or semi-confining clay layer, the PCPT/*in-situ* sampling exploration will be conducted in two steps. Initially the piezocone penetrometer test will be

TABLE 5-3
IN-SITU GROUNDWATER SAMPLES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	SAMPLE NUMBER	APPROXIMATE SAMPLING DEPTH (FEET BLS)	TOTAL PCPT DEPTH (FEET BLS)
1	WHF-1-WP-01-01	85	170
	WHF-1-WP-01-02	170	
3	WHF-3-WP-01-01	110	200
	WHF-3-WP-01-02	200	
	WHF-3-WP-02-01	110	200
	WHF-3-WP-02-02	200	
9	WHF-9-WP-01-01	75	150
10	WHF-10-WP-01-01	75	150
	WHF-10-WP-02-01	75	150
	WHF-10-WP-02-02	150	
11	WHF-11-WP-01-01	50	150
12	WHF-12-WP-01-01	90	
	WHF-12-WP-01-02	160	160
13	WHF-13-WP-01-01	80	130
	WHF-13-WP-02-01	80	130
	WHF-13-WP-02-02	130	
14	WHF-14-WP-01-01	90	160
	WHF-14-WP-01-02	160	
15	WHF-15-WP-01-01	?	100
	WHF-15-WP-01-02	100	
	WHF-15-WP-02-01	?	100
	WHF-15-WP-02-02	100	
16	WHF-16-WP-01-01	?	80
	WHF-16-WP-01-02	80	
	WHF-16-WP-02-01	?	80
	WHF-16-WP-02-02	80	
17	WHF-17-WP-01-01	?	200
18	WHF-18-WP-01-01	100	200
	WHF-18-WP-01-02	200	

NOTE: Total PCPT exploration: 2,570 feet
Total In-situ groundwater samples: 29

BLS - Below Land Surface
PCPT - Piezocone Penetrometer Test

conducted to a vertical position just above the confining unit. The approximate depth to this unit will be determined from the downhole geophysical logs and borings logs from both new and existing monitoring wells. Should existing logs indicate that no significant confining unit exists, the initial PCPT will be conducted to a depth of approximately 100 feet BLS.

If scheduled, a BAT System groundwater sample will be obtained at this depth. Upon extraction of the BAT System, a pilot hole will be augured to the desired depth and a 3-inch ID PVC casing will be installed. If a confining unit exist the casing shall be installed within the clay to prevent cross-contamination of the aquifer units. Exact depths for PVC casing installation shall be determined from conditions encountered in the field.

Step two in this process shall consist of completing the PCPT exploration and collecting the lower aquifer zone *in-situ* groundwater samples. After completion of the cased pilot hole, the piezocone shall be inserted to the bottom of the casing. The casing will be filled with silica sand to prevent rod deformation and then the PCPT shall be conducted to completion depth. Upon extraction of the piezocone penetrometer, the BAT system shall be driven to the desired depth in the lower aquifer zone and the sample collected.

Upon completion of the exploration the cased pilot hole shall be reamed out and the borehole tremie grouted with a cement/bentonite mixture to the surface.

5.3.1.4 **Well Elevation/Location Survey** At the end of the installation of Phase I monitoring wells, an initial elevation survey will be conducted. New monitoring well measuring point elevations will be tied in with existing measurements within site groupings. Details for undertaking the initial measurement point elevation survey are presented in the Site - Specific Quality Assurance Plan Addendum (Volume II, Appendix C).

Subsequent to Phase II monitoring well installation, a well elevation and location survey will be conducted by a registered land surveyor. The spatial position, elevation of well measuring point, and ground elevation will be surveyed for each monitoring well, observation well, and piezometer installed at NAS Whiting Field's. Spatial coordinates for wells and piezometers will be referenced to NAS Whiting Field grid coordinate system. All elevations will be based on NGVD of 1929.

Third order accuracy will be required for the survey. Horizontal locations will be located to an accuracy of 0.1 feet and elevations will be surveyed to an accuracy of 0.01 feet.

5.3.1.5 **Aquifer Hydraulic Properties** In order to characterize the hydraulic properties of the sand and gravel aquifer at NAS Whiting Field, both a pumping test and slug tests of individual wells will be undertaken.

In August 1985, Geraghty & Miller (1985) attempted a pumping test using production well W-S2. Due to complications, only a production well yield test was conducted. Based upon the specific capacity of well W-S2, Geraghty & Miller (1985) estimated the transmissivity within the lower zone of the sand and gravel aquifer to be 30,000 gallons per day per foot. Drawdowns of 1.29 to 1.48 feet

were noted in monitoring wells WHF-5-1 through WHF-5-4, which are screened just above (155 to 173 feet BLS) what is believed to be the upper clay layer. This indicates leakage through the clay layer is taking place in the vicinity of production well W-S2.

In that only a partial knowledge of the sand and gravel aquifer hydraulic characteristics was gained from the Geraghty & Miller yield test, a more extensive pumping test is to be undertaken during the Phase I RI field investigation. The intent of the pumping test will be to determine the hydraulic properties in both the upper and lower zones of the sand and gravel aquifer along with that of the semi-confining unit.

A 14-day pump test is scheduled at NAS Whiting Field to ascertain the hydraulic properties in both the upper and lower zones within the sand and gravel aquifer. Production well W-S2 is to be used as the pump well. Prior to the pump test, production wells W-S2 and W-W3 will be off line for 4 days to allow for recovery of the potentiometric surface in the vicinity of W-S2.

The pump test at production well W-S2 will be run in conjunction with the Phase I source area investigation (see Section 3.7) also slated for this well. As such the 14-day period for pumping will assure that sufficient time is available to stabilize contaminant migration to the production well and to collect the eight *in-situ* groundwater samples. The off/on time periods for pumping also parallels the typical operation period for production well W-S2, i.e., 10 days on and 5 days off line.

Wells to be monitored during the pump test shall include monitoring well WHF-5-1, observation wells WHF-5-OW-1 and WHF-5-OW-2, and piezometers WHF-5-PZ-1 and WHF-5-PZ-2. The approximate locations of the wells and piezometers to be monitored during the pumping test are presented on Figure 5-4, Appendix A. During the pumping test, the two new observation wells and piezometers will be temporarily equipped with individual pressure transducers coupled to an eight-channel data logger. Potentiometric surface measurements from monitoring well WHF-5-1 shall be obtained manually using an electric tape. In addition, production well discharge will be monitored with the existing orifice weir installed in-line on the production well discharge pipe. Details on undertaking the pumping test are presented in the Site-Specific Quality Assurance Plan Addendum (Volume II, Appendix C).

Due to an expected variability in stratigraphy underlying NAS Whiting Field, single-hole permeability tests (slug tests) will be performed on each existing and new monitoring well. Information derived from the slug test program will aid in the delineation of the spatial variability of the hydraulic conductivity within the sand and gravel aquifer. Both rising and falling head slug tests will be performed in each individual well except for wells which are screened across the water table. In this case, only rising head tests will be performed. Data will be analyzed by either the method of Cooper et al. (1967) for confined conditions or the method of Bouwer and Rice (1976) for unconfined conditions.

Calculated values of hydraulic conductivity (K) will be evaluated by means of a two-way analysis of variance to determine if (a) a significant difference in K exists laterally in the sand and gravel aquifer underlying NAS Whiting Field and

(b) a significant difference in K exists between the upper and lower zones of the sand and gravel aquifer. Comparisons shall be made at the 95 percent significance interval. Should significant differences exist, a Tukey's Test will be run to test for significant differences between individual pairs of sample means.

Results from the analysis of the slug tests will be used in calculations of the fate and migration of contaminants from existing sources. Information derived from this modeling effort will be used in conjunction with screening remedial alternatives and performing the baseline risk assessment. Details on modeling efforts will be developed upon a clearer understanding of the hydrogeology underlying NAS Whiting Field and presented as part of the Phase II RI Work Plan addendum.

This concludes the Work Plan discussion of methods and supporting rationale for the Phase I RI. Additional information on specific procedures may be found in Volume II - Sampling and Analysis Plan. The following sections present the preliminary activities and site specific exploration programs for the Phase I RI.

5.3.2 Preliminary Activities Preliminary activities associated with the Phase I RI site investigation at NAS Whiting Field include securing subcontractors to perform the PCPT/*in-situ* groundwater sampling program, monitoring well installations, and laboratory services; arranging for the acquisition of necessary permits and other authorizations; conducting a reconnaissance of the sites to determine logistics (i.e., location of exploration, decontamination stations, etc.); and mobilization of equipment and supplies to NAS Whiting Field.

The mobilization subtask consists of field personnel orientation and equipment mobilization, and will be performed at the initiation of the subsurface investigation and sampling program. A field team orientation meeting will be held to familiarize personnel with site history, health and safety requirements, and field procedures.

Equipment mobilization will include the procurement of rentals (if appropriate) and set-up of the following items:

- field office,
- field gas chromatograph (GC),
- sampling equipment,
- health and safety equipment, and
- decontamination materials.

5.3.3 Site-Specific Explorations The site-specific explorations developed for the Phase I RI field program are designed to acquire the data needed to verify the presence of environmental contamination at the NAS Whiting Field sites and to support ongoing FS activities. The field program will also provide a qualitative assessment of geologic and hydrogeologic conditions at NAS Whiting Field.

To provide a framework for hydrogeologic characterization of the various sites at NAS Whiting Field, a review area for each of the 13 sites or clusters of sites was identified. The review area for each site is indicated on the referenced site maps. The site-specific explorations will provide a geologic and

hydrogeologic assessment of the review area as part of the RI field activities and data evaluation. Each review area assessment will include identification of the direction of groundwater movement in the geologic units of concern and an evaluation of contamination.

The following sections present a site specific summary of location, description, and history including results and conclusions from previous investigations. In addition, the site-specific explorations planned for the Phase I RI at each site are presented.

5.3.3.1 Site 1 - Northwest Disposal Area

Site Location. Site 1 covers an area of approximately 5 acres and is located just west of the perimeter patrol road and north of the "E" drainage ditch. This site was used as a general refuse disposal area from the time NAS Whiting Field was established in 1943 until around 1965. The site is in a depressed area which is approximately 10 feet below the perimeter road. The location of the site is shown on Figure 5-5.

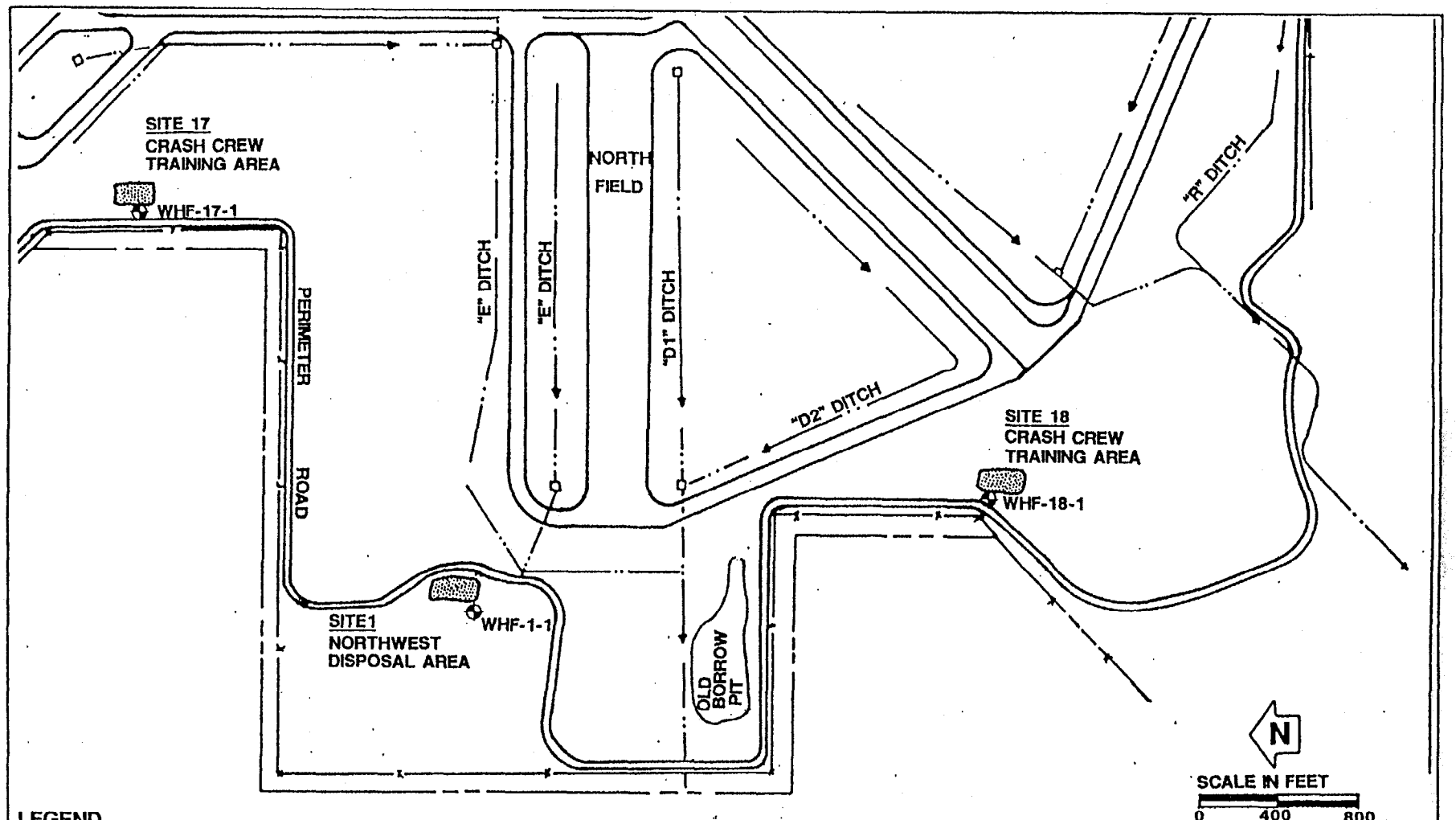
Site Description. The site is currently covered with rows of small pine trees approximately 5 to 6 feet in height. No buried wastes are exposed at the site, nor are there other indications of past waste disposal operations.

Due to the site's location, in a depression, much of the precipitation infiltrates directly into the soil. Any surface drainage from the site occurs along the southwestern edge and is ultimately intercepted by the concrete-lined "E" ditch just to the south. This ditch drains into Clear Creek, which is located approximately 1,300 feet west of the disposal area. Clear Creek, in turn, drains further south into the Blackwater River.

Site History. Waste disposed at this site included primarily general refuse and wastes associated with the operation and maintenance of aircraft (paint, paint thinner, solvents, waste oils, and hydraulic fluid). Access to the site was uncontrolled and the IAS determined that there were no records on the types of wastes disposed at Site 1. Table 5-4 summarizes the types and quantities of wastes potentially disposed at Site 1.

As part of the Verification Study, Geraghty & Miller (1986) installed a monitoring well (WHF-1-1) to a depth of 122 feet adjacent to and southwest of the site (see Figure 5-5). A 13-foot thick clay unit was described at this site at a depth of 95 feet BLS. Depth to the groundwater surface at this location was about 66 feet BLS. The lithologic log for monitoring well WHF-1-1 is provided in Appendix B. It is anticipated that the location of this monitoring well is not downgradient of Site 1.

A groundwater sample was collected from monitoring well WHF-1-1 and a surface water sample was collected from Clear Creek, downstream of the site. Both samples were analyzed for the USEPA list of priority pollutants as listed in Table 5-5. The laboratory results for both water samples did not detect any contaminants except for trace levels of lead (Clear Creek, 1 ug/l, and well WHF-1-1, 8 ug/l). These levels are well below the



LEGEND

WHF-1-1 EXISTING MONITORING WELL

FIGURE 5-5

SITE PLAN
SITES 1, 17, & 18

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

TABLE 5-4
WASTES POTENTIALLY DISPOSED AT SITE 1, NORTHWEST DISPOSAL AREA
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED* TOTAL QUANTITY	COMMENTS
General refuse	Naval Air Station	1943 to 1965	--	Site 1 was a secondary disposal area during this period (Site 16 was the primary).
Paint stripping wastewater	AIMD Paint Shop	1943 to 1965	200,000 gallons	Paint stripping wastes diluted with copious amounts of rinse water.
Waste paints and thinners	Operations Maintenance Division	1943 to 1960	300 gallons	**After 1960, this waste went to the Fire Fighting Training Area.
Solvents (MEK, toluene, xylene, PD-680)	Air Frame Shop, Aircraft Maintenance, Transportation Division Shop	1943 to 1965	20,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division, Transportation Division Shop	1943 to 1965	40,000 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: * - Assumes 3/10 of the total maximum yearly waste generated was disposed at Site 1, 1/5 disposed at Site 11, and 1/2 disposed at Site 16; estimates rounded to one significant figure.

** - Maximum quantity disposed at this site or Fire Fighting Training Area

TABLE 5-5
LIST OF PRIORITY POLLUTANTS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

VOLATILES	DETECTION LIMIT (ug/l)
Acrolein	100
Acrylonitrile	100
Benzene	1
Bis(chloromethyl)ether	5
Bromoform	5
Carbon Tetrachloride	3
Chlorobenzene	1
Chlorodibromomethane	5
Chloroethane	5
2-Chloroethylvinyl Ether	5
Chloroform	5
Dichlorobromomethane	5
Dichlorodifluoromethane	5
1,1-Dichloroethane	5
1-2-Dichloroethane	3
1,1-Dichloroethylene	5
1,2-Dichloropropane	5
1,2-Dichloropropylene	5
Ethylbenzene	1
Methyl Bromide	5
Methyl Chloride	5
Methylene Chloride	5
1,1,2,2-Tetrachloroethane	5
Tetrachloroethylene	3
Toluene	1
1,2-trans-Dichloroethylene	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
Trichloroethylene	1
Trichlorofluoromethane	5
Vinyl Chloride	1

TABLE 5-5 (cont.)
LIST OF PRIORITY POLLUTANTS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

ACID EXTRACTABLES	DETECTION LIMIT (ug/l)
2-Chlorophenol	15
2,4-Dichlorophenol	10
2,4-Dimethylphenol	5
4,6-Dinitro-o-Cresol	50
2,4-Dinitrophenol	30
2-Nitrophenol	10
4-Nitrophenol	20
p-Chloro-m-Cresol	25
Pentachlorophenol	30
Phenol	5
2,4,6-Trichlorophenol	20

BASE NEUTRAL EXTRACTABLES	DETECTION LIMIT (ug/l)
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzidine	10
Benzo(a)anthracene	10
Benzo(a)pyrene	10
3,4-Benzofluoranthene	10
Benzo(ghi)perylene	10
Benzo(k)fluoranthane	10
Bis(2-chloroethyl)ether	10
4-Bromophenyl Phenyl ether	10
Butylbenzyl Phthalate	10
2-Chloronaphthalene	10
4-Chlorophenyl Phenyl ether	10
Chrysene	10
Dibenzo(a,h)anthracene	25
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
3,3-Dichlorobenzidene	10
Diethylphthalate	10
Dimethylphthalate	10
Di-n-Butyl Phthalate	10
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
Di-n-Octyl-Phthalate	10
1,2-Diphenylhydrazine	10
Fluoranthene	10

TABLE 5-5 (cont.)
LIST OF PRIORITY POLLUTANTS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

BASE NEUTRAL EXTRACTABLES (Cont.)	DETECTION LIMIT (ug/l)
Fluorene	10
Hexachlorobenzene	10
Hexachlorobutadiene	10
Hexachlorocyclopentadiene	10
Hexachloroethane	10
Indeno(1,2,3-cd)pyrene	10
Isophorone	10
Naphthalene	10
Nitrobenzene	10
N-Nitrosodimethylamine	10
N-Nitrosodi-n-propylanmine	10
N-Nitrosodiphenylamine	10
Phenanthrene	10
Pyrene	10
1,2,4-Trichlorobenzene	10

PESTICIDES	DETECTION LIMIT (ug/l)
Malathion	1
Aldrin	0.01
a-BHC	0.01
b-BHC	0.01
g-BHC	0.01
d-BHC	0.01
Chlordane	0.01
4,4'-DDT	0.01
4,4-DDE	0.01
4,4-DDD	0.01
Dieldrin	0.01
a-Endosulfan I	0.01
b-Endosulfan II	0.01
Endosulfan Sulfate	0.01
Endrin Aldehyde	0.07
Heptachlor	0.03
Heptachlor Epoxide	0.01
PCB-1242	0.01
PCB-1254	0.2
PCB-1221	0.2
PCB-1232	0.2
PCB-1248	0.2
PCB-1260	0.2
PCB-1016	0.2
Toxaphene	1
Kepone	0.35

TABLE 5-5 (cont.)
LIST OF PRIORITY POLLUTANTS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

HERBICIDES	DETECTION LIMIT (ug/l)
2,4-D	2
2,4,5-TP Silvex	20

METALS AND CYANIDE

Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc
Cyanide

State of Florida's primary drinking water standard (Section 17-550.310, FAC) of 50 ug/l.

Based on the results of the Verification Study and the IAS the following conclusions can be made for Site 1.

1. Site 1 received significant quantities of wastes from NAS Whiting Field operations for a period of 22 years (1943 to 1965).

2. The geology beneath the site consists of fine to coarse sands to a depth of 95 feet BLS at which point a clay layer exists which is 13 feet thick.

3. Groundwater flow direction has not been defined; however, monitoring well WHF-1-1 is not anticipated to be located downgradient of the site.

4. No priority pollutant list compounds were detected in a groundwater sample collected from WHF-1-1 or surface water sample collected from Clear Creek downgradient of the site.

Based on these conclusions Site 1 will be included in a Phase I RI to verify the presence or a absence of contamination and groundwater flow direction.

Phase I Explorations Program

The Phase I exploration program for Site 1 will include the following activities:

- downhole geophysical logging of monitoring well WHF-1-1,
- PCPT/*in-situ* groundwater sampling and analysis, and
- slug test in existing wells.

In addition, the following Phase II explorations may be undertaken should initial data indicate groundwater contamination:

- plume delineation,
- source area soil sampling, and
- potential receptors survey.

Figure 5-6 shows the approximate locations of the explorations at Site 1. Downhole geophysical logging will be conducted in monitoring well WHF-1-1 to confirm the presence of a clay unit at a depth of 95 feet BLS and start the data base for ground truthing the use of borehole geophysics at NAS Whiting Field. Subsequent to downhole geophysical logging WHF-1-1, water level observations will be conducted on WHF-1-1, WHF-17-1, and WHF-18-1 to approximate groundwater flow direction at Site 1. An interpretative groundwater flow pattern is presented on Figure 5-7. The synoptic round of groundwater level observations will help to confirm the groundwater flow direction presented on Figure 5-7.

As seen from Figure 5-7, existing monitoring well WHF-1-1 is not anticipated to be downgradient of Site 1. Therefore, one PCPT exploration is proposed for Site 1 at the position indicated in Figure 5-7. The synoptic round of water level

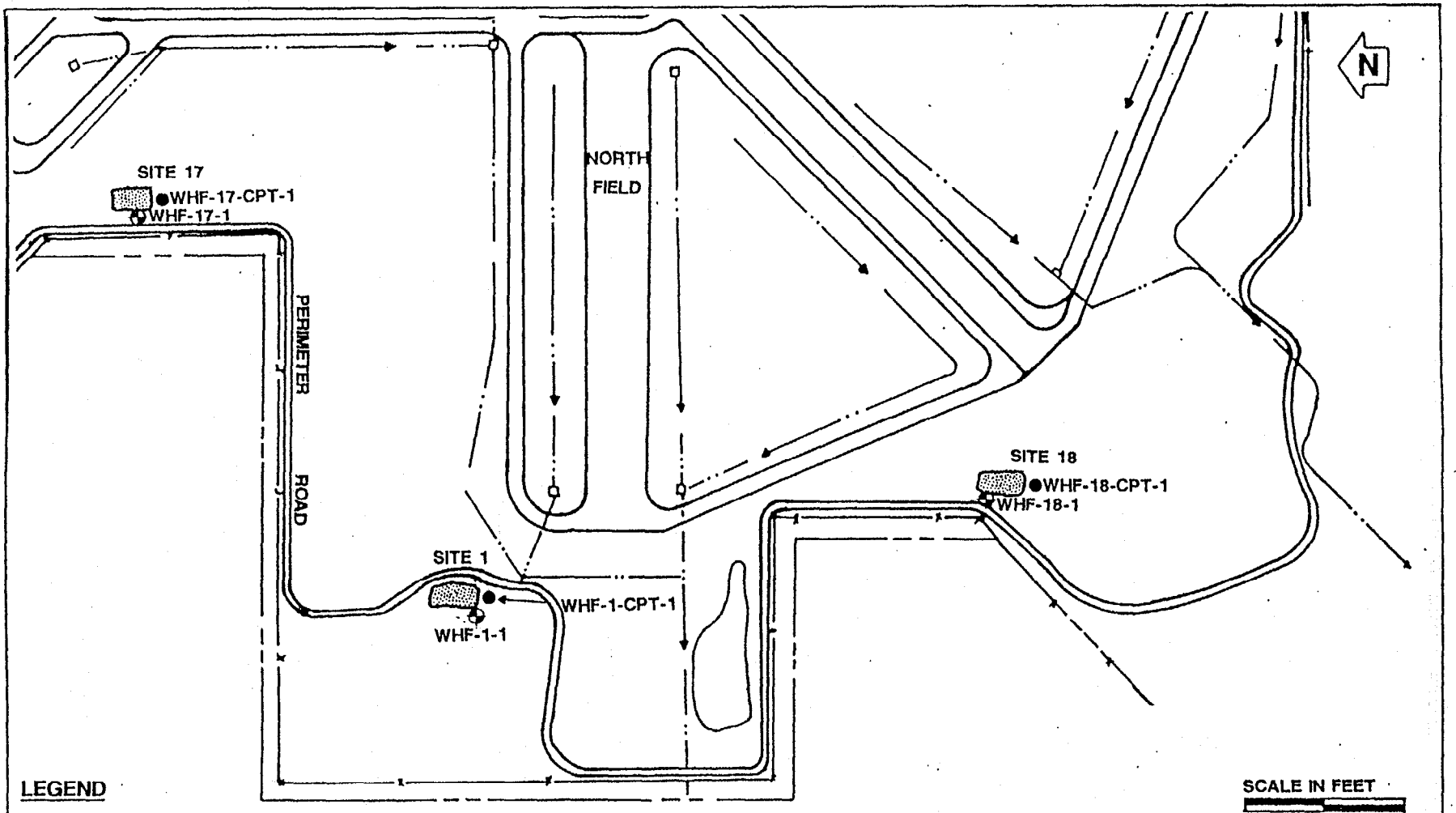
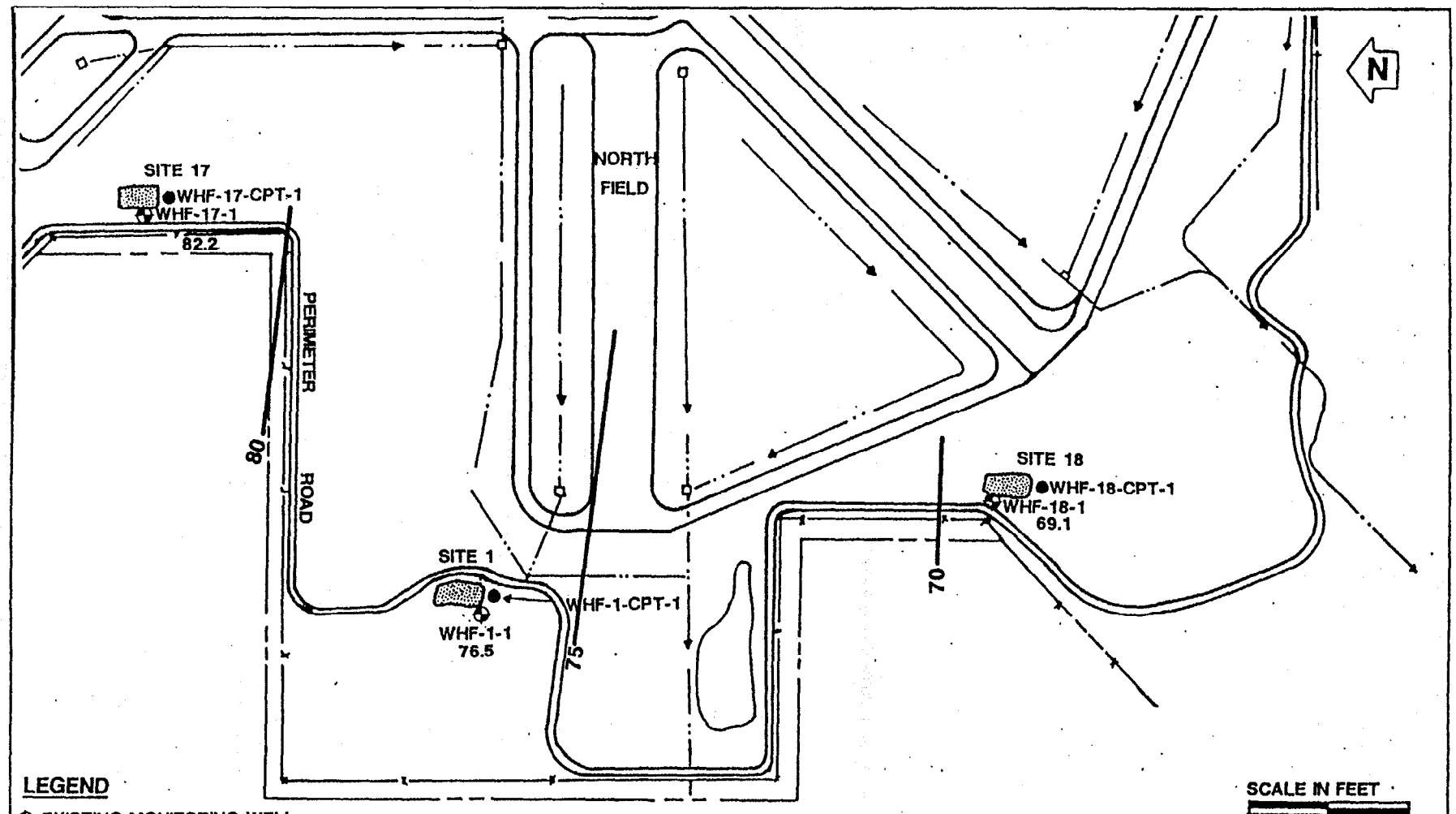


FIGURE 5-6

SITES 1, 17, & 18
EXPLORATION PROGRAM

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA



SOURCE: GERAGHTY AND MILLER (1986)

FIGURE 5-7

SITES 1, 17 & 18
POTENTIOMETRIC SURFACE
SAND AND GRAVEL AQUIFER

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

measurement will be obtained from WHF-1-1 and other wells in the area to assist in the final placement of the PCPT explorations. The PCPT exploration will develop additional information on groundwater flow direction and the presence and elevation of the clay layer downgradient of Site 1. The results of this exploration plus the results from the downhole geophysical log of the site monitoring well will be used to locate a downgradient location for collection of an upper aquifer zone groundwater sample and the approximate depth at which the sample should be taken. An *in-situ* groundwater sample will be collected in the upper aquifer and lower aquifer zones. The approximate depths anticipated are specified in Table 5-2.
Groundwater samples collected during this program will be analyzed for TCL volatile organics and metals. Additional information on the laboratory analytical program is presented in Section 5.4.

5.3.3.2 Site 3 - Underground Waste Solvent Storage Area

Site Location. Site 3 is located approximately 90 feet south of Building 2941 and just north of the Paint Locker, Building 2987. The location of the site is shown on Figure 5-8.

Site History. Two 500-gallon underground metal tanks were used from 1980 to April of 1984 for the storage of waste solvents and residue generated from paint-stripping operations conducted at Building 2941. Wastes from the tanks were periodically pumped out for off Navy property disposal.

In April of 1984, use of the underground tanks was discontinued and the two tanks were removed from the site. During excavation operations at the site, one of the tanks was punctured by a backhoe, resulting in the spillage of approximately 120 gallons of waste solvents onto the ground. Cleanup operations conducted at the site resulted in the recovery of approximately 50 gallons of the waste solvent. In addition, approximately 6 cubic yards of contaminated soil were removed from the site and taken off Navy property for disposal. Examination of the tanks after their removal revealed holes up to 0.5 inch in diameter. The holes were apparently caused by the waste solvents corroding through the metal tanks. The extent to which the paint-stripping wastes leaked from the tanks is unknown. A sample of sludge material that had accumulated in the tanks was collected for chemical analysis prior to the tank excavation operations. Table 2-2 summarizes the analytical results for this sample.

During the Verification Study in 1986, a soil boring was drilled at the spill site and split-spoon subsurface soil samples were collected at 5-foot intervals to a total depth of 25 feet. Based on a description of the samples collected, the soils to a depth of 20 feet consist primarily of red clay with minor amounts of sand. Within the interval of 20 to 25 feet, the lithology changed to a fine- to medium-grained white sand.

Two monitoring wells (WHF-3-1 and WHF-3-2) were installed about 50 feet east and 60 feet west of the site, respectively. These wells tap the lower zone of the sand and gravel aquifer at a depth of 152 feet. The locations of the monitoring wells are shown in Figure 5-8. The lithologic logs for these wells are provided in Appendix B. Water levels in both wells were found to be more than 100 feet BLS.

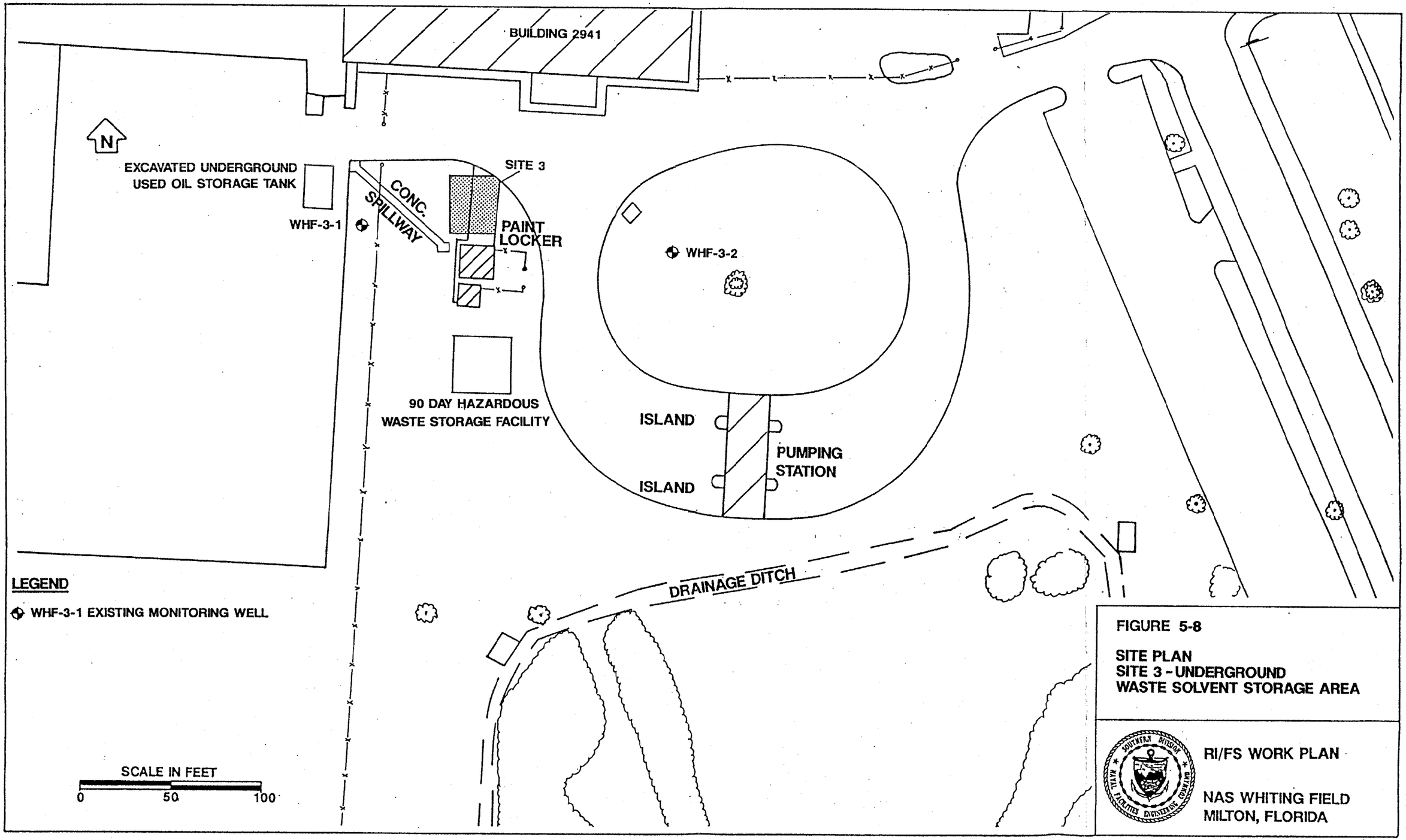


FIGURE 5-8

SITE PLAN
SITE 3 - UNDERGROUND
WASTE SOLVENT STORAGE AREA

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

00181 B032

Six soil samples were collected at Site 3 and analyzed for volatile organic compounds (VOCs), benzene, toluene and xylene (BTX), methyl isobutyl ketone, phenols, and metals (including chromium, lead, cadmium, zinc, arsenic, barium, mercury, selenium, and silver).

No organic chemicals were detected in the soil sample to a depth of 25 feet BLS except for phenols (0.61 ug/l) at the surface. Geraghty & Miller (1986) attributed this to the vegetative matter found in the uppermost part of the soil. Of the nine metals analyzed for, five were detected in varying concentrations. The results of the metal analyses for soils from Site 3 are summarized in Table 5-6.

In addition, the two monitoring wells, WHF-3-1 and WHF-3-2, were also sampled. Groundwater samples were analyzed for priority pollutants. Except for trace concentrations of arsenic and lead (below FDER's drinking-water standards), no priority pollutants were detected in the groundwater collected from WHF-3-2. However, in monitoring well WHF-3-1, three chlorinated hydrocarbons were detected: 1,1,1-trichloroethane at 13 ug/l, 1,1,2-trichloroethane at 111 ug/l, and trichloroethene at 18 ug/l. Based on the these findings, the groundwater at Site 3 does not appear to be affected by metal contaminants. The groundwater west of the spill site, however, has been impacted by VOCs.

Based on the results of waste solvents during the IAS and Verification Study the following conclusions may be made for Site 3.

1. The Site 3 waste solvent underground storage tanks received significant quantities of waste solvents during the period from 1980 to April 1984 when the tanks were removed.

2. During the tank removal operations one tank was punctured and 120 gallons of waste solvent were spilled, of which approximately 50 gallons were recovered.

3. Examination of the tanks subsequent to removal revealed holes of up to 0.5 inches in diameter.

4. The geology beneath the site consists of 22 feet of sandy clay underlain by fine to coarse sand to a depth of 110 feet BLS, which is underlain by a clay layer 20 feet thick.

5. Groundwater is present at 100 feet BLS and flow direction is anticipated to be westerly but has not been accurately defined.

6. Sludge samples collected and analyzed from the tanks revealed high levels of organic solvents and metals.

7. Surface soils contain elevated levels of zinc, chromium and cadmium.

8. Groundwater west of Site 3 contains 1,1,1-trichloroethane (13 ug/l), 1,1,2-trichloroethane (111 ug/l), and trichloroethene (18 ug/l).

TABLE 5-6
METALS ANALYSES FROM SITE 3 SOIL BORINGS
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SAMPLE INTERVAL (feet BLS)	CONCENTRATIONS, mg/kg				
	ZINC	SILVER	CHROMIUM	CADMIUM	MERCURY
0-0	586	0.92	43	0.28	0.20
5-7	2.6	1.85	29	<0.008	0.15
10-12	<0.8	1.74	24	<0.008	0.11
15-17	<0.8	0.98	7.1	<0.008	<0.01
20-22	<0.8	1.09	<1	<0.008	0.16
25-27	<0.8	0.75	<1	<0.008	0.22

Source: Geraghty & Miller (1986)

NOTE: mg/kg - milligrams per kilogram
BLS - below land surface

9. Groundwater east of the site contains no elevated levels of priority pollutant compounds.

Based on the conclusions presented above, Site 3 will be included in the Phase I Remedial Investigation.

Phase I Explorations Program

The exploration program at Site 3 will consist of the following activities:

- downhole geophysical logging of monitoring wells WHF-3-1 and WHF-3-2,
- two PCPT/*in-situ* groundwater sampling explorations,
- installation of monitoring well WHF-3-3, and
- slug tests in new and existing wells.

In addition the following Phase II RI field investigation subtasks are anticipated:

- plume delineation and
- source area soil sampling.

A further discussion of Phase II RI subtasks is presented in Section 5.3.7.

Figure 5-9 shows the approximate locations of the explorations at Site 3. Downhole geophysical logging will be conducted in monitoring wells WHF-3-1 and WHF-3-2 to confirm the lithologic boring logs and determine the location of WHF-3-3 and PCPT explorations.

To aid in the determination of lower aquifer zone groundwater flow direction, monitoring well WHF-3-3 will be installed. The anticipated location of this well is indicated on Figure 5-9. The depth of this monitoring well is anticipated to be approximately 150 feet BLS, which corresponds to the screened interval for monitoring wells WHF-3-1 and WHF-3-2. After the installation and development of monitoring well WHF-3-3, the measuring point elevation for the three wells will be surveyed by site personnel. This preliminary survey will be used to ascertain depth to potentiometric surface to plot groundwater flow direction underneath Site 3.

Based upon the results of downhole geophysical logging and determination of groundwater flow direction, the two proposed PCPT/*in-situ* groundwater explorations will be sited. The first exploration (WHF-3-CPT-1) is estimated to be located to the south of monitoring well WHF-3-1 (see Figure 3-9) and is anticipated to be downgradient of the excavated waste oil tank. The second exploration, WHF-3-CPT-2 is located within the area where the two waste solvent tanks were removed. The PCPT explorations will provide information about the lithology and groundwater elevation downgradient of Site 3. The PCPT data, when evaluated in conjunction with the data from previous investigations (i.e., downhole geophysical logging and the boring log for monitoring well WHF-3-3) will help determine the optimum location for BAT System *in-situ* groundwater sampling.

Immediately following the PCPT explorations, *in-situ* groundwater samples will be obtained in the same two general areas. Should PCPT data indicate a perched or

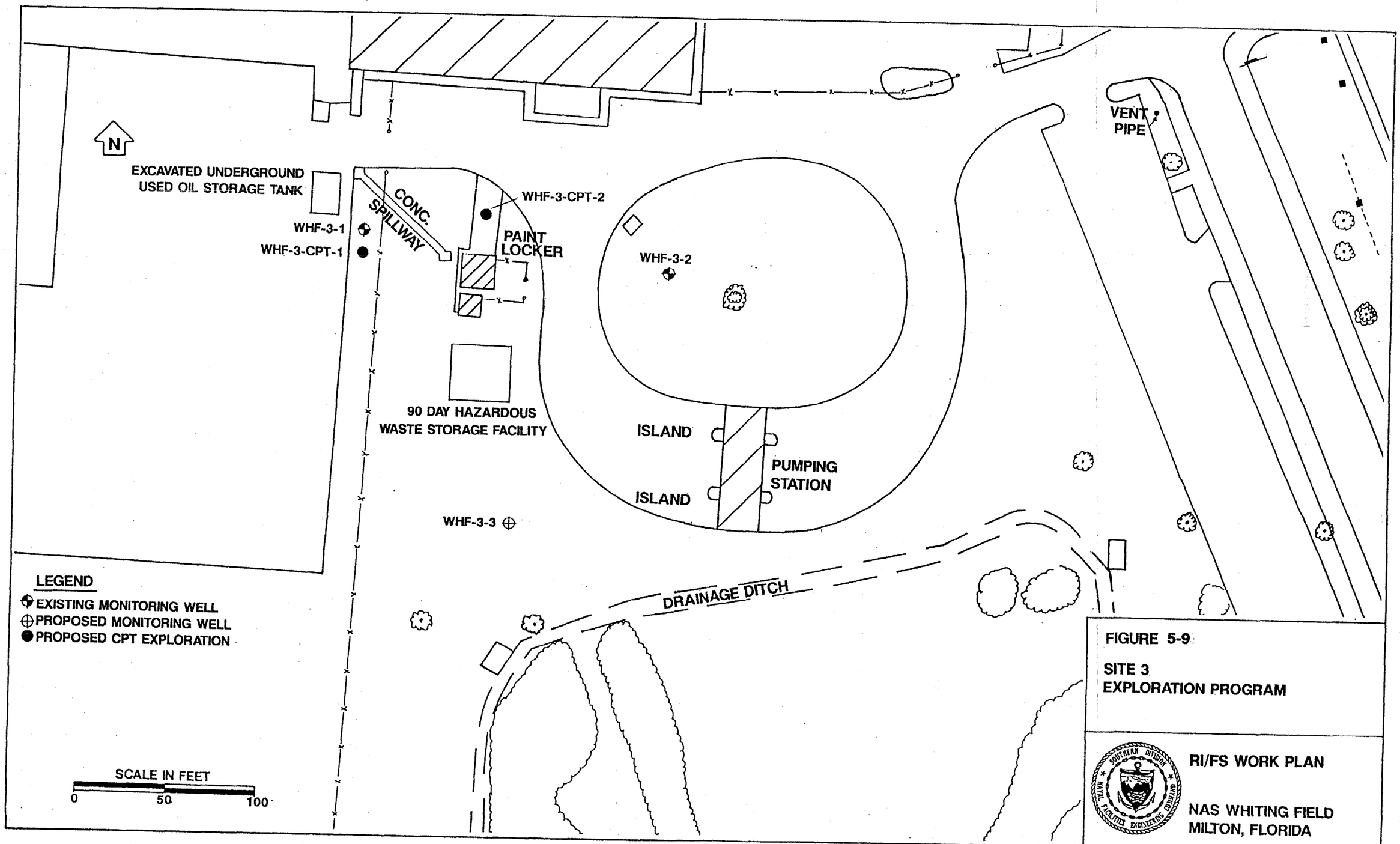


FIGURE 5-9

SITE 3
EXPLORATION PROGRAM

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

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upper unconfined groundwater body, an *in-situ* groundwater sample will be obtained in this zone. In addition, a lower zone sample will be collected at position WHF-3-CPT-2. No lower zone sample will be obtained from WHF-3-CPT-1 due to its proximity to monitoring well WHF-3-1. Samples will be shipped to the analytical laboratory for the analysis of TCL volatile organics. Specific information on the laboratory analytical program is presented on Section 5.3.4.

5.3.3.3 Site 4 - North AVGAS Tank Sludge Disposal Area

Site Location. Site 4 is located north of the Tow Lane on the North Field. The location of the site is shown on Figure 5-10.

Site Description. The area is currently grass covered with no visible evidence of contamination. Surface drainage from the relatively flat site most likely discharges to the "P" drainage ditch, which is located near the southeast corner of the site. The "P" ditch ultimately drains to Big Coldwater Creek, which is approximately 2.6 miles east of the site. Water supply well W-N4 is located approximately 1,200 feet southeast of the site.

Site History. Site 4 contains nine 23,700-gallon underground steel tanks of which eight were used for AVGAS storage. These eight AVGAS storage tanks are labeled 1467, A, B, C, D, E, F, and G. The tank farm covers an area of approximately 2.5 acres and is surrounded by a fence. The tanks date back to 1943 when NAS Whiting Field first began operations. The past use of the ninth tank, "H", is not known but presently it is used for water contaminated jet fuel storage.

Approximately every 4 years, the tanks required cleaning to remove the sludge material which settled on the bottoms of the tanks. Cleaning operations consisted of a workman entering the tanks and removing the accumulated sludge. The sludge material, which contained tetraethyl lead, was then buried in the area immediately adjacent to the tank being cleaned. A hand shovel was used to dig a shallow hole into which the sludge was placed and then covered over. Reportedly, 25 to 30 gallons of sludge were generated per tank during cleaning operations. From 1943 to 1968, the tank bottom sludge was disposed in this manner. The IAS estimated that over this time period, the tanks would have been cleaned an estimated six times. Assuming that 25 to 50 gallons of sludge were disposed per tank during each cleaning, roughly 1,200 to 2,400 gallons of sludge were buried throughout the tank farm in the areas surrounding the tanks.

Six of the tanks have since been abandoned in place and are filled with water. The remaining three tanks (F, G, and H) are presently being used for the storage of gasoline (Tank F), diesel (Tank G), and contaminated jet fuel (Tank H). These tanks and this site are included in the Navy's UST Program to comply with FDER's and USEPA's storage tank regulations.

During the Verification Study, 28 surface soil samples were collected around the nine tanks. Portions of these samples were then mixed together to produce one composite sample. This composite sample was then split into two parts for the analysis of total lead and Extraction Procedure (EP) toxicity lead. Analyses of the two soil samples determined total lead concentrations of 15 and 27 milligrams per kilogram (mg/kg). The results of the EP toxicity tests showed no detectable lead at 0.01 mg/l.

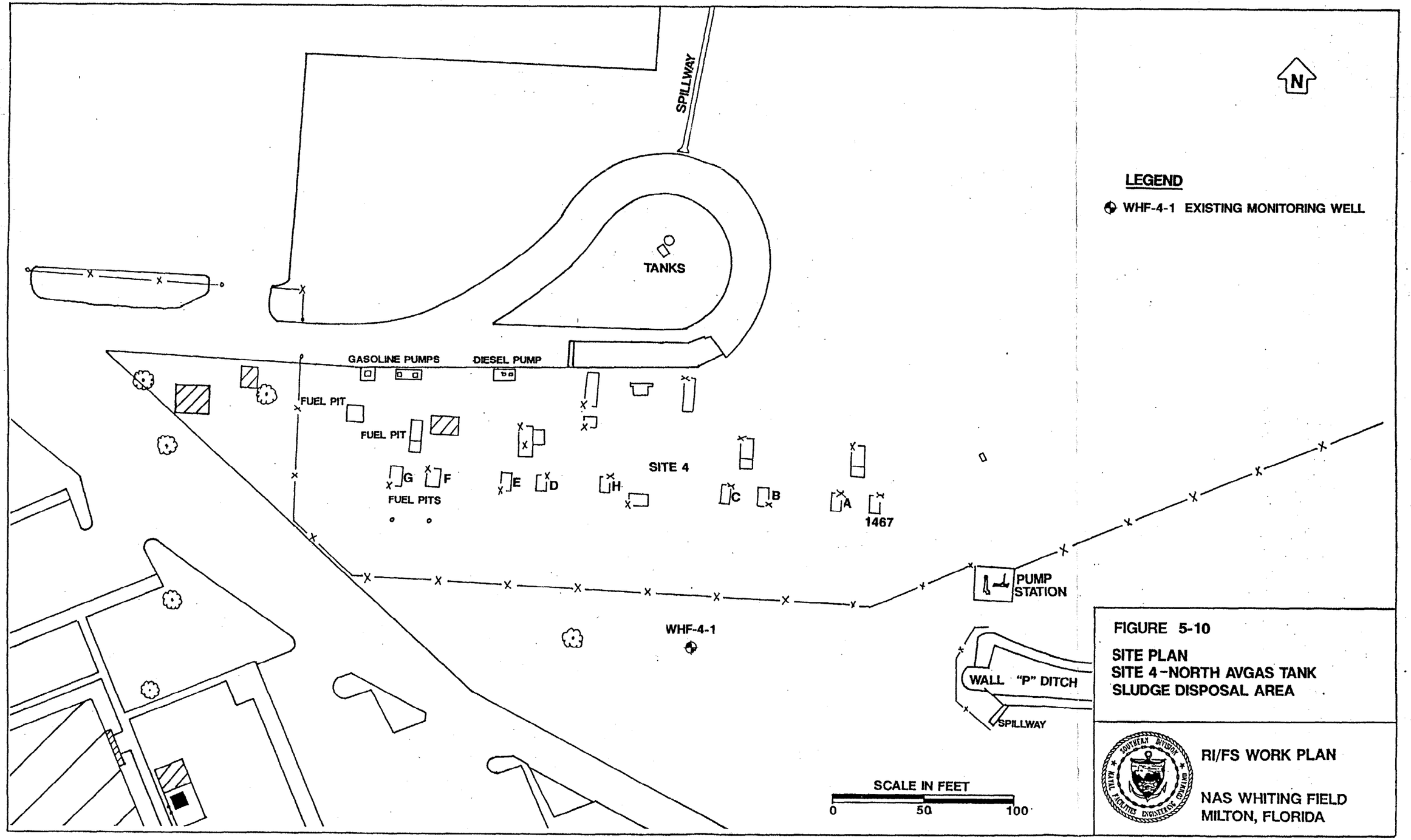

FIGURE 5-10

SITE PLAN
SITE 4 - NORTH AVGAS TANK
SLUDGE DISPOSAL AREA

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

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In addition to the surface soil investigation, monitoring well WHF-4-1 was installed south of and adjacent to the site to a depth of 152 feet (see Figure 5-10). The lithology beneath the site consists of sandy clay to a depth of 30 feet BLS which is underlain by 68 feet of fine to coarse sand. At a depth of 98 feet a clay unit was described as 21 feet thick. Appendix B provides the lithologic log for the well. The depth to the groundwater surface was measured to be about 102 feet BLS.

A groundwater sample obtained from WHF-4-1 was analyzed for the following constituents: BTX, naphthalene, ethylene dibromide (EDB), and lead. The analyses showed benzene at 17 ug/l and toluene at 10 ug/l in the water samples. The benzene concentration exceeds the state's drinking water standard of 1 ug/l (Section 17-550.310, FAC). No standard currently exists for toluene. A trace of lead, significantly below FDER's drinking water standard, was also detected.

Based on an evaluation of the results of the IAS and Verification Study the following conclusions can be made for Site 4.

1. The tank sludge disposal area was used between 1943 and 1968 to bury an estimated 1,200 to 2,400 gallons of tank bottom sludge material from AVGAS underground storage tanks.

2. The geology beneath the site consists of 30 feet of sandy clay underlain by 68 feet of fine to coarse sand below which a 21 feet thick clay layer was described.

3. Groundwater was present at 102 feet below ground surface; however, flow direction has not been determined.

4. Surface soils contain total lead concentrations between 15 and 27 mg/kg and passed the EP toxicity test.

5. Groundwater contains benzene (17 ug/l) and toluene (10 ug/l). The benzene concentrations exceed FDER drinking water standard of 1 ug/l.

6. Site 4 is included in the Navy's UST program to comply with FDER's and USEPA's storage tank regulations.

Based on the above conclusions Site 4 will be investigated further under the Navy's UST program and will not be addressed under this CERCLA/IR RI/FS.

As part of the Navy's UST program the following recommendations (E.C. Jordan, 1989) have been made for the existing tanks.

Interim Compliance. The proposed interim compliance for tank numbers F and G is to drain, inspect, clean, and repair the systems every 3 years because the tanks are greater than 20,000 gallons. No interim compliance is proposed for tanks A through E because of their out of service status.

Proposed Action. The proposed interim compliance measures are to be implemented until such time as the construction standards of the storage systems comply with Chapter 17-61, FAC. Recommendations for updating the storage tank systems are

to remove tank systems 1467-A through 1467-E by a target date of 31 December 1992. However, FDER was to be notified of the out of service status of those tanks by a target data of 31 December 1989. The proposed action for tanks F and G is to replace these tanks with an aboveground storage system with impervious containment and proper protection devices. The target data for completing this action is 31 December 1992.

5.3.3.4 Site 5 - Battery Acid Seepage Pit

Site Location. Site 5 is located west of Building 1478 (Figure 5-11, Appendix A).

Site Description. NAS Whiting Field's south potable supply well (W-S2) is located approximately 110 feet east of the site. Two additional potable wells, the west well (W-W3) and the north well (W-W4), are located approximately 1,200 and 2,100 feet northwest of the site, respectively. All three of these wells are screened into the lower zone of the sand and gravel aquifer.

Site History. From 1964 to 1984, waste battery acid and electrolyte solution from the battery shop, Building 1478, were poured down the drain of a sink that was connected to a dry well. An estimated 180 gallons of waste electrolyte solution were discharged to the dry well annually. The dry well is located just west of the battery shop and consists of a 60-inch diameter concrete culvert pipe set vertically into the ground and filled with lime rock. The disposal operations were discontinued in 1984 when the sink drain was disconnected from the dry well and connected to the sanitary sewer.

On 9 February 1984, the FDER conducted a hazardous waste compliance inspection at NAS Whiting Field which included the battery shop. Shortly thereafter, the FDER issued Warning Notice NWHW 57-1011 to the Navy stating that "the battery electrolyte and/or wastes consisted of hazardous waste constituents and that the disposal of hazardous waste constituted violations of Florida Administrative Code Chapters 17-4 and 17-30, and Chapter 403, Florida Statutes."

In June 1985, Geraghty & Miller, Inc., began a field investigation program at the battery shop site. Four soil-test borings were drilled around the site. Soil samples were collected for chemical analysis. In addition, at each of the boring locations, a 4-inch diameter monitoring well was installed into the middle portion of the sand and gravel aquifer at an interval presumably above a low permeability zone of clayey sediments reported from 155 feet to 173 feet BLS (as recorded in the driller's log for production well W-S2). Monitoring wells WHF-5-2, WHF-5-3, and WHF-5-4 were installed to total depths of 147 feet. Monitoring well WHF-5-1 was installed to a depth of 142 feet. Groundwater samples were collected for analysis.

The results of the detection and monitoring program indicated that the groundwater quality and the soils in the vicinity of the battery shop had not been adversely impacted by metals or other chemicals believed to be associated with past discharges to the dry well. However, benzene in monitoring wells WHF-5-2 and WHF-5-4 was detected at concentrations of 1.0 to 26.0 ug/l. The source of the benzene in the groundwater is not known. Analyses from supply well W-S2

also indicated the presence of a low concentration of trichloroethene (4 ug/l), the source of which is also unknown.

Based on an evaluation of the results from the Verification Study the following conclusions can be made for Site 5.

1. A dry well outside the battery shop annually received 180 gallons of waste electrolyte solution between the years 1964 to 1984.

2. The overburden beneath the site does not contain any chemicals or compounds associated with the battery shop discharges.

3. Groundwater beneath Site 5 contains benzene (1.0 to 26.0 ug/l) and trichloroethene (4 ug/l) that exceed the FDER drinking water criteria of 1.0 ug/l and 3.0 ug/l, respectively.

4. The source of benzene and trichloroethene is not believed to be the battery shop dry well. Thus, the source location is unknown.

Site 5 will not be investigated under a Phase I RI due to the absence of site specific contaminants in groundwater. The benzene and trichloroethene groundwater contamination will be investigated under the facility-specific production well investigation subtask.

5.3.3.5 SITE 6 - South Transformer Oil Disposal Area

Site Location. The approximate location of disposal of transformer oil in the "O-2" ditch, as shown in Figure 5-11 (Appendix A), is located about 700 feet southeast of supply well W-S2 and about 500 feet southeast of Building 1454.

Site Description. The grassed "O-2" drainage ditch into which the transformer oil was disposed drains in a northeasterly direction to the "O" ditch. The "O" ditch connects to the "P" ditch which drains east into Big Coldwater Creek, which is located approximately 2.3 miles east of the disposal site.

NAS Whiting Field's south potable supply well (W-S2) is located approximately 700 feet northwest of the disposal area. Two additional potable wells, the west well (W-W3) and the north well (W-N4) are located approximately 1,700 and 2,600 feet northwest of the site, respectively. All three wells tap the lower zone of the sand and gravel aquifer.

Site History. From the 1940's until 1964, Building 1478 (currently the battery shop) was used as a transformer repair and rework shop. Prior to servicing the transformers, the dielectric fluid, which might have contained PCBs, was reportedly drained into the grassed "O-2" drainage ditch located southeast of Building 1454. Disposal operations were discontinued in 1964 so Building 1478 could be converted into the battery shop. This ditch has since been paved.

As part of the Verification Study, 10 soil samples were collected along the flanks of the paved ditch and analyzed for PCBs. These soils were described as typically sandy clay. Each sample was a composite sample from each location and was collected from the surface to a depth of 2 feet. The laboratory results of

the soil samples at Site 6 did not detect any PCBs above the detection limit of 0.2 mg/kg. In addition, previous analyses (EPA Method 608) of groundwater from supply well W-S2 in November 1985, March 1986, and April 1986 did not detect PCBs or other related compounds.

Based on an evaluation of the results from the IAS and Verification Study, the following conclusions can be made for Site 6.

1. The drainage ditch area called Site 6 was used between 1943 and 1964 to dispose of spent dielectric transformer fluids.

2. Soils on the slopes of "0-2" drainage ditch do not contain PCBs, however, the presence of PCBs beneath the floor of the ditch has not been verified.

Site 6 will be investigated under the Phase I RI to determine the presence or absence of PCBs beneath the floor of the ditch.

Phase I Exploration Program

The exploration program for Site 6 will consist of obtaining 12 surficial soil samples (0 to 0.5 foot depth interval) at the approximate locations indicated on Figure 5-12 (Appendix A). The samples will be forwarded to the analytical laboratory for the analysis of PCBs (USEPA Method 8080).

Sampling positions selected for this study are in locations not originally sampled during the Verification Study (Geraghty & Miller, 1986). They encompass a small concrete plume leading to the "0-2" drainage ditch and samples within the "0-2" drainage ditch. For locations that have been concreted over, samples will be obtained from underneath the concrete flume after a 1-foot square section of flume has been removed. After extraction of the samples, the flume will be patched with concrete.

5.3.3.6 Site 7 - South AVGAS Tank Sludge Disposal Area

Site Location. Site 7 is located northwest of the South Field and about 1,800 feet south of supply well W-S2. The location of the site is shown on Figure 5-13.

Site Description. Based on local topography, surface runoff from this grass covered site probably discharges to the "A" ditch, which is located west of the site. The "A" ditch ultimately discharges to Clear Creek, which lies approximately 0.8 miles southwest of the site.

Site History. The site includes eight 23,700-gallon underground steel tanks and two 15,000-gallon lube oil storage tanks which were used for AVGAS and AVLUBE storage from 1943 to the late 1970's. The tank farm covers an area of approximately 1.8 acres.

Similar to Site 4, the tanks were cleaned approximately every 4 years to remove the sludge material which settled on the bottom of the tanks. Cleaning operations consisted of a workman entering the tanks and removing the accumulated

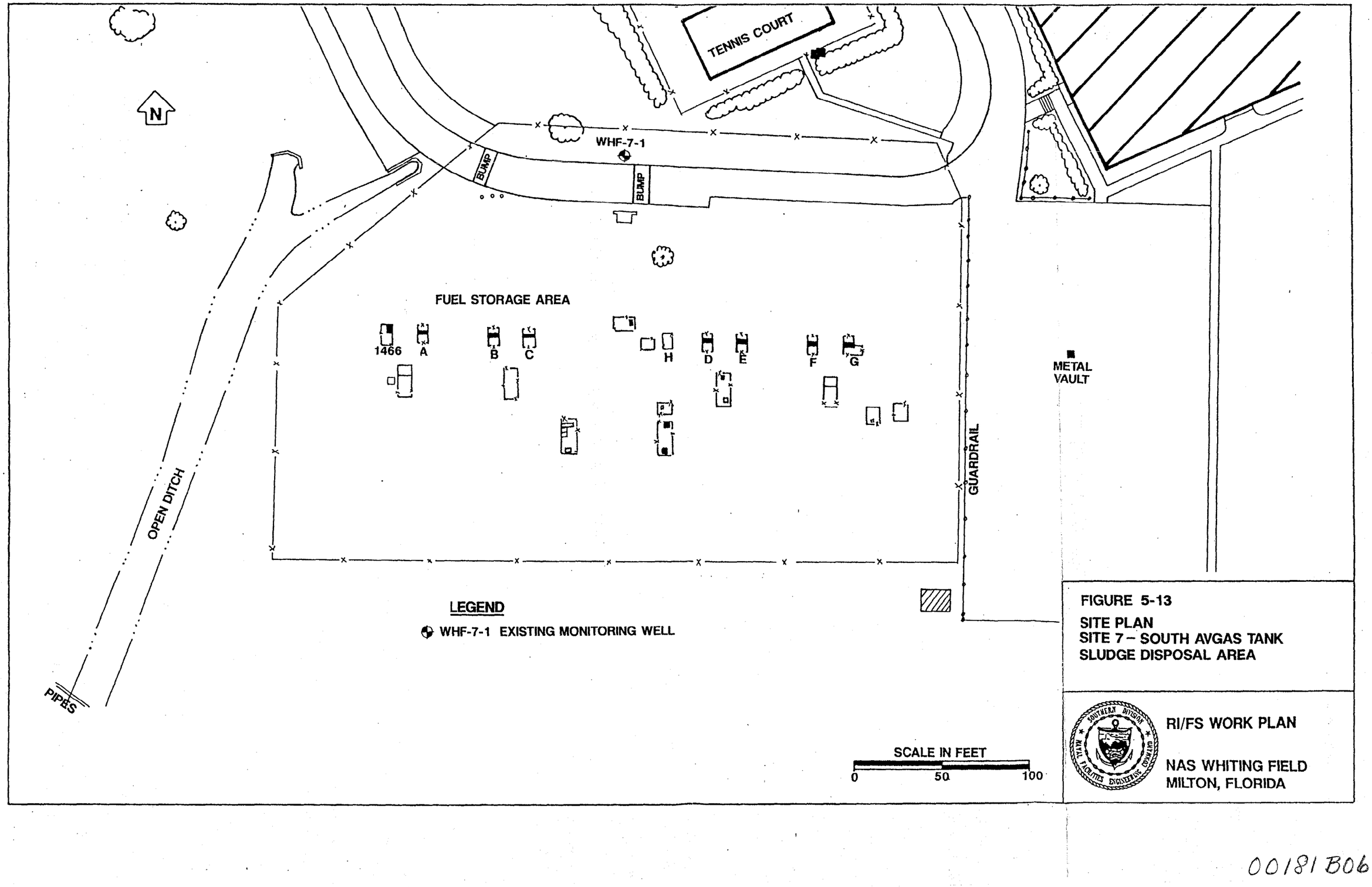

FIGURE 5-13
SITE PLAN
SITE 7 – SOUTH AVGAS TANK
SLUDGE DISPOSAL AREA

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

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sludge. The sludge material, which contained tetraethyl lead, was then buried in the area immediately adjacent to the tank being cleaned. A hand shovel was used to dig a shallow hole into which the sludge was placed and covered. Reportedly, 25 to 50 gallons of sludge were generated per tank during cleaning operations.

The IAS estimated that from 1943 to 1968 the tanks would have been cleaned an estimated six times. Assuming that 25 to 50 gallons of sludge were disposed per tank during each cleaning, roughly 1,200 to 2,400 gallons of sludge were buried throughout the tank farm in the area surrounding the tanks. Presently, all but four of the tanks have been filled with water. These four active tanks are currently used for No. 2 fuel oil storage. These tanks and the site are included in the Navy's UST Program to comply with FDER's and USEPA's storage tank regulations.

Thirty-one soil samples were collected during the Verification Study to a depth of 2 feet. Portions of these samples were composited into two samples and analyzed for total lead content and EP toxicity for lead. A monitoring well, WHF-7-1, also shown in Figure 5-13, was installed to a depth of 142 feet into the upper sand and gravel aquifer. The lithologic log for the well is presented in Appendix B. The depth to the water table was determined to be 130 feet BLS. Groundwater samples were collected and tested for BTX, naphthalene, EDB, and lead.

The laboratory results of the soil samples determined concentrations for total lead at 132 and 575 kg/mg; EP toxicity tests of these same soil samples did not detect any lead above the detection limit of 0.01 mg/l.

Analyses of the groundwater sample collected from monitoring well WHF-7-1 determined high concentrations of benzene (8,800 ug/l), toluene (43,800 ug/l), EDB (23,560 ug/l), and also lead (0.86 mg/l). The concentration of benzene, EDB, and lead exceed the State's drinking water standards.

Based on the chemical analyses, the Verification Study concluded that the groundwater in the upper part of the sand and gravel aquifer near the south AVGAS tank farm has been contaminated by lead and hydrocarbons. The study then recommended further investigation at this site.

Based on an evaluation of the results of the IAS and Verification Study the following conclusions can be made for Site 7.

1. The tank sludge disposal area was used between 1943 and the late 1970's to bury an estimated 1,200 to 2,400 gallons of tank bottom sludge material from 8 AVGAS underground storage tanks.

2. The geology beneath the site consists of 30 feet of sandy clay underlain by 68 feet of fine to coarse sand below which a 21 feet thick clay layer was described.

3. Groundwater was present at 102 feet below ground surface, however, flow direction has not been determined.

4. Surface soils contain total lead concentrations between 132 and 575 mg/kg and passed EP toxicity test.

5. Groundwater contains benzene (8,800 ug/l), toluene (43,800 ug/l), EDB (23,560 ug/l), and lead (0.86 mg/l). The benzene, EDB, and lead concentrations exceed FDER drinking water standards.

6. Site 7 is included in the Navy's UST Program to comply with FDER's and USEPA's storage tank regulations.

Based on the above conclusions, Site 4 will be investigated further under the Navy's UST program and will not be addressed under this CERCLA/IR RI/FS.

As part of the Navy's UST program the following recommendations (E.C. Jordan, 1989) have been made for the existing tanks.

Interim Compliance and Proposed Action. No interim compliance with Section 17-61, FAC, is proposed for tanks 1466-D through 1466-G because of their out of service status. It is recommended that these tanks be removed or properly abandoned by a target date of 31 December 1992. FDER should be notified of the out of service status of these tanks.

5.3.3.7 Site 8 - AVGAS Fuel Spill Area Site 8 is located south of Building 1406. The south production well, W-S2 is approximately 2,600 feet to the north of Site 8 (Figure 5-14). In the summer of 1972, 25,000 gallons of high octane aviation fuel was spilled at the South Field. The spill occurred when a rubber fueling hose was accidentally cut and leaked unnoticed over a 3-day weekend. The aviation fuel flowed approximately 200 feet across a concrete apron and onto a grassed area where it ponded and killed the vegetation in an area of approximately 2 acres (Geraghty & Miller, 1986). This site is included in the Navy's UST Program to comply with FDER and USEPA storage tank regulations.

There is no indication of any contamination at the site. The area where the fuel was ponded is currently covered with grass with no signs of biological stress.

During the Verification Study, soil samples were collected at 12 locations, from the 0.0 to 2.0 foot depth interval in the lowest point of the spill area. At each auger hole, the soil was composited and analyzed for total lead and EP Toxicity for lead. A monitoring well, WHF-8-1, was installed to a depth of 180 feet BLS and a groundwater sample was collected and analyzed for BTX, EDB, naphthalene, and lead.

The laboratory results for the soil samples taken from Site 8 show concentrations for total lead ranging from 3.1 to 27 mg/kg, but all EP toxicity tests for lead were below the detection limit of 0.01 ug/l.

The depth to groundwater at Site 8 is about 117 feet BLS. The laboratory results for the groundwater samples collected from monitoring well WHF-8-1 showed benzene at 2 ug/l and toluene at 26 ug/l. Lead and EDB concentrations were below Florida's drinking water standards but benzene slightly exceeded the state

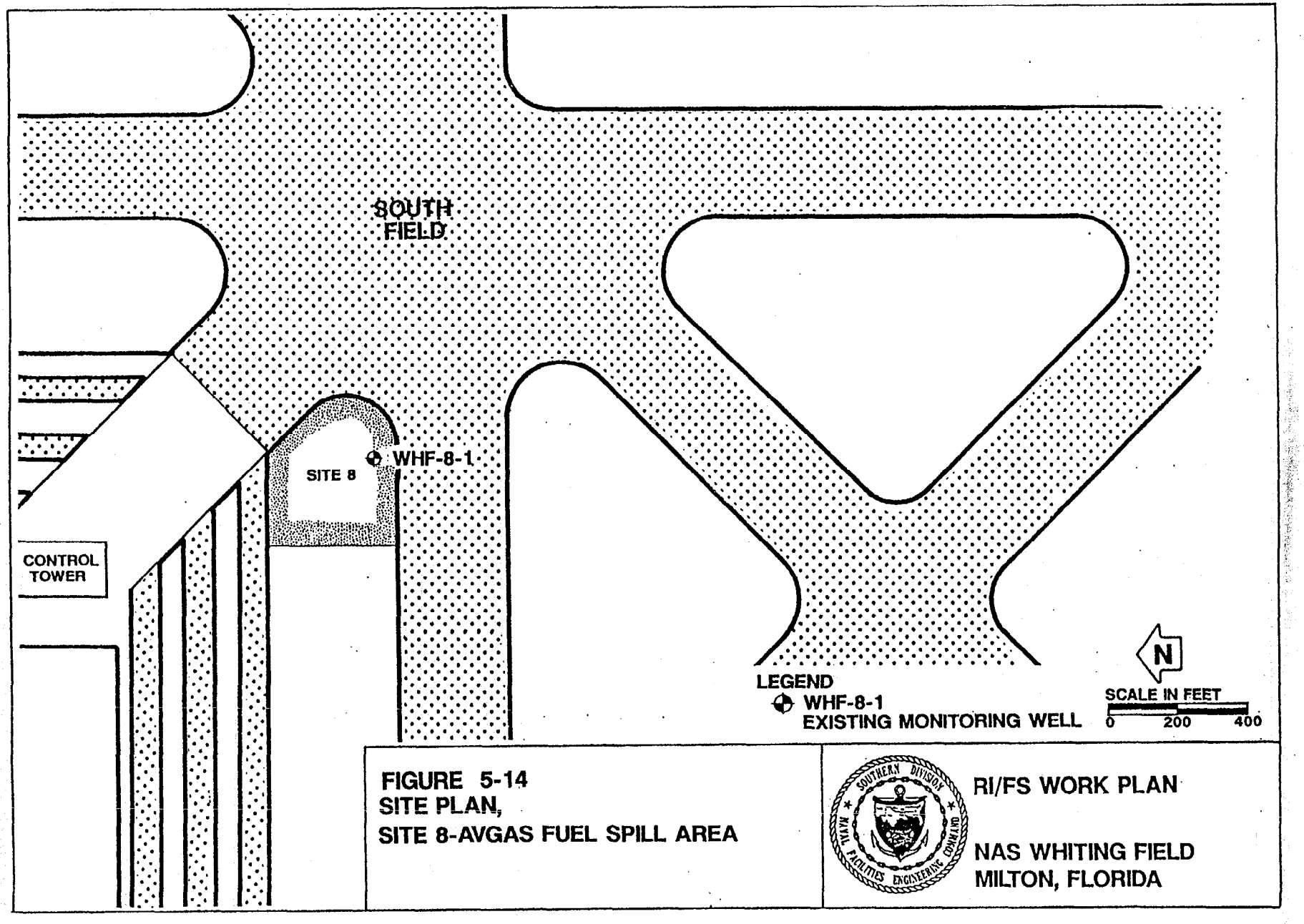


FIGURE 5-14
SITE PLAN,
SITE 8-AVGAS FUEL SPILL AREA

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

standard of 1 ug/l. Naphthalene concentrations were below the analytical method detection limit.

Based on an evaluation of results from the Verification Study the following conclusions can be made about Site 8.

1. During the summer of 1972, 25,000 gallons of AVGAS were spilled at Site 8.

2. Geology beneath the site consists of 35 feet of sandy clay underlain by 83 feet of fine to coarse sand below which a 10 foot thick clay layer was described. Below the clay layer to a depth of 180 feet below ground surface exists a fine to coarse sand.

3. Groundwater is present at 117 feet BLS; however, the direction of flow has not been determined.

4. Surface soils contain total lead concentrations ranging from 3.1 mg/kg to 27 mg/kg but all soil samples passed the EP toxicity test.

5. Groundwater at Site 8 contained benzene (2 ug/l) and toluene (26 ug/l). The benzene concentration exceeds FDER drinking water criteria of 1.0 ug/l.

6. Site 8 is included in the Navy's UST program to comply with FDER and USEPA petroleum cleanup regulations.

Based on the above conclusions, Site 8 will be investigated further under the Navy's UST program and will not be addressed under this CERCLA/IR RI/FS.

5.3.3.8 Sites 9 and 10 - Waste Fuel Disposal Pit and Southeast Open Disposal Area (A)

Due to their proximity to one another, Sites 9 and 10 have been combined as a single study area.

Site 9 - Waste Fuel Disposal Pit

Site Location. Site 9 is located along the eastern property line near South Field. During the 1950's and 1960's, waste fuel was disposed in a clay pit. The waste fuel disposal pit reportedly has been covered over. The precise location of the disposal pit is unknown. However, the pit was reportedly located in the northern portion of an existing borrow pit, as shown in Figure 5-15.

Site Description. The IAS reported that the general area where the disposal pit is located can be characterized as a depressed area, which is approximately 10 feet below the grade of the perimeter road. Surface runoff from portions of Site 10 is to this depressed area. Surface drainage for most of the area is into the northeastern most corner where it apparently ponds and slowly infiltrates into the soil. During the IAS onsite survey, approximately 6 to 12 inches of water were ponded in this area. Also, during the IAS investigation there were signs

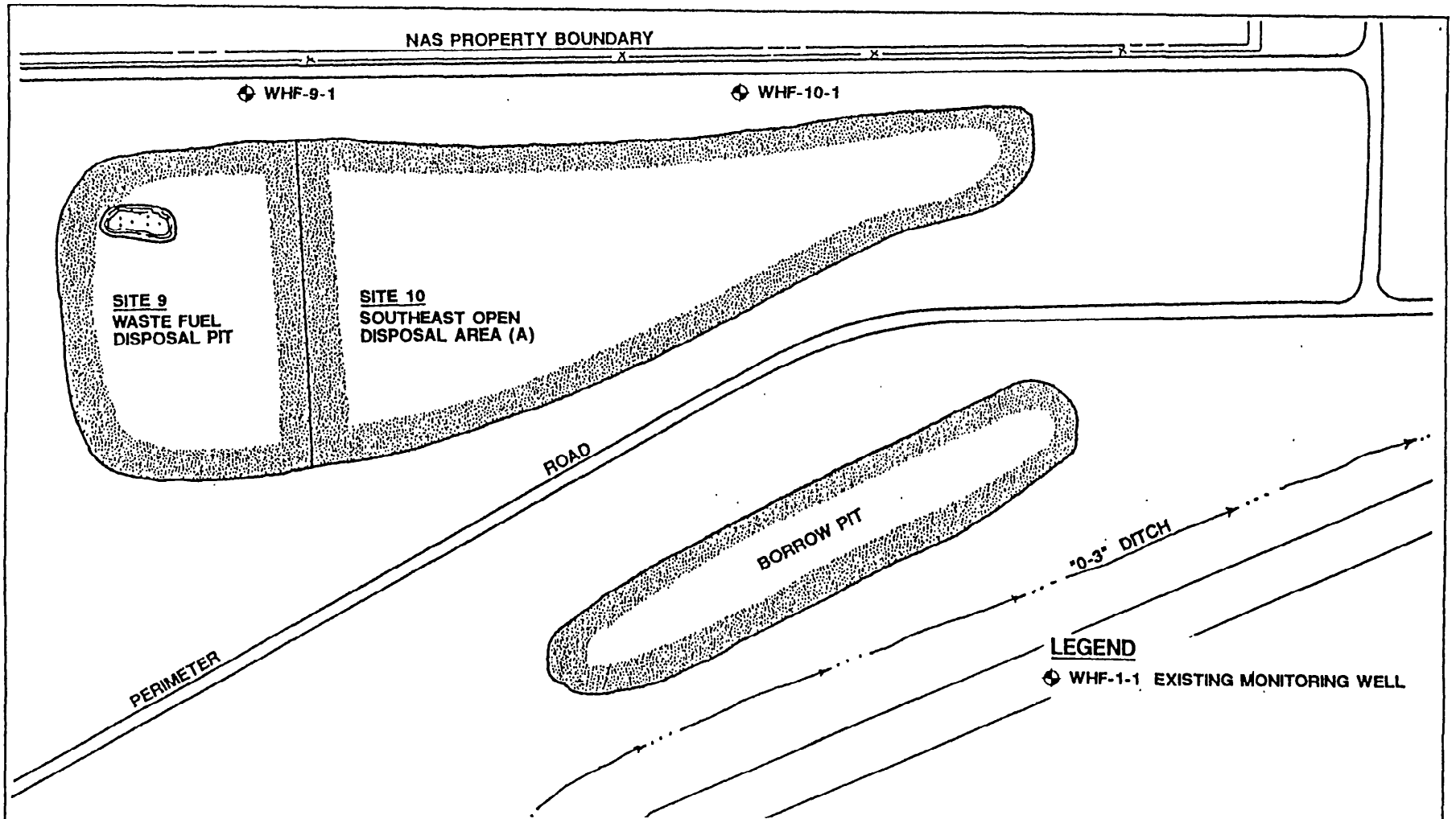


FIGURE 5-15

SITE PLAN
SITES 9 & 10

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

of surface erosion along the eastern embankment of the patrol road, where there is a steep grade.

Site History. During the 1950's and 1960's, tank trucks transported waste fuel which contained tetraethyl lead for disposal in the northern portion of the borrow pit. Approximately 200 to 300 gallons of waste fuel were disposed at the site per trip. The total quantity of waste fuel disposed at the site during this period of time, however, is unknown.

During the Verification Study, soil samples were collected from six locations. Two soil samples were collected from each of six test holes from the intervals of the surface to 1 foot and from 1 foot to 2 feet BLS. These 12 samples then were analyzed for BTX concentrations, total lead content, and EP toxicity for lead. A monitoring well, WHF-9-1, was also installed to a depth of 120 feet BLS, adjacent to the east side of the site where the water table surface was determined to be about 87 feet BLS. Groundwater samples were collected for the analysis of BTX, EDB and lead. The lithologic log for well WHF-9-1 is provided in Appendix B.

The soil samples collected in the field were described as typically sandy clay. Total lead content ranged from 9 mg/kg to 14/kg; however, the results for EP Toxicity lead did not detect any lead at a detection limit of 0.01 mg/l. Analyses of the groundwater samples did not detect any BETX or EDB and only a trace concentration of lead was detected (well below the FDER's drinking water standard).

Based on an evaluation of the results for the IAS and Verification Study the following conclusions may be made about Site 9.

1. During the 1950's and 1960's a clay pit in the northern portion of an existing borrow pit was used to dispose of significant quantities of waste oil.

2. The geology beneath Site 9 consists of 50 feet of sandy clay underlain by 25 feet of fine to coarse sand below which is another 15 foot thick layer of clay.

3. Groundwater beneath the site is located at approximately 87 feet BLS. Groundwater flow direction beneath the site has not been determined.

4. Surface soils contain lead (9 mg/kg to 14 mg/kg) but passed the EP Toxicity test for lead. Soils did not contain BTX compounds.

5. Groundwater east of Site 9 did not contain BTX, EDB, or significant levels of lead.

Based on the above conclusions Site 9 will be included in the Phase I RI because groundwater flow direction has not been defined.

SITE 10 - Southeast Open Disposal Area (A)

Site Location. Site 10 is contiguous to and south of Site 9 and located within the same old borrow pit area. The site covers an area of approximately 4 acres. The location of the site is shown on Figure 5-15.

Site Description. A major portion of the surface runoff from Site 10 drains north to a depression adjacent to the site. Runoff from the depressed area, along with the remaining area of the disposal site, is east toward Big Coldwater Creek approximately 1.9 miles to the east. Water level elevations in monitoring wells WHF-9-1 and WHF-10-1 indicate a southerly component of flow across Sites 9 and 10 (Geraghty & Miller, 1986).

Site History. From 1965 to 1973, this site was used as an open disposal area. It was used mainly for the disposal of inert types of wastes such as construction debris (concrete, lumber, asphalt, etc.), trees, brush, metal cans, and similar material not suitable for landfill disposal. The IAS reported that transformer oil, potentially contaminated with PCBs, was also disposed at this site. The transformers were reportedly placed on flatbed trucks and driven to the site where the oil was drained onto the ground. Empty pesticide and herbicide containers from the pesticide shop were also reportedly disposed at this site.

The IAS reported that access to the site was uncontrolled and there are no records on the types of wastes disposed. Wastes potentially disposed at this site include wastes associated with the operation and maintenance of aircraft such as waste solvents, paint, oil, and hydraulic fluid. Table 5-7 summarizes the types and quantities of wastes potentially disposed at Site 10. The site was covered after its closure in 1973, but construction rubble has been disposed at this site since this date.

A monitoring well, WHF-10-1, was installed to a depth of 117 feet BLS adjacent to the east side of the site as part of the Verification Study. The lithologic log for this well is presented in Appendix B. The depth to the groundwater table was determined to be 88 feet BLS. A water sample from monitoring well WHF-10-1 was analyzed for the USEPA's list of priority pollutants, along with additional pesticide compounds.

No organic constituents were detected in the groundwater sample and very minor concentrations of lead, zinc, and silver were detected at levels well below the FDER's drinking water standards. However, the study concluded that monitoring well WHF-9-1 and monitoring well WHF-10-1 were not situated conclusively downgradient from their respective sites and that additional wells should be installed downgradient of the sites.

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 10.

1. Site 10 was used as a construction debris disposal area from 1965 to 1973. Wastes may have included PCB transformer fluids and pesticide containers.

TABLE 5-7
WASTES POTENTIALLY DISPOSED AT SITE 10, SOUTHEAST OPEN DISPOSAL AREA (A)
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED* TOTAL QUANTITY	COMMENTS
Construction and demolition debris	Naval Air Station	1965 to 1973	--	Site 10 was a secondary disposal area during this period. It was used primarily for the disposal of inert wastes.
Paint stripping wastewater	AIMD Paint Shop	1965 to 1973	40,000 gallons	Paint stripping diluted significantly with copious amounts of rinse water.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop, Aircraft Maintenance, Transportation Division Shop	1965 to 1973	5,000 gallons	**
Waste oils and hydraulic fluids	Operation Maintenance Division, Transportation Division Shop	1965 to 1973	8,000 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: * - Assumes that 1/5 of the total maximum yearly waste generated was disposed at Site 10 and 4/5 was disposed at Site 15

** - Maximum quantity disposed at this site and/or Fire Fighting Training Area

2. Geology beneath Site 10 consists of 40 feet of sandy clay underlain by 35 feet of fine to coarse sands below which another 23-foot thick layer of clay exists.

3. Groundwater is located at 88 feet BLS at Site 10 and groundwater flow direction has not been defined.

4. Soils were not sampled at Site 10.

5. Groundwater east of the site contains no priority pollutant list compounds.

Based on the above conclusions Site 10 will be studied further in the Phase I RI because groundwater flow direction has not been determined.

Phase I Exploration Program

The exploration program at Sites 9 and 10 will consist of the following activities:

- geophysical logging of the existing monitoring wells WHF-9-1 and WHF-10-1,
- installation of one monitoring well (WHF-9-2), and
- three PCPT/*in-situ* sampling and analysis explorations.

In addition, the following optional activities may be undertaken in the Phase II RI should the analysis of *in-situ* groundwater samples indicate contamination:

- plume delineations,
- source area soil sampling, and
- potential receptors survey.

More details concerning these anticipated Phase II subtasks are presented in Section 5.3.7.

Geraghty & Miller (1986) suggest that groundwater flow underneath Sites 9 and 10 may be to the south to southeast. To obtain a clearer definition an additional monitoring well, WHF-9-2, is to be installed at the approximate location shown on Figure 5-16. The depth of the monitoring well will be approximately 120 feet BLS, which corresponds to the screened interval of monitoring wells WHF-9-1 and WHF-10-1.

Upon well completion and development, the measuring point elevation for the three wells in this site grouping will be surveyed by site personnel. This preliminary survey will aid in defining groundwater flow direction and the siting of the PCPT/*in-situ* groundwater sampling explorations.

Geophysical logging will be conducted on existing monitoring wells WHF-9-1 and WHF-10-1. Results will allow a confirmation of existing lithologic descriptions. This data correlated with groundwater flow direction will be used to optimize the locations of PCPT/*in-situ* groundwater sampling explorations.

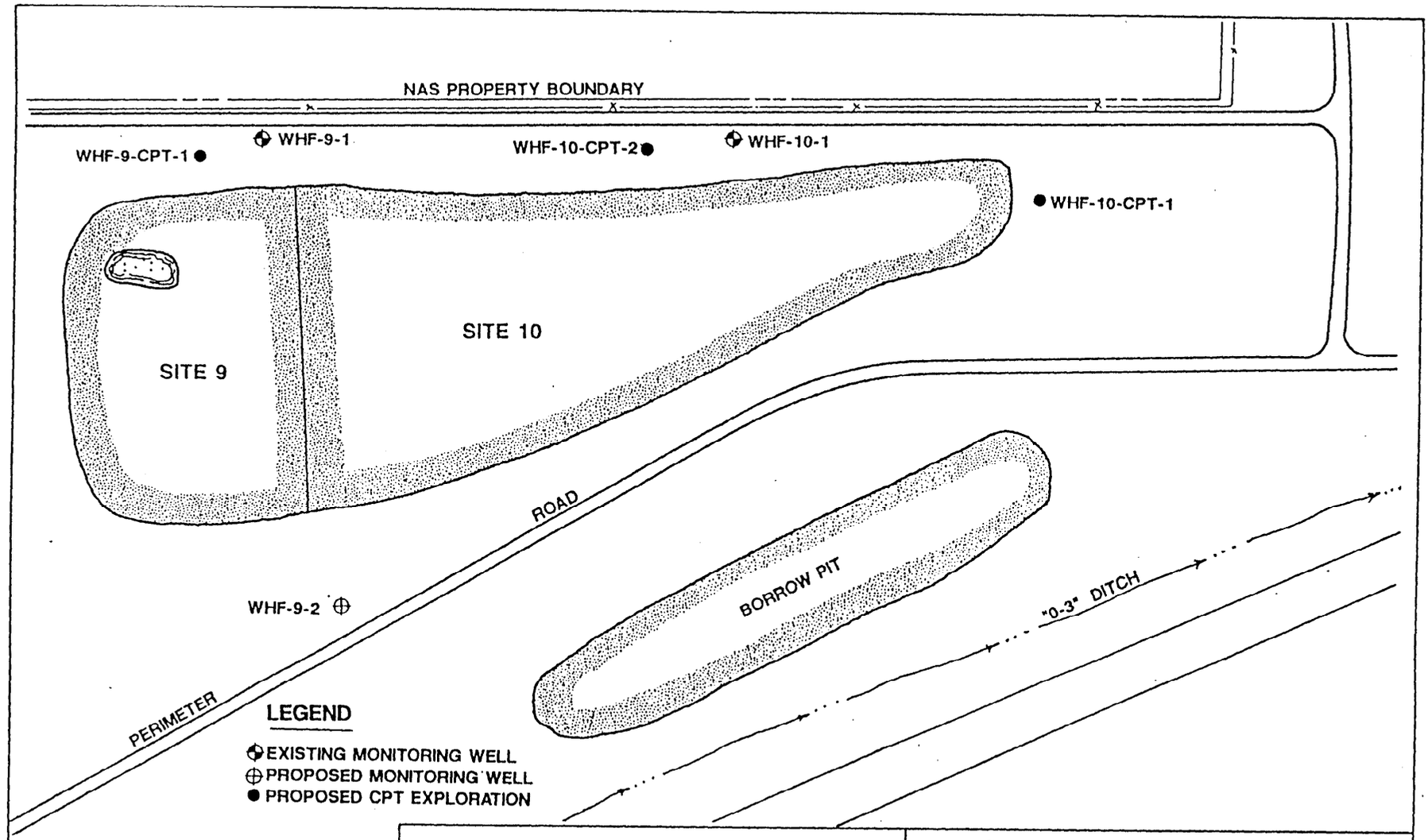


FIGURE 5-16

SITES 9 & 10
EXPLORATION PROGRAM

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

Three PCPT explorations are proposed around Sites 9 and 10 at the approximate locations indicated on Figure 5-16. As previously stated, groundwater flow is anticipated to be in a southern direction. Hence, exploration WHF-10-CPT-1 is to the south of the two disposal areas. Due to the length of the eastern edge of the two disposal areas, two additional PCPT explorations, WHF-9-CPT-1 and WHF-10-CPT-2, are anticipated.

Immediately following the PCPT explorations, *in-situ* groundwater samples will be obtained. If PCPT data indicate a groundwater body overlying an upper clay layer or lens, *in-situ* samples will be obtained in this zone at all three locations. In addition, a lower aquifer zone *in-situ* groundwater sample will be obtained at location WHF-10-CPT-1. No lower aquifer zone samples are proposed at locations WHF-9-CPT-1 and WHF-10-CPT-2 due to their proximity to existing monitoring wells.

5.3.3.9 **Sites 11, 12, 13, and 14 - Southeast Open Disposal Area (B), Tetraethyl Lead Disposal Area, Sanitary Landfill and Short-Term Sanitary Landfill.** Due to their close proximity to one another, Sites 11, 12, 13, and 14 have been combined as a single study area. Even with this approach to the investigation, it is anticipated that evaluations concerning no further action, Phase II RI and interim remedial action can still be made on a site-specific basis, if necessary.

Site 11 - Southeast Open Disposal Area (B)

Site Location. Site 11 is located in the southeastern portion of the air station near the eastern property line. The location of the site is shown on Figure 5-17.

Site Description. The site generally slopes from south to north and from west to east. Surface runoff from the site is toward the northeastern corner where there is a low point. Runoff apparently ponds in this area. Any runoff from the site would continue in a northeasterly direction across the dirt access road which borders the site on the north. Surface runoff from the site would ultimately drain to Big Coldwater Creek located approximately 1.7 miles east of the site. A bermed area with pine trees borders the area on the east. Drainage ditch "Y" is located just south of the site, but does not receive runoff from the site. Groundwater flow in the area is in a southerly direction.

Site History. This 3 acre site was used as an open disposal area from the time NAS Whiting Field was established in 1943 until approximately 1970. The site had uncontrolled access and there are no records on the types of wastes disposed. The site was reportedly used to dispose of a wide variety of wastes which included general refuse, construction debris (concrete, asphalt, lumber, etc.), tree clippings, and furniture. Transformers, potentially containing PCBs, were also drained at the site. Wastes associated with the operation and maintenance of aircraft (paint, paint thinner, solvents, waste oils, and hydraulic fluid) may have also been disposed at the site. Table 5-8 summarizes the types and quantities of wastes potentially disposed at Site 11.

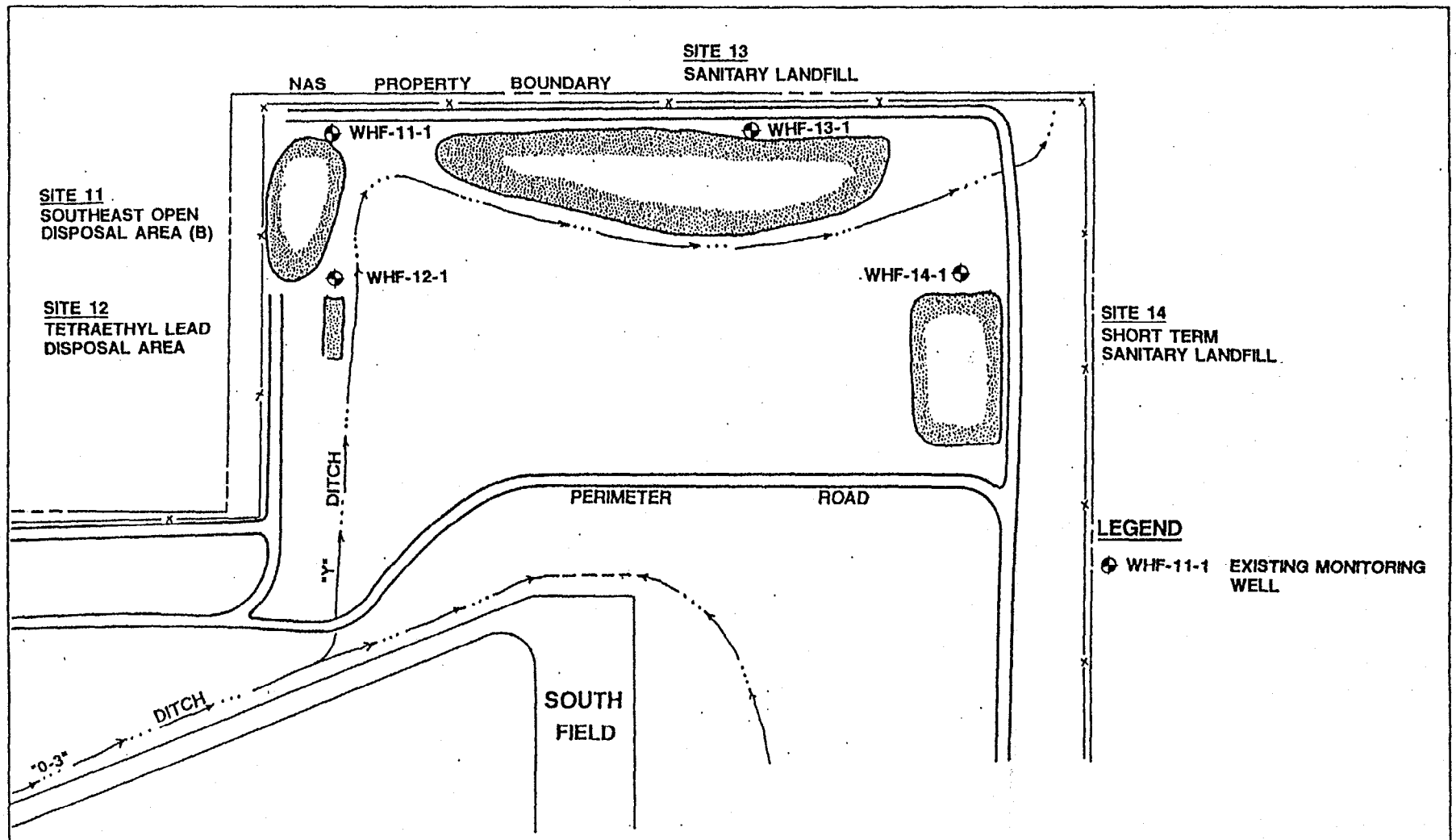


FIGURE 5-17

SITE PLAN
SITES 11, 12, 13, & 14

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

TABLE 5-8
WASTES POTENTIALLY DISPOSED AT SITE 11, SOUTHEAST OPEN DISPOSAL AREA (B)
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED* TOTAL QUANTITY	COMMENTS
General refuse	Naval Air Station	1943 to 1970	--	Site 11 was a secondary disposal during this period (Site 16 was the primary).
Paint stripping wastewater	AIMD Paint Shop	1943 to 1970	100,000 gallons	Paint stripping wastes diluted significantly with copious amounts of rinse water.
Waste paints and thinners	Operations Maintenance Division	1943 to 1960	200 gallons	**After 1960, this waste went to the Fire Fighting Training Area.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop, Aircraft Maintenance, Transportation Division Shop	1943 to 1970	20,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division, Transportation Division Shop	1943 to 1970	30,000 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: * - Assumes 3/10 of the total maximum yearly waste generated was disposed at Site 1, 1/5 disposed at Site 11, and 1/2 disposed at Site 16; estimates rounded to one significant figure.

** - Maximum quantity disposed at this site and/or Fire Fighting Training Area

Disposal operations at the site were discontinued around 1970. At this time, a final covering was placed over the site and pine trees planted. Pine trees approximately 25 to 30 feet tall now occupy the site, with the exception of the northeastern portion. The areas surrounding the site are also pine covered.

As part of the Verification Study, monitoring well WHF-11-1 was installed to a depth of 120 feet BLS on the eastern side of the site as shown in Figure 5-17. The lithologic log for this well is shown in Appendix B. Groundwater was present at 60 feet BLS. Groundwater samples were collected and analyzed for the USEPA's list of priority pollutants, with additional pesticide compounds. The water quality analyses did not detect any organic constituents except bis(2-ethylhexyl) phthalate at 23 ug/l and only trace concentrations of mercury and zinc.

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 11.

1. Site 11 is a 3-acre disposal area used between 1943 and 1970 to dispose of a variety of wastes including PCB transformer fluids, paint and solvent wastes, waste oils, and spent hydraulic fluid.

2. Geology beneath the site consists of 72 feet of sandy clay underlain by 60 feet of fine to coarse sand with clay stringers.

3. Groundwater is present at 55 feet BLS; however, flow direction has not been adequately defined.

4. Soils from Site 11 were not sampled or analyzed for priority pollutant list compounds.

5. Groundwater did not contain priority pollutant list compounds that exceeded local, State or Federal drinking water criteria.

Based on the above conclusions, Site 11 will be included in the Phase I RI to define groundwater flow direction and verify the presence or absence of contamination.

SITE 12 - Tetraethyl Lead Disposal Area

Site Location. Site 12 is located in the southeastern part of the base and adjoins Site 11. The site location is shown in Figure 5-17.

Site Description. The "Y" drainage ditch, which is not lined, is located immediately adjacent to the south of the site and receives surface runoff from the area. The drainage ditch ultimately discharges to Big Coldwater Creek, approximately 1.7 miles east of the site.

Site History. Tank bottom sludge from the cleaning of the North and South Aqua Fuel System storage tanks and fuel filters contaminated with tetraethyl lead were disposed of at Site 12 in May 1968. The disposal area consists of two earth-covered mounds within a fenced area of approximately 50 feet by 25 feet. Each of the mounds is approximately 5 feet high and 10 feet in diameter with reportedly about 200 to 400 gallons of sludge in each mound.

Geraghty & Miller (1986) collected composite soil samples from a depth of 2 to 3 feet within each sludge mound. These samples were analyzed for total lead concentration and EP toxicity for lead. In addition, monitoring well, WHF-12-1 was installed to a depth of 112 feet BLS at the location shown in Figure 5-17. The lithologic log for well WHF-12-1 is presented in Appendix B. Groundwater was present at 79 feet BLS. A groundwater sample was collected and analyzed for BTX, naphthalene, EDB, and lead.

The laboratory results for the soil samples taken from Site 12 show concentrations for total lead ranging from 4 to 11 mg/kg. The EP toxicity test detected no lead above 0.01 mg/l. The laboratory results of the groundwater sample taken from monitoring well WHF-12-1 show a trace concentration of lead (0.002 mg/l). No organic constituents were detected in the groundwater sample.

Geraghty & Miller (1986) installed monitoring wells WHF-11-1 and WHF-12-1 to the east of their respective sites, under the preconception that the primary direction of groundwater flow in this area was east toward Big Coldwater Creek. The overall regional flow in this area now appears to have a component of flow to the south-southeast (Geraghty & Miller, 1986). Therefore, it was recommended that additional monitoring wells should be installed to the south of the sites to further investigate conditions downgradient of Sites 11 and 12.

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 12.

1. Site 12 consists of two earth covered mounds of petroleum storage tank sludge disposed of in May 1968. The sludge contained petroleum compounds including tetraethyl lead.

2. The geology beneath the site consists of 26 feet of clay underlain by 35 feet of fine to coarse sand below which a 23-foot thick clay layer was described.

3. Groundwater was present beneath the site at 79 feet BLS and groundwater flow direction has not been adequately defined.

4. Soils contains lead (4 mg/kg to 11 mg/kg) but pass the EP toxicity for lead test.

5. Groundwater east of the site (not anticipated to be downgradient) contained no EDB, BETX, naphthalene or lead which exceeded local, State or Federal regulatory criteria.

Site 12 will be investigated in the Phase I RI to refine groundwater flow direction and assess downgradient groundwater quality.

SITE 13 - Sanitary Landfill

Site Location. Site 13 is located on the eastern property line of the South Field. This 4-acre site was the last operating sanitary landfill for NAS Whiting Field. The location of the site is shown in Figure 5-17.

Site Description. The vegetated "Y" drainage ditch borders the landfill to the west and south. The general land slope in the area is from the northwest to southeast. However, the landfill is depressed from surrounding ground and runoff typically ponds onsite. In the event there is surface runoff from the site, it would drain toward Big Coldwater Creek, located approximately 1.7 miles east of the site.

Site History. Landfill operations at the site began in 1979 and ceased in 1988. This site received all the NAS Whiting Field's landfill wastes disposed on-station except construction and demolition debris which is disposed at Site 2. The IAS reported that during the first year of operation, wastes associated with the operation of maintenance of aircraft such as waste solvents, paint, oil and hydraulic fluid were potentially disposed at the site. Asbestos wrapped in plastic was also disposed at the landfill. Table 5-9 summarizes the types and quantities of wastes potentially disposed at Site 13.

As part of the Verification Study, monitoring well WHF-13-1 was installed to a depth of 112 feet BLS at the location shown in Figure 5-17. The lithographic log for well WHF-13-1 is provided in Appendix B. The depth to groundwater at the site was determined to be 51 feet BLS. A groundwater sample was collected and analyzed for USEPA's list of priority pollutants. No organic constituents were detected in the groundwater and only minor concentrations of lead (0.006 mg/l), mercury (0.0005 mg/l), nickel (0.006 mg/l), and zinc (0.24 mg/l) were detected. Due to Site 13's proximity to Site 14, recommendations from the Verification Study for this area are provided in the Site 14 discussion.

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 13.

1. Site 13 is a 4-acre landfill which was used from 1979 to 1988. Potential waste types include solvents, paint wastes, waste oil, hydraulic fluids, and asbestos.

2. Geology beneath the site consists of 78 feet of sandy clay underlain by 2 feet of fine to coarse sand below which a 25-foot thick clay layer was described.

3. Groundwater was present at 51 feet BLS and groundwater flow direction was not adequately defined beneath the site.

4. Groundwater east of the site (not believed to be downgradient) contained no priority pollutant compounds in concentrations which exceeded any local, State or Federal drinking water criteria.

Site 13 will be included in the Phase I RI to define groundwater flow direction and assess downgradient groundwater quality.

SITE 14 - Short-Term Sanitary Landfill

Site Location. Site 14 is located on 2.5 acres in the southeastern portion of the station near the end of abandoned runway 27 and close to Site 13. The location of Site 14 is shown in Figure 5-17.

TABLE 5-9
WASTES POTENTIALLY DISPOSED AT SITE 13, SANITARY LANDFILL
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED TOTAL QUANTITY	COMMENTS
General refuse	Naval Air Station	1979 to 1988	--	Site 13 was the primary landfill for the Naval Air Station.
Paint stripping wastewater	AIMD Paint Shop	1979 to 1980	24,000 gallons	Paint stripping wastes diluted significantly with copious amounts of rinse water.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop, Transportation Division Shop, Helicopter Maintenance	1979 to 1980	1,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division, Transportation Division Shop	1979 to 1980	600 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: ** - Maximum quantity disposed at this site or Fire Fighting Training Area

Site Description. Much of the central portion of the site is unvegetated, with the area around the periphery of the site being grass or weed covered. The area surrounding the site is covered with pine trees. Access to the site is from the perimeter patrol road. The site generally slopes from west to east. Surface drainage from the area is in an easterly direction towards the vegetated "Y" ditch which borders the site on the east. The ditch drains east towards Big Coldwater Creek which is located approximately 1.8 miles east of the site. The site itself is poorly drained and shows obvious signs of surface erosion.

Site History. This site was used for 6 to 9 months starting in 1978 and continuing into 1979 as a sanitary landfill. The site was abandoned after this short period of time due to excessive amounts of clay in the soil which caused water to pond throughout the site. Trucks delivering wastes were continually getting stuck, so the decision was made to relocate the site. During the short period of time the landfill was operating, waste solvents and residue from paint stripping operations probably were disposed at the landfill. However, the majority of wastes that were disposed at the site would have been general refuse and non-hazardous waste. Table 5-10 summarizes the types and quantities of wastes potentially disposed at Site 14.

During the Verification Study, monitoring well WHF-14-1 was installed to a depth of 152 BLS feet along the east side of the site (see Figure 2-17). The lithologic log for the well is shown in Appendix B. Depth to groundwater at this site is about 90 feet BLS. A groundwater sample was collected and analyzed for the USEPA's list of priority pollutants. No organic contaminants were detected in monitor well WHF-14-1; however, trace concentrations of lead (0.003 mg/l) and zinc (0.11 mg/l) were detected.

Based on an evaluation of the results from the IAS and Verification Study, the following conclusions can be made about Site 14.

1. Site 14 was a 2.5-acre, short-term sanitary landfill which received for 6 to 9 months a variety of wastes including waste solvents and paint wastes.

2. Geology beneath the site consists of 50 feet of sandy clay underlain by 67 feet of fine to coarse sands.

3. Depth to groundwater was approximately 90 feet; however, groundwater flow direction was not adequately defined.

4. Groundwater east of Site 14 (not anticipated to be downgradient) did not contain priority pollutant compounds which exceed any local, State, or Federal drinking water criteria.

Site 14 will receive additional investigation under the Phase I RI to refine groundwater flow direction information and assess downgradient groundwater quality.

Recommendations in the Verification Study were similar to those made for Sites 11, 12, 13, and 14 above. The basis for this recommendation is the fact that the wells installed during the Verification Study are located east of their

TABLE 5-10
WASTES POTENTIALLY DISPOSED AT SITE 14, SHORT-TERM SANITARY LANDFILL
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED TOTAL QUANTITY	COMMENTS
General refuse	Naval Air Station	1978 to 1979	--	Site 14 was a primary landfill for this brief period; relocated due to drainage problems.
Paint stripping wastewater	AIMD Paint Shop	1978 to 1979	24,000 gallons	Paint stripping wastes diluted significantly with copious amounts of rinse water.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop, Aircraft Maintenance Transportation, Division Shop	1978 to 1979	1,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division and Transportation Division Shop	1978 to 1979	600 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: ** - Maximum quantity disposed at this site and Fire Fighting Training Area

respective sites due to the preconception that groundwater flow in this area is primarily east. However, based on information collected during the Verification Study, the groundwater flow in this area appears to be in a more southerly direction.

Phase I Exploration Program

The exploration program at Sites 11, 12, 13, and 14 will consist of the following subtasks:

- geophysical logging of the four existing monitoring wells,
- installation of one monitoring well (WHF-11-2),
- five PCPT explorations/*in-situ* groundwater sampling and analysis,
- collecting six soil samples at Site 12, and
- collecting three sediment samples in the "Y" drainage ditch.

In addition, the following optional activities may be undertaken during the Phase II RI site investigation should the laboratory results of the *in-situ* groundwater samples indicate groundwater contamination:

- plume delineation,
- potential receptors survey, and
- source area soil sampling.

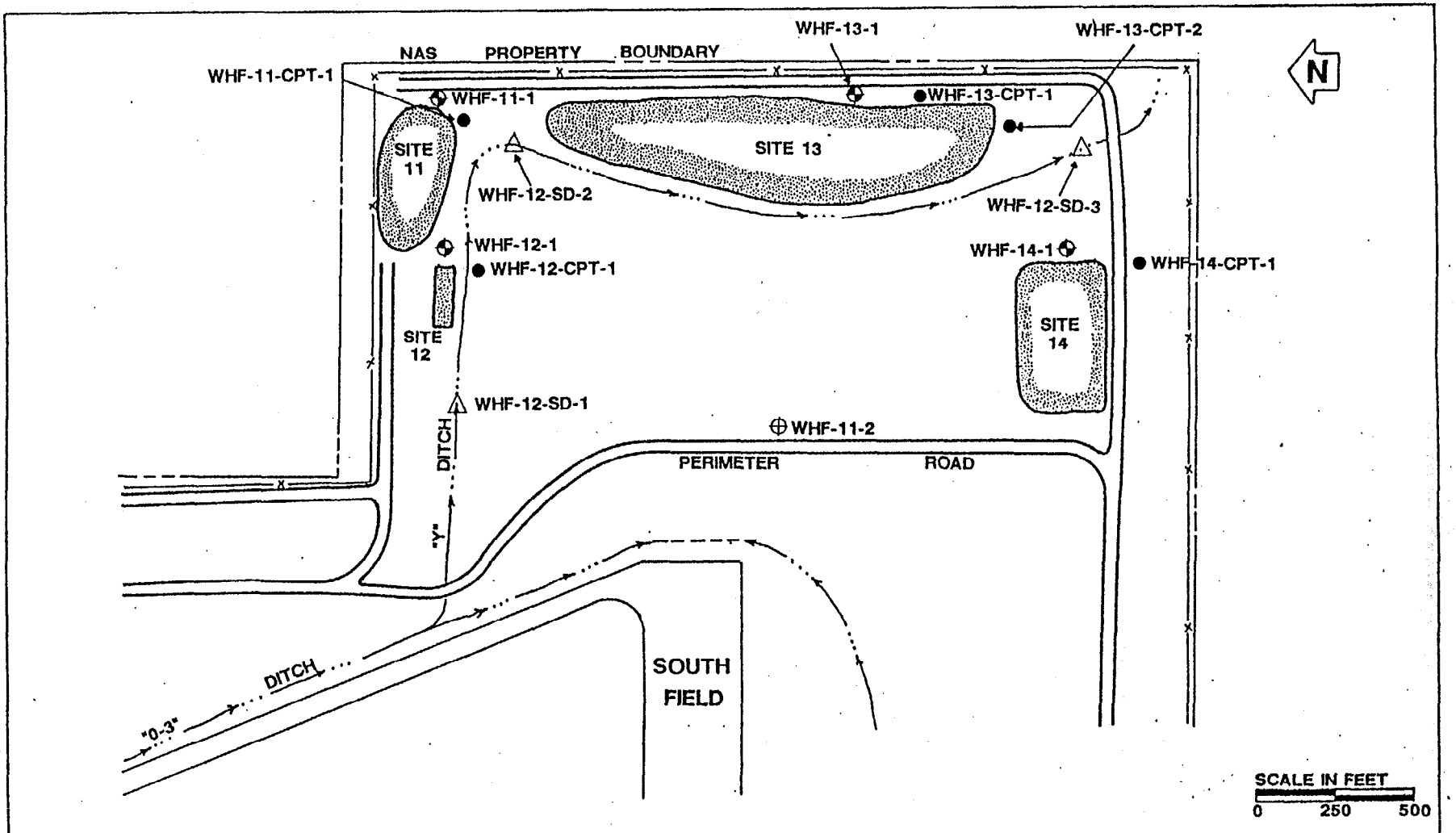
To further clarify groundwater flow, one background monitoring well, WHF-11-2, will be installed at the approximate position shown in Figure 5-18. The depth of the monitoring well is anticipated to be 150 feet BLS, which corresponds to the screened interval of the existing monitoring wells. Depth to potentiometric surface measurements from the five wells in the area will be used to plot groundwater flow direction. Monitoring well WHF-11-2 will also be used to obtain background quality data during Phase II operation if so required.

Downhole geophysical logging will be conducted on the existing monitoring wells to verify the lithologic logs and further assess the geologic setting in the area. This information coupled with groundwater flow information will be used to optimize the location of PCPT explorations.

Five PCPT explorations are proposed within the area of Sites 11, 12, 13, and 14. The approximate locations of the five explorations are presented on Figure 5-18 and are anticipated to be in a downgradient direction of the four sites.

In-situ groundwater samples will be collected in the immediate vicinity of each PCPT exploration. At all five locations a lower aquifer zone groundwater sample will be obtained. If the presence of a groundwater body above the upper clay layer is confirmed during the PCPT explorations, *in-situ* groundwater samples will also be collected from this zone. Groundwater samples will be shipped to the analytical laboratory for the analysis of TCL volatile organics and metals.

In that the "Y" drainage ditch is the dominant drainage feature around this site grouping, sediment samples will be obtained at three locations within the "Y" ditch (see Figure 5-18). Sediment samples from the 0.5- to 1.0-foot interval, will be shipped to the analytical laboratory for the analysis of TCL constituents.



LEGEND

- EXISTING MONITORING WELL
- PROPOSED MONITORING WELL
- PROPOSED CPT EXPLORATION
- PROPOSED SEDIMENT SAMPLING LOCATION

FIGURE 5-18

SITES 11, 12, 13, & 14 EXPLORATION PROGRAM

RI/FS WORK PLAN

NAS WHITING FIELD MILTON, FLORIDA

Results from the analytical program will be used to determine if the "Y" drainage ditch is a potential contaminant transport pathway which may be impacting Big Coldwater Creek.

Three soil samples will be obtained from each of the two earth covered mounds located at Site 12. Samples will be obtained at a depth interval of approximately 1.0 to 1.5 feet into the mounds. Samples will be shipped to the laboratory for the analysis of total lead and for hazardous waste characteristics.

Results from the total lead analysis will be used during the risk assessment for both ecological risk and risk to human health. The hazardous waste characteristics (reactivity, ignitability, TCLP, etc.) analysis will be used to determine if the sludge was properly disposed.

5.3.3.10 Site 15 and 16 - Southwest Landfill and Open Disposal and Burn Area
Due to the proximity of these sites to one another, they have been combined into one study area for investigative purposes.

Site 15 - Southwest Landfill

Site Location. Site 15 is located southeast of the wastewater treatment plant on an area of approximately 15 acres. The location of the site is shown on Figure 5-19.

Site Description. The site is located at the foot of the Western Highlands. The area has a surface slope of about 5 percent. The land slopes from east to west towards Clear Creek. Thus, surface runoff from the site is to Clear Creek which is approximately 1,200 feet west of the site. The IAS reported that much of the site is covered with small pine trees; however, there are numerous areas void of vegetation. Severe surface erosion, as a result of the surface slope, was evident at the site during the IAS survey. The IAS also reported that the erosion problem was compounded by the fact that vegetative cover has not been fully established at the site. As a result of the erosion, some of the buried wastes have been exposed, including paint cans, oil filters, and spark plugs. Berms have been created throughout the landfill area to reduce surface erosion. The site is surrounded by tall pine trees.

Site History. This area was operated as a landfill from 1965 to 1979, during which time it received the majority of wastes generated at NAS Whiting Field. Wastes disposed included primarily general refuse and other wastes associated with the operation and maintenance of aircraft (paint, paint thinner, solvents, waste oil, and hydraulic fluid). This included wastes from the AIMD and the training squadrons. Bagged asbestos was also reportedly disposed at the site, as well as potentially PCB-contaminated dielectric fluid. The IAS estimated approximately 3,000 to 4,500 tons of waste were disposed at the site annually. Table 5-11 summarizes the types and quantities of wastes potentially disposed at Site 15. The site was operated as a landfill, with the waste material being covered on a daily basis. No burning was conducted at the site.

As part of the Verification Study, monitoring well WHF-15-1 was installed to a depth of 72 feet BLS along the west side of the site (see Figure 5-19). The

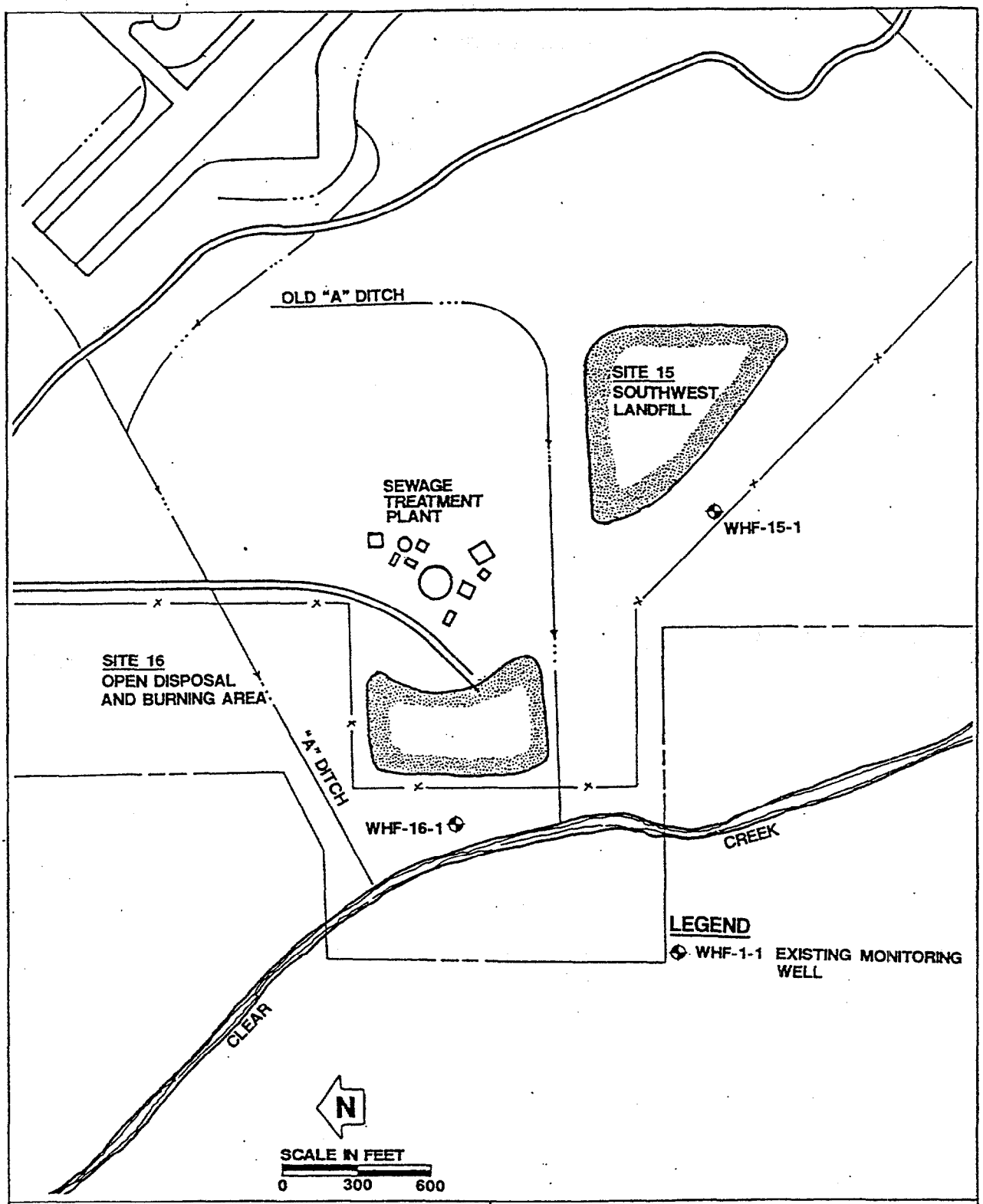


FIGURE 5-19

SITE PLAN
SITES 15 & 16

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

TABLE 5-11
WASTES POTENTIALLY DISPOSED AT SITE 15, SOUTHWEST LANDFILL
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED* TOTAL QUANTITY	COMMENTS
General Refuse	Naval Air Station	1965 to 1979	--	Site 15 was a primary landfill during this period.
Paint stripping wastewater	AIMD Paint Shop	1965 to 1979	300,000 gallons	Paint stripping wastes diluted significantly with copious amounts of rinse water.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop Aircraft Maintenance Transportation Division Shop	1965 to 1979	40,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division and Transportation Division Shop	1965 to 1979	60,000 gallons	**

NOTE: * - Assumes that 4/5 of the total maximum yearly waste generated was disposed at Site 15 and 1/5 disposed at Site 10.

** - Maximum quantity disposed at this site and Fire Fighting Training Area

lithologic log for well WHF-15-1 is shown in Appendix B. Depth to the groundwater table was measured to be about 27 feet BLS and based on the water elevations, groundwater is thought to flow west towards Clear Creek. A groundwater sample was collected during the investigation and analyzed for the USEPA's list of priority pollutants. Bis(2-ethylhexyl)phthalate (118 ug/l) was the only organic compound detected in the water sample from well WHF-15-1. Trace concentrations of lead (0.003 ug/l) and zinc (0.06 mg/l) were also detected in the water sample.

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 15.

1. The Southwest Landfill was operated from 1965 to 1979 to dispose of general wastes including paint wastes, solvents, waste oil, asbestos, transformer fluids, and spent hydraulic fluids.

2. The geology beneath the site consists of 42 feet of sandy clay underlain by 30 feet of sands.

3. Groundwater was present at 27 feet BLS.

4. Groundwater west of the site contains bis(2-ethylhexyl)phthalate (118 ug/l).

Site 15 will be included in Phase I RI to refine groundwater flow information and assess downgradient groundwater quality.

Site 16 - Open Disposal and Burn Area

Site Location. Site 16 is located just east of Clear Creek and west of the wastewater treatment plant. The site covers an area of approximately 10 acres. The location of the site is shown in Figure 5-19.

Site Description. The waste disposal area is located on a small plateau west of Clear Creek at an elevation of approximately 50 feet above MSL. To the east of the site lies the Western Highlands of the coastal plain, and to the west, the land drops to Clear Creek at a slope of about 10 percent. Clear Creek is located approximately 200 feet west of the site. The majority of the site and surrounding area is covered with tall pine trees.

Due to its topographic setting, the site collects surface runoff from areas to the east. Surface runoff flows from the sites to the west and Clear Creek. Due to the close proximity of the site to Clear Creek, surface runoff is quickly discharged to the creek. Groundwater flow in the area of the site is expected to follow that of surface water, flowing from east to west toward Clear Creek.

Site History. This site was used as an open disposal and burn area from the time NAS Whiting Field was established in 1943 until around 1965. During this period of time, the site reportedly received the majority of wastes generated at the air station. These wastes consisted of general refuse and wastes associated with the operation and maintenance of aircraft (paint, solvents, waste oil, and hydraulic fluid). This included wastes from AIMD and the training squadrons. The IAS also

reported that PCB-contaminated dielectric fluid was probably disposed at the site. Approximately 3,000 to 4,500 tons of waste were disposed at the site annually. Table 5-12 summarizes the types and quantities of wastes potentially disposed at Site 16. Reportedly, the majority of wastes disposed at the site were burned for volume reduction. Waste diesel fuel was added to the wastes to promote improved burning.

As part of the Verification Study, monitoring well WHF-16-1 was installed west of the site as shown in Figure 5-19. It was installed to a depth of 42 feet BLS with depth to groundwater table determined to be about 11 feet. Appendix B provides the lithologic log for monitoring well WHF-16-1. A groundwater sample was collected and analyzed for the EPA's list of priority pollutants. The laboratory analysis of the sample showed a concentration of bis(2-ethylhexyl)phthalate at 36 ug/l and trace amounts of lead and zinc that were well below the FDER's drinking water standard.

Based on an evaluation of the results from the IAS and Verification Study, the following conclusions can be made for Site 16:

1. Site 16 was an open disposal and burn area used from 1943 to 1965 to dispose of and burn general facility wastes which included waste solvents, paint wastes, transformer fluids, waste oil, and hydraulic fluids.

2. The geology beneath the site consists of 9 feet of fine to medium sand underlain by 6 feet of clay below which is fine to coarse sands.

3. Groundwater at the site was present at 11 feet BLS.

4. Groundwater west of the site contained bis(2-ethylhexyl)phthalate (36 ug/l).

Site 16 will be investigated under the Phase I RI to refine groundwater flow information and assess downgradient groundwater quality.

Phase I Exploration Program

The exploration program at Sites 15 and 16 will consist of the following activities:

- geophysical logging of existing monitoring wells WHF-15-1 and WHF-16-1,
- installation of one monitoring well (WHF-16-2),
- four PCPT explorations with associated *in-situ* groundwater sampling and analysis,
- drainage ditch sampling, and
- obtaining surficial soil samples.

In addition, if initial exploratory and analytical data suggest contamination, the following activities may be undertaken during Phase II of the RI field investigation:

TABLE 5-12
WASTES POTENTIALLY DISPOSED AT SITE 16, OPEN DISPOSAL AND BURN AREA
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

WASTE	SOURCE OF WASTE	TIME PERIOD	ESTIMATED* TOTAL QUANTITY	COMMENTS
General refuse	Naval Air Station	1943 to 1975	--	Site 16 was a primary disposal area during this period, Site 1 the secondary.
Paint stripping wastewater	AIMD Paint Shop	1943 to 1975	300,000 gallons	Paint stripping wastes diluted significantly with copious amounts of rinse water.
Waste paints and thinners	Operations Maintenance Division	1943 to 1975	500 gallons	**After 1960, this waste went to the Fire Fighting Training Area.
Solvents (MEK, toluene, xylene, and PD-680)	Air Frame Shop, Aircraft Maintenance, Transportation Division Shop	1943 to 1975	40,000 gallons	**
Waste oils and hydraulic fluids	Operations Maintenance Division Transportation Division Shop	1943 to 1975	70,000 gallons	**

Source: Envirodyne Engineers (1985)

NOTE: * - Assumes that 1/2 of the total maximum yearly waste generated was disposed at Site 16, 3/10 was disposed at Site 1 and 1/5 disposed at Site 11. Estimates rounded to one significant figure.

** - Maximum quantity disposed at this site and Fire Fighting Training Area

- plume delineation,
- source area delineation, and
- potential receptors survey.

The approximate locations of the Phase I explorations are presented in Figure 5-20.

One additional monitoring well (WHF-16-2) will be installed to refine groundwater flow direction data at these sites. Downhole logging will be conducted to verify lithology in existing wells and assess geology at the new well location. This information coupled with the refined groundwater flow information will be assessed to optimize the PCPT exploration locations.

Four PCPT explorations with subsequent groundwater sampling are proposed in the area of Sites 15 and 16. The location of these explorations are presented in Figure 5-20. Due to the length of the downgradient edge of each site, two explorations are proposed for each site.

Due to the potential for the erosional process to act as a transport mechanism of contaminants to Clear Creek, old drainage ditch "A" is scheduled for sediment sampling (see Figure 5-2). Sediment samples will be obtained from the 0.5 to 1.0-foot depth interval within the ditch. Samples will be shipped to the laboratory for the analysis of TCL constituents.

Due to the presence of Boy Scouts of America activities in the past around Sites 15 and 16, surface soils at each landfill will be sampled. At each landfill three randomly selected surface soil samples (0.0 to 0.5 foot interval) will be collected for shipment to the laboratory. Samples collected for TCL volatile organics analysis will be collected in 4-inch long brass liners and sealed immediately with Teflon end caps. Soil samples will be analyzed for TCL constituents.

This initial soil sampling program at Sites 15 and 16 is intended to ascertain if the potential for a risk to human health by dust inhalation, soil ingestion, etc., exists. If data from this program and the *in-situ* groundwater sampling and analysis program indicate contamination in either medium, a more detailed study will be undertaken under the Phase II RI site investigation.

5.3.3.11 **Sites 17 and 18 - Crash Crew Training Areas** Due to the proximity of these sites to one another, they have been combined into one study area for the purpose of investigation.

Site 17 - Crash Crew Training Area

Site Location. Site 17 is located in the North Field approximately 1,750 feet north of "E" drainage ditch as shown in Figure 5-5.

Site History. During the last 27 years this area has been used for fire fighting training and is presently being used for fire fighting training. However, the specific training location has been relocated within the boundaries of the site. During a training session, approximately 110 gallons of JP-4 fuel is poured into shallow surface depressions, ignited, and then extinguished using an AFFF. As

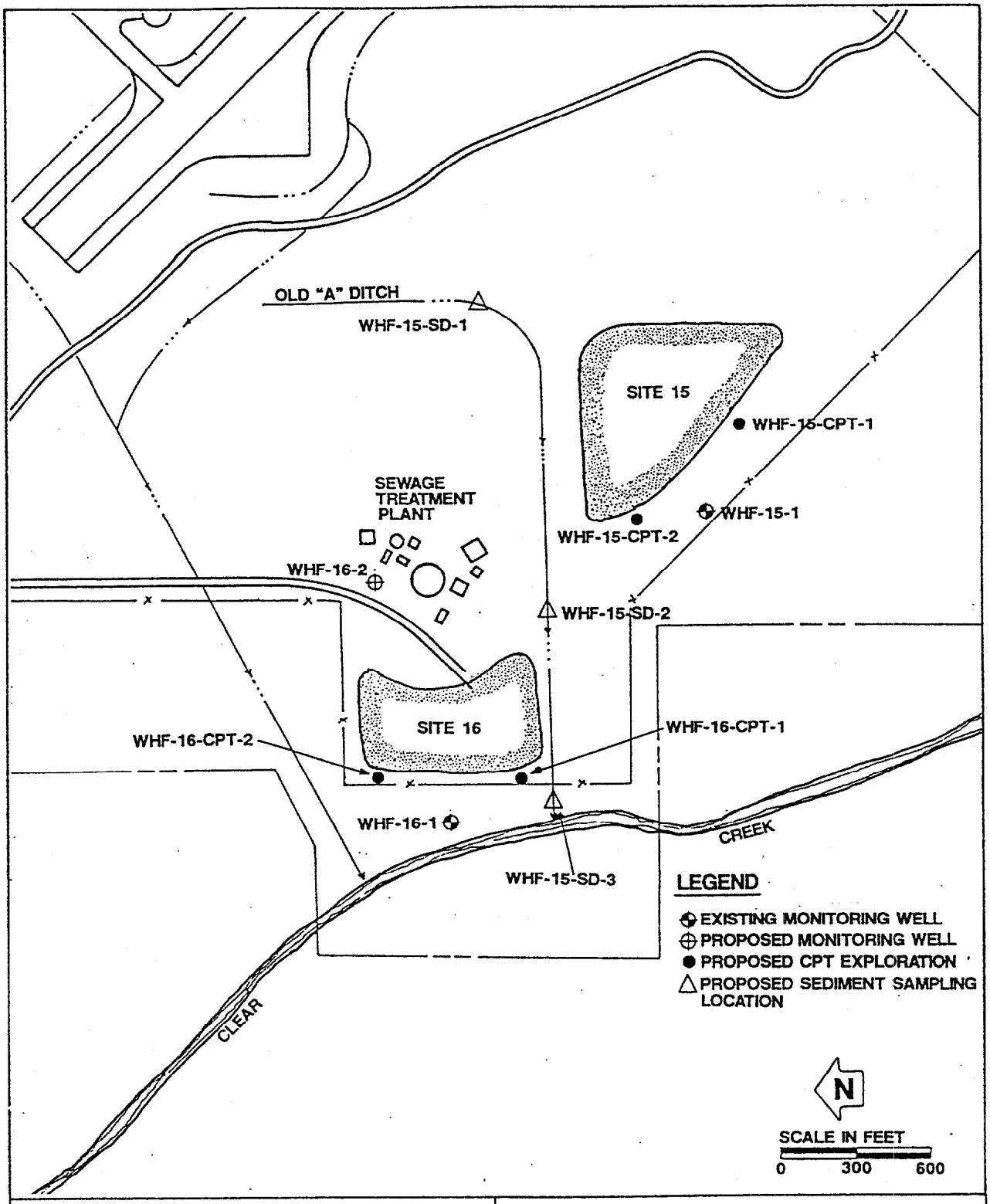


FIGURE 5-20

SITES 15 & 16
EXPLORATION PROGRAM

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an indication of volumes of materials used during these exercises, NAS Whiting Field records (as presented in the Verification Study) state that 6,285 gallons of fuel and 3,148 gallons of AFFF were used during 1984 between the two training areas (Sites 17 and 18).

Site 17 was not included in the IAS but was added to the list of areas of concern in December 1985 by the FDER after reviewing a Plan of Action entitled Naval Assessment and Control of Installation Pollutants, Verification Study, NAS Whiting Field. Subsequently, monitoring well WHF-17-1 was installed adjacent to the site (see Figure 5-5) as part of the Verification Study. The well was installed to a depth of 152 feet with the water table surface determined to be about 112 feet BLS. The lithologic log for this well is provided in Appendix B. A water sample was collected and analyzed for the USEPA's list of priority pollutants. Analyses of the groundwater sample showed trace amounts of lead and mercury and also bis(2-ethylhexyl)phthalate at a concentration of 18 ug/l. During the Verification Study, it was documented that certain foams used for fire fighting may contain minor amounts of phthalate esters. Although drinking water standards for phthalates have not been established, proposed USEPA ambient water criterion for protection of human health has been calculated to be 15,000 ug/l (as reported in the Verification Study).

Based on an evaluation of the results from the IAS and Verification Study, the following conclusions can be made for Site 17.

1. Site 17 has been used as a fire fighting training area for the last 27 years. Significant volumes of fuels have been used in these operations.

2. The geology beneath the site consists of 85 feet of sandy clay underlain by 67 feet of fine to coarse sands.

3. Groundwater at the site was present at 112 feet BLS.

4. Groundwater west of the site contained bis(2-ethylhexyl)phthalate (18 ug/l).

Site 17 will be investigated under the Phase I RI to refine groundwater flow information and assess downgradient groundwater quality.

Site 18 - Crash Crew Training Area

Site Location. Site 18 is located on the southwest fence line of the North Field as shown in Figure 5-5.

Site History. The background of Site 18 is identical to that of Site 17, which was described previously. The site has been used as a fire fighter training area for the past 27 years.

As part of the Verification Study, monitor well WHF-18-1 was installed to 122 feet BLS. The well is located adjacent to the site as shown in Figure 5-5. The water table surface was determined to be about 94 feet BLS. The lithologic log for well WHF-18-1 is presented in Appendix B. A water sample was collected from

the well and analyzed for the USEPA's list of priority pollutants. Analyses of the groundwater sample showed trace amounts of lead and mercury and also bis(2-ethylhexyl)phthalate (32 ug/l).

Based on an evaluation of the results from the IAS and Verification Study the following conclusions can be made for Site 18.

1. Site 18 has been used as a fire fighting training area for the past 27 years receiving significant quantities of fuels.

2. The geology beneath the site consists of 78 feet of fine to coarse sand underlain by 2 feet of clay below which is 42 feet of fine to coarse sands.

3. Groundwater at the site was present at 94 feet BLS.

4. Groundwater west of the site contained bis(2-ethylhexyl)phthalate (32 ug/l).

Site 18 will be investigated under the Phase I RI to refine groundwater flow information and assess downgradient groundwater quality.

Phase I Exploration Program

The Phase I exploration program for Sites 17 and 18 will include the following activities:

- downhole geophysical logging of monitoring wells WHF-17-1 and WHF-18-1,
- PCPT/*in-situ* groundwater sampling and analysis at each site, and
- slug tests in existing wells.

In addition, the following Phase II explorations may be undertaken should initial data indicate groundwater contamination:

- plume delineation,
- source area soil sampling, and
- potential (terrestrial) receptors survey.

Figure 5-6 shows the approximate locations of the explorations at Site 17 and 18. Geophysical logging will be conducted in existing monitoring wells to expand the understanding of the sites. This data will be used to optimize the location of PCPT explorations.

As seen from Figure 5-7, existing monitoring wells are not truly downgradient of either of the two sites. Therefore, one PCPT exploration each is proposed for Sites 17 and 18 at the positions indicated in Figure 5-7. Prior to undertaking the PCPT explorations, a synoptic round of water level measurement will be taken to assist in final placement of the PCPT explorations. The results of this exploration plus the results from the downhole geophysical log of the site monitoring well will be used to determine if an upper aquifer zone sample should be taken. An *in-situ* groundwater sample will be collected in the upper aquifer

and lower aquifer zones at the approximate depths specified in Table 5-2. Groundwater samples collected during this program will be analyzed for TCL volatile organics.

5.3.4 Phase I Facility-Specific Explorations The facility-specific explorations to be conducted during the Phase I RI will include the following programs:

- surface water and sediment sampling and
- production well source area investigations.

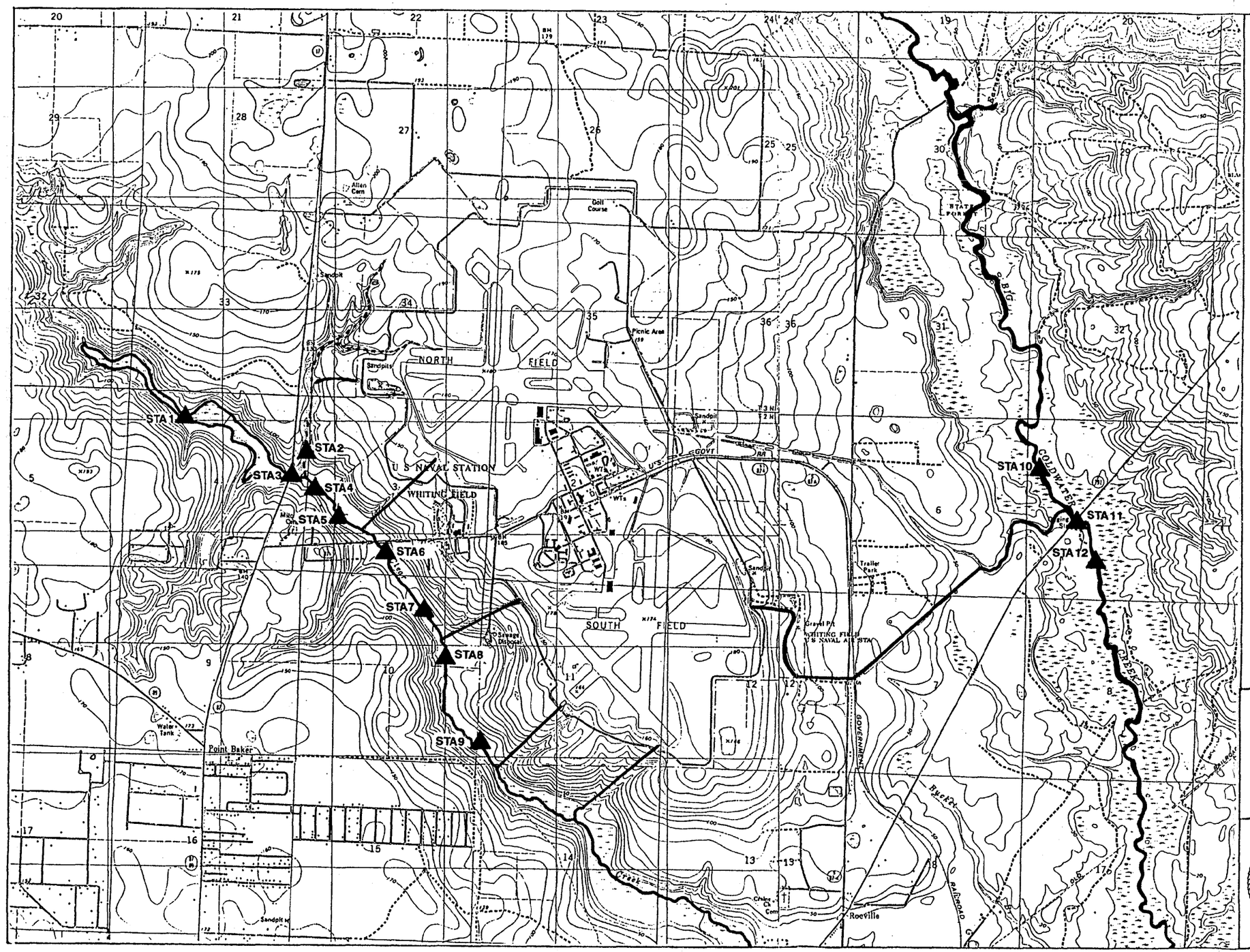
These programs are described in the following sections.

5.3.4.1 Surface Water and Sediment Sampling Program In that Clear Creek and Big Coldwater Creek are the primary receiving water bodies for both groundwater and overland flow, twelve sampling stations established to collect samples for laboratory analysis. The intent of the program is the evaluate whether the two creeks have been impacted and, their current conditions. Data derived from this subtask will be used in the ecological baseline risk assessment. Assessments will be made with regards to both current conditions and anticipated future conditions during remedial alternatives evaluation.

Number and Location of Sample Stations. Twelve surface water and sediment samples will be collected from locations along Clear Creek and Big Coldwater Creek, as shown in Figure 5-21. Sampling stations will be situated both upstream and downstream of major drainage ditch discharge points which may have been impacted by the identified disposal sites at NAS Whiting Field. The intent is to determine the impact of discharge from NAS Whiting Field on creek water and sediment quality. Additional sampling stations will be established farther downstream to ascertain recovery, if applicable, and to further assess the impact of groundwater discharge to both creeks. These locations are approximate and may be relocated based on actual site conditions. All samples will be sent to laboratory for analyses of the constituents listed in Section 3.9 of the SAP (Volume II).

Sampling Procedures. All samples will be collected in accordance with procedures discussed in Sections 6.7.3 and 6.6.5 of the QAPP (Volume II, Appendix B). Surface water samples will be collected by dipping the sampler container directly into the water. If the water is not deep enough to permit the use of this method, a glass or stainless steel beaker will be used to transfer the sample into the container. Sediment samples will be collected using a stainless steel scoop, mixed in a glass or stainless steel pan, and placed into the sample container. Volatile organic analytes samples will be removed from the stream and placed directly into the sample container without mixing. All data generated during surface water and sediment sampling will be recorded in bound field log books.

5.3.4.2 Production Well Source Area Investigation Program Production wells W-W3 and W-S2 are known to be contaminated by trichloroethene and benzene respectively. However, the source areas affecting these wells are not clearly defined and the extent of groundwater contamination has not been delineated. A phased exploration program has been designed to delineate these source areas and to ascertain the extent of groundwater contamination associated with them.



SOURCE:
USGS QUADRANGLE MILTON NORTH, FLORIDA
PHOTOREVISED 1987
AND USGS QUADRANGLE HAROLD, FLORIDA 1973.

FIGURE 5-21

SURFACE WATER/SEDIMENT/BIOTA SAMPLING STATIONS

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00181B07Z

In-Situ Groundwater Sampling - Quadrant Identification In order to decrease the size of the area to be investigated for source area delineation, the first phase of this program is intended to delineate the radial quadrant or quadrants from which contaminated groundwater is being pulled toward the two production wells. As such, eight to nine *in-situ* groundwater sampling locations have been established around each production well in a radial pattern. Figures 5-4 (Appendix A) and 5-24 (Appendix A) present the approximate location of the *in-situ* sampling points for each investigation.

For both sites an initial PCPT will be conducted to ascertain groundwater sampling locations within both the upper and lower zone of the sand and gravel aquifer. In that low density petroleum hydrocarbons (i.e., benzene) are a concern at production well W-S2, *in-situ* groundwater samples initially will be obtained only within the upper aquifer zone at the eight sampling locations around the well. These samples will be shipped to the laboratory for the analysis of the TCL volatile organics.

Based upon positive analytical results, lower aquifer zone groundwater samples will be collected only at those locations where volatile organics were detected in upper aquifer zone samples. This approach will ascertain the vertical extent of contamination within the quadrant(s) which are contributing to the contamination of the production wells. For both sampling events, samples will be collected during the operation of the production well.

In that trichloroethene, a dense chlorinated hydrocarbon, has been detected in groundwater pumped from production well W-W3, both upper and lower zone groundwater samples will be collected at the nine locations identified in Figure 5-24 (Appendix A).

Positive laboratory results for an *in-situ* groundwater sample will give an indication of the general direction of the source area. This will aid in reducing the overall area to be investigated in a follow-up Source Area Identification Program.

5.3.5 Phase II - Remedial Investigation The specific scope of the Phase II RI will be determined based upon an evaluation of the results from the Phase I RI. The following Phase II RI subtasks are anticipated to be conducted based upon the current understanding of the NAS Whiting Field sites:

- potential receptor survey,
  - terrestrial and aquatic survey,
  - domestic well survey,
- plume delineation;
- production well investigations; and
- source area investigations.

The general technical approach, methodology, and supporting rationale are presented in the following sections. In keeping with the dynamic nature of this RI/FS planning document, an amendment to this Work Plan will be developed describing the detailed Phase II RI.

5.3.5.1 **Phase II - Potential Receptor Survey** The purpose of this activity is to obtain information on the ecology of areas in and around NAS Whiting Field. This information is needed to support the ecological risk assessment and the evaluation of remedial alternatives. Potential points of exposure of environmental receptors include the terrestrial ecosystems in the vicinity of the various sites; the aquatic ecosystems of Clear Creek, Big Coldwater Creek, and the Blackwater River; and private domestic wells located downgradient of NAS Whiting Field. The ecosystems were described to some extent in the Initial Assessment Study (Envirodyne Engineers, 1985). The proposed biological survey will verify and supplement the ecological information contained in the Envirodyne report.

The objectives of the biological survey are to provide information necessary to:

- identify environmental receptors with regard to the common flora and fauna of the sites and surrounding area;
- identify migration pathways for contaminants in site-specific food chains and determine the potential for human exposure;
- identify the location of any threatened, endangered or rare species, sensitive environmental areas or cultural habitats near the site;
- assess possible disruptive effects of contaminants on plant and animal population associated with the site;
- complete any necessary wetlands or floodplains assessments; and
- evaluate the potential ecological impacts associated with remedial alternatives.

The components of the biological survey are described below. Field and laboratory methods will be based in part on EPA/600/3-89/013, Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document. The objectives of the survey will be accomplished in part by a field investigation by a qualified biologists.

The IAS data on ecological receptors list potentially rare, endangered, or threatened species, as listed by three different Federal and State agencies, which may reside in the vicinity of NAS Whiting Field. More information is required regarding what species have actually been documented in proximity to the base and what species may reside near particular sites.

The IAS data also includes lists of other mammalian, reptile, amphibian, bird, and fish species which may reside in the area. The IAS discusses which of these organisms would be found in particular parts of the base. However, there is no documentation for this portion of the report as no references to the source of the information is stated. Collection of additional information is required to document the presence of receptors and also to clarify the types of receptors near each site.

The biological survey of NAS Whiting Field consist of two components:

- terrestrial survey and
- aquatic survey.

Further specific information on terrestrial receptors will be gathered either during the Phase II RI on a site by site basis if analytical results from the Phase I RI indicate either soil or groundwater contamination or, at a later time to collect additional information if the destruction or disturbance of terrestrial habitats needs to be evaluated as part of the FS. It is anticipated that a terrestrial survey will only be required at sites where soil contamination has been found and where the area near the site comprises a suitable habitat for terrestrial organisms.

The aquatic survey portion will be conducted during the Phase II RI as it will be necessary to address risks associated with present or future contaminated groundwater discharge to Clear Creek and Big Coldwater Creek. The survey scope is very limited and not extensive but serves only to characterize the potentially impacted ecosystems. Further quantitative studies or fish tissue sampling will only be required in Phase II where significant contamination was measured in creek surface water or sediments.

Aquatic Survey. Aquatic organisms are more readily collected for identification than terrestrial wildlife. Scientists will collect plankton, aquatic invertebrates, benthic macroinvertebrates, and fish for taxonomic identification in the surface water bodies and wetlands associated with NAS Whiting Field. Sampling equipment will include a plankton tow, an aquatic dip net, an Ekman dredge, and a seine. Site-specific characterization is important because aquatic organisms are the most likely receptors of chemical contamination and extensive ecotoxicity data exist for them.

If chemical contamination of sediments and surface water of Clear Creek and Big Coldwater Creek is determined as part of the Phase I RI field investigation, then quantitative sampling of the creeks will be implemented to assess the extent of impacts. Three replicate benthic samples will be taken with a Petite Ponar Dredge at each of the 12 sampling locations (see Figure 5-21) on Clear Creek and Big Coldwater Creek. Each sample will be 0.333 m^2, for a total area sampled of 1.0 m^2 at each station. Each grab sample will be immediately placed in a holding tub. The materials will then be washed through a 1-cm screen to hold back large woody debris or leaves. The large items will be discarded after close inspection for clinging organisms. The material washed through the 1-cm screen will then be washed through a 0.5-mm screen. Material retained on the 0.5-mm sieve will be washed into a container (large enough to be filled only half way with screened material) and fixed with 70 percent ethanol. The container will be clearly labeled with the station and replicate number, collection date and time, location, and collector's name.

At each sampling location for benthic invertebrates other data on water quality and bottom composition will be collected. The information will be recorded on a biological sampling data sheet (Figure 5-22).

BIOLOGICAL SAMPLING DATA SHEET
AQUATIC SURVEYS

LOG. NO._____

Site:_____ Type of Sample:_____ Date: _____

Water Body:_____ Number of Samples_____ Time (24 hr clock):_____
Location:_____ Equipment Used:_____ Collector(s): _____
County_____ Weather (present):_____ _____
Township:_____ (past): _____ Preservative(s): _____
Contaminants of Concern:_____

Terrain Characteristics: Land Use (500 m radius)

___Urban ___Upland Conifer ___Flat
___Cultivated ___Swamp hardwood ___Rolling
___Pasture ___Swamp Conifer ___Hilly
___Upland hardward ___Marsh ___Mountains

Stream Cover (Overall upstream view)

___Dense (75%-100% shaded)
___Partly open (15-75%)
___Open (0-25%)

Stream Gradient

___Pool
___Riffle
___Cascade
___Flat

Physical Characteristics of Bottom (estimate % of each component over 12m stretch of site)

___Bedrock ___Gravel (1/8"-3) ___Large Woody Debris
___Boulders (>10") ___Sand (<1/8") ___Detritus
___Rubble (3"-10") ___Silt-caly-muck ___Leaf litter

Habitat
Width ( ): _____

Depth ( ): _____

Flow (c /): _____meter type_____

pH: _____D.O._____

Water (color, etc.) _____secchi:_____

Immediate shore: _____

Temperature Air: _____water_____

Notes: _____

_____

Observations and Notes: (Check off and describe)

Fish:_____

Algae:_____

Macrophytes:_____
Submergent or emergent:_____

Invertabrates:_____

Mammals:_____

Discharges:_____

Distance from outfall:_____

Plume characteristics:_____

Foreign matter:_____

Obstructions:_____

Other:_____

_____

FIGURE 5-22
BIOLOGICAL SAMPLING DATA SHEET FORM AQUATIC SURVEY

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Invertebrate samples will be collected qualitatively by use of an aquatic dipnet and dredge if quantitative sampling is not determined to be necessary. This will include collection of only one sample per location.

In the laboratory the collected organisms will be sorted, identified to the genus level where possible, and counted. The analysis results will be recorded on biological identification forms (Figure 5-23). After identification the organisms will be retained in labeled vials in 70 percent ethanol.

Fish will be sampled using a seine at the 12 sampling stations prior to the benthic sampling in these areas. A seine large enough to sample the entire reach of the stream will be used. One end of the seine will be pulled along one shore while the other end is pulled in the direction of the current in a parallel fashion along the opposite shore. After a distance of 20 to 30 feet, one end of the seine will be worked to the opposite shore and the two ends beached. Fish will be identified, weighed, and measured in the field and returned to the stream unharmed to the extent possible. Species that cannot be readily identified will be weighed, preserved in 70 percent ethanol, and identified later in the laboratory.

Terrestrial Survey. Terrestrial surveys will only be conducted in the event where soil or groundwater contamination has been measured during Phase I RI activities and the area near the site provides sufficient habitat for terrestrial organisms. Terrestrial surveys may also be required in the instance where destruction or alternation of habitat needs to be evaluated as part of the FS.

The first step of the terrestrial survey will be to identify wetland and upland plant communities present in the vicinity of each site. Scientists will describe the species of aquatic and terrestrial vegetation present or expected at the site. Species of submergent, floating, emergent, shrub, and tree layer vegetation present in wetlands, streams, and other water bodies will be listed. Herbaceous, shrub, and tree layer species will be described for upland areas.

Scientists will identify wetlands based on national Wetlands Inventory maps (if available), U.S. Geological Survey topographic maps, aerial photographs, and field investigation. Identification of vegetative cover and soil types around the individual sites at NAS Whiting Field will be recorded by the field biologists on a Wetland Delineation Form (Figure 5-25).

Field personnel will also record any observations of terrestrial wildlife species (i.e., birds, mammals, reptiles, and amphibians). However, it will not be possible to fully characterize all species of wildlife present without extensive trapping and field collection efforts. Therefore, scientists will identify potential terrestrial receptors primarily based upon the identified habitat types (wetland and upland plant communities) and reports of the habitats and ranges of indigenous terrestrial wildlife.

Domestic Well Survey. A survey will be conducted to identify all potential groundwater receptors. By contacting local agencies (e.g., water management district office, county public health agency, etc.) and possibly conducting a door-to-door survey in the study area, domestic wells and their uses will be

BIOTA IDENTIFICATION FORM

SAMPLE NO. _____
REPLICATE NO. _____
DATE _____

GENUS/SPECIES	COUNT	COMMON NAME	REFERENCE/REMARKS

SIGNATURE OF IDENTIFIER _____

FIGURE 5-23
BIOTA IDENTIFICATION FORM

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WETLANDS DELINEATION FORM
(Based on U.S. Army Corps of Engineers DATAFORM1/JUL88)

Routine Page 1

DATE: _____ TRANSECT: _____ PLOT: _____

APPLICANT: _____ UTM East: _____ Meters

FILE NUMBER: _____ UTM North: _____ Meters

PROJECT TITLE: _____

CITY/TOWN: _____ STATE: _____ COUNTY: _____

DETERMINATIONS

Prevalence of Hydrophytes? ( ) NO ( ) YES Basis:

Hydric Soils Present? ( ) NO ( ) YES Basis:

Wetland Hydrology Apparent? ( ) NO ( ) YES Basis:

CONCLUSIONS

Altered? ( ) NO ( ) YES (If yes, see attached form)
(Soils, Plants, Hydrology)

Normal Circumstances? ( ) NO ( ) YES Remarks:

Wetland? ( ) NO ( ) YES Remarks:

COMMENTS

PRINTED NAME
(Persons performing delineation)

FIGURE 5-25
WETLANDS DELINEATION FORM

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

WETLANDS DELINEATION FORM (continued) Routine Page 2

Transect: _____ Plot: _____

VEGETATION

TREE:	Species	Status	LIANA:	Species	Status
1.			1.		
2.			2.		
3.			3.		
4.			4.		

SAMPLING/SHRUB:			SEEDING/HERB:		
1.			1.		
2.			2.		
3.			3.		
4.			4.		

Percent Hydrophytes: _____% Remarks: _____

Depth & Horizon	Munsell Color (wet) Matrix/Mottle	USDA Texture (wet)	Remarks
0 inch			
3 inch			
5 inch			
16 inch			

Series & Phase:

Check: ( )Histosol ( )Histic Epidedon ( )Anaerobio Soil ( )Sulfidic Odor
( )Aquic Mositure Regime ( )Peraquic Moisture Regime ( )On NICHS List
( )Iron Concretions ( )Manganese Concretions
( )Organic Streaking of Subsurface Horizon in Sandy Soil
( )Organic Pan in Sand Soil ( )Organic Layer Over Sandy Soil >3 in.
CORDR IMMEDIATELY BELOW THE A-HORIZON OR AT 10 INCHES, WHICHEVER IS LESS:
( )Gleyed ( )Mottled with Matrix Chroma <2 ( )Unxottled with Chroma <1

HYDROLOGY

OBSERVED DATA Check: ( )Saturation in upper 12 inches ( )Inundation
( )Drift Lines ( )Sediment Deposits ( )Enorsuted Detritus
( )Watermarks ( )Drainage Patterns (in low areas)

Depth of STANDING WATER: Depth to SATURATION

RECORDED DATA:

SOURCE: _____ DATED: _____

FIGURE 5-25(CONT.)
WETLANDS DELINEATION FORM (PAGE 2)

RI/FS WORK PLAN

NAS WHITING FIELD
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identified. Should groundwater data indicate the need for such a matter, off base domestic wells will be sampled.

5.3.5.2 Phase II - Plume Delineation For those sites or site groupings determined to have impacted groundwater, a Phase II RI site investigation program will be undertaken to define the nature and extent of the contaminant plume. This program will consist of two exploration techniques: installation of downgradient monitoring wells for long-term monitoring of groundwater quality and *in-situ* groundwater sampling and analysis to define the vertical and horizontal extent of the contaminant plume.

To delineate the extent of groundwater contamination emanating from a site or site grouping, an *in-situ* groundwater sampling and analysis program will be undertaken. The intent of this program is to define the vertical and horizontal extent of the contaminant plume. Knowledge of the contaminant extent will be used to calculate the volume of contaminated groundwater and to properly place permanent monitoring wells. Analysis of groundwater samples will be conducted using a field gas chromatograph. Indicator parameters to be analyzed for shall be defined by their presence in samples collected during the initial PCPT/*in-situ* groundwater sampling episode (i.e., any of the TCL volatile organics).

The installation of downgradient monitoring wells will result in permanent monitoring stations which can be used to monitor future remedial efforts or monitor contaminant migration.

Based upon the analytical results for the Phase II *in-situ* groundwater samples, monitoring wells will be installed downgradient of those sites where groundwater contamination is present. The installation of both upper zone and lower zone monitoring wells are anticipated at this time.

Boreholes for downgradient monitoring wells will be advanced using mud-rotary techniques. Standard penetration tests will be conducted at 5-foot intervals and at changes in stratigraphy throughout each overburden boring. Split-spoon samples will be logged, placed in 8-ounce drillers jars, and archived for future reference. Headspace readings will be conducted on each driller's jar containing a saturated overburden sample using an organic vapor analyzer to ascertain contaminated water bearing zones.

Monitoring well screen placement and length will be defined based upon the results of the PCPT exploration program, the *in-situ* groundwater sampling and analysis program, and actual field conditions encountered during drilling (i.e., lithology). Initially, 5-foot sections of slotted screen are proposed for placement just above the upper or lower clay layer.

Modification of this approach will take place if free petroleum product is anticipated to be present in the upper aquifer zone or if a contaminated zone is encountered (as suggested by headspace measurements) above the lower clay.

At sites where floating free product is anticipated a 10-foot section of screen will be installed. The screen shall be installed such that approximately 6 feet of screen shall extend below the water table. Candidate sites for screen placement across the water table will include those sites where free product was

noted during split-spoon sampling or where the analysis of *in-situ* groundwater samples indicate petroleum related contamination (i.e., excessive levels of benzene, ethylbenzene, toluene, total xylenes, etc.).

In borings where headspace measurements indicate a contaminated layer above the lower clay layer, monitoring wells will be screened across the zone of contamination. Screen length shall be sized by 2.5-foot increments according to the thickness of the contaminated zone. Maximum length of screen will not exceed 10 feet in these wells.

Monitoring wells, to be used for long-term monitoring or where conditions warrent it, will be constructed of 4-inch ID, Type 316 stainless steel, with 0.010-inch wire-wrapped well screens. Well screen length will vary due to geologic and hydrogeologic conditions found in each boring, but will not exceed 10 feet in length. The screen will be surrounded with a sandpack consisting of 20/30 mesh silica sand placed by a tremie pipe to a maximum depth of two feet above the screen followed by a 2 foot bentonite slurry plug. The remainder of the boring will be backfilled using a tremie pipe first with a bentonite slurry plug then with a cement/bentonite mixture to within 2 feet of the surface. A protective casing with locking cover (10-inch ID and 6 feet in length) will be placed over the top of the well. Each well and protective casing will extend approximately 3 feet above the ground surface and will be cemented into place. All well construction data will be recorded on well construction sheets. Each monitoring well will be developed after installation. The specific method selected will depend upon the final depth of well, depth of water, aquifer permeability, and parameters selected for analysis. Methods of development available will include: bailing, pumping, air lift, or surge blocks.

5.3.5.3 Phase II - Production Well Investigation

Production Well Source Area Identification. Based upon the results from the quadrant identification program, a coarse sampling grid (i.e., 500- to 1000-foot grid interval) will be established in the quadrants identified to be contributing to production well contamination. *In-situ* groundwater samples will be collected at the appropriate depths and analyzed for indicator parameters (i.e., trichloroethene, benzene, etc.) using a field GC.

In addition, facility records of past and present activities will be re-evaluated in an attempt to locate potential source areas. It is anticipated that this will further reduce the area to be investigated.

Production Well Source Area Extent. Should additional source areas be identified during this investigation, further studies will be proposed during the Phase II RI site investigation to investigate the extent of both groundwater contamination and the source area.

5.3.5.4 Phase II - Source Area Investigations For those sites determined during the Phase I hydrogeologic investigation to be potentially contributing to groundwater contamination, a detailed source area investigation will be undertaken. The intent of this program will be to determine the types of contaminants present and the lateral and vertical extent of the source area.

At non-landfill source areas, a grid system will be established to define soil boring and sampling locations. The size of the grid will be a direct function of the source area size. Soil samples will be obtained across the grid at a depth corresponding to native soil and at the land surface. The analytical program will be dependent upon types of hazardous waste disposed of at the particular sites. Sites which may have received various types of waste or for which information on disposal practices are sparse will be sampled for the analysis of constituents of the TCL.

For landfills, the extent of the source area will be determined by the use of surface geophysic's techniques, e.g., ground penetrating radar. Due to the difficulty and often hazardous conditions associated with drilling through landfills, this particular exploratory technique is not advisable for characterizing the types of contaminants present. As such, other sampling techniques (e.g., slant boring from landfill edge, sampling seeps, etc.) will be proposed if the need arises.

5.4 TASK 4 - SAMPLE ANALYSIS AND VALIDATION. Samples collected during the RI field activities will be analyzed in accordance with the DQOs established in Section 4.0. Table 5-13 summarizes the number of samples (including QA/QC samples) planned for the NAS Whiting Field Phase I RI.

Quality control during sample analysis is described by USEPA's Contract Laboratory Program - Caucus Organic Protocol (CLP-COP) and Contract Laboratory Program - Caucus Inorganic Protocol (CLP-CIP) and NEESA's Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (June 1988).

5.5 TASK 5 - DATA EVALUATION. Data evaluation is the process of organizing validated data into a working format and then reviewing and using the data to meet project objectives. Based on this process, Task 5 can be divided into two distinct components: data reduction and data evaluation. A brief description of these components is provided below.

5.5.1 Data Reduction Data obtained from the various field investigations will be condensed and organized to facilitate evaluation and presentation. Data reduction will result in the production of various tables, figures, and drawings describing and summarizing the pertinent site features. These include:

- figures displaying boring and monitoring well locations,
- hydrogeologic cross-sections,
- groundwater contour maps, and
- contaminant contour maps.

Data reduction will be facilitated by computerization. The computerized sampling and analytical data base will be amenable to manipulation and creation of different sorting profiles. Sorting profiles will assist in evaluating the occurrence and distribution of contaminants with the different media. Appropriate tables, maps, and figures will be produced to summarize the occurrence and distribution of contaminants at the various sites and in adjacent areas.

TABLE 5-13
SUMMARY OF CHEMICAL ANALYSES[1]
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

		NEESA LEVEL C REQUIREMENTS						NEESA LEVEL E REQUIREMENTS	
SITE NUMBER	ENVIRONMENTAL MEDIUM	TCL VOAs	TCL SVOAs	TCL PEST/PCBs	TAL INORGANICS	TCL PCBs	TAL METALS	RCRA HAZARD CHARACTERISTICS[2]	TOTAL LEAD
1	Groundwater	2					2		
3	Groundwater	3							
6	Soil					12			
9	Groundwater	1					1		
10	Groundwater	3					3		
11	Groundwater	2					2		
12	Groundwater	2					2		
	Sediment	3	3	3	3				
	Soil							6	6
13	Groundwater	4					4		
14	Groundwater	2					2		
15	Groundwater	4					4		
	Soil	3	3	3	3		3		
	Sediment	3	3	3	3				
16	Groundwater	4					4		
	Soil	3	3	3	3				
17	Groundwater	2					2		
18	Groundwater	2					2		
W-W3	Groundwater	18							
W-S2	Groundwater	16							

TABLE 5-13 (Cont.)
SUMMARY OF CHEMICAL ANALYSES1
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

		NEESA LEVEL C REQUIREMENTS						NEESA LEVEL E REQUIREMENTS	
SITE NUMBER	ENVIRONMENTAL MEDIUM	TCL VOAs	TCL SVOAs	TCL PEST/PCBs	TAL INORGANICS	TCL PCBs	TAL METALS	RCRA HAZARD CHARACTERISTICS[2]	TOTAL LEAD
STA1	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA2	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA3	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA4	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA5	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA6	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA7	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA8	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA9	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA10	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA11	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
STA12	Surface Water	1	1	1	1				
	Sediment	1	1	1	1				
SUBTOTAL	Groundwater	65					28		
	Soil	6	6	6	6	12		6	6
	Surface Water	12	12	12	12				
	Sediment	18	18	18	18				

TABLE 5-13 (Cont.)
SUMMARY OF CHEMICAL ANALYSES[1]
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SITE NUMBER	ENVIRONMENTAL MEDIUM	NEESA LEVEL C REQUIREMENTS						NEESA LEVEL E REQUIREMENTS	
		TCL VOAs	TCL SVOAs	TCL PEST/PCBs	TAL INORGANICS	TCL PCBs	TAL METALS	RCRA HAZARD CHARACTERISTICS[2]	TOTAL LEAD
Duplicates	Groundwater	7					3		
	Soil[3]	1	1	1	1	2			
	Surface Water[3]	2	2	2	2				
	Sediments[3]	2	2	2	2				
Matrix Spike/Dup	Soil[3]	2	2	2	2	2			
	Surface Water[3]	2	2	2	2				
	Sediments[3]	2	2	2	2				
Field Blank[4]	Water	11	2	2	2	1	7	1	1
Equipment Blank[5]	Water	36	2	2	2	1	1	1	1
Trip Blank[6]	Water	32							
TOTAL	Groundwater	72					31		
	Soil	9	9	9	9	16			
	Surface Water	16	16	16	16			6	6
	Sediment	22	22	22	22				
	Blank	79	4	4	4	2	8	2	2

NOTES:
[1] Listing of sample ID Code in Site-Specific Quality Assurance Plan Addendum
[2] Includes analysis for ignitability, corrosivity, reactivity, and TCLP
[3] 10% replicate under Level D QC requirements
[4] 1/source/event
[5] 1/day
[6] 1/cooler

TCL - Target Compounds List
TAL - Target Analyte List
VOA - Volatile Organic Analytes
SVOA - Semivolatile Organic Analytes
PEST - Pesticides
PCBs - Polychlorinated Bi Phenyls

5.5.2 Data Evaluation Usable data, as determined by validation and evaluation, will be presented in data tables organized by sample media and location. Once data are reduced to this usable format, they will be reviewed and evaluated to determine if RI project objectives have been met. The data will then be used in the risk assessment to develop appropriate target levels for the FS.

5.5.3 Modeling Results of the analysis on each site's physical characteristics, source area characteristics, and extent of contamination analyses will be combined in the analysis of contaminant fate and transport. The observed extent of contamination will be used to assess the transport pathway's rate of migration and the fate of the contaminants over the period between suspected release and monitoring. Contaminant fate and transport will also be estimated based on site physical characteristics and source characteristics.

Both analyses will require the use of either analytical or numerical modeling. While field data generally best define the extent of contamination, models will be used to interpolate among and extrapolate from isolated field samples and will be used to interpret field data to create a more detailed description.

Models applicable to site characterization are grouped according to their relative accuracy and their ability to depict site conditions. Analytical and semianalytical models quantitatively estimate site conditions with relatively low accuracy and resolution if site conditions are complex. They will provide order-of-magnitude estimates. However, they often require that simplified assumptions be made regarding site conditions and chemical characteristics. Such models will be use during preliminary analyses to govern Phase II activities by providing initial estimates on the fate and migration of contaminants.

More detailed numerical models can provide greater accuracy and resolution. They are capable of representing spatial variations in site characteristics and irregular geometries. These models can more accurately represent the actual configuration and effects of remedial actions on site conditions. However, numerical models require an extensive input data base plus accurate representation of the parameters affecting both groundwater and contaminant transport.

If applicable for sites at NAS Whiting Field, numerical models will be used to provide a more accurate representation of contaminant fate and migration. These models will be used also for screening alternative remedial actions and for the detailed analysis of alternatives.

Deciding whether analytical or numerical models should be used and selecting appropriate models for either the remedial investigation or the feasibility study will be based on the hydrogeologic information derived during the Phase I RI field investigations. At that time the hydrogeology underlying NAS Whiting Field will be better defined and a rational choice of the specific model, plus any additional input parameter needs, can be made.

It is noted, however, that modeling may not be required if site conditions are well understood and if the potential effectiveness of different remedial actions can be easily evaluated. In selecting and applying models, it is important to

remember that a model is an artificial representation of a physical system and is only one way of characterizing and assessing a site.

5.6 TASK 6 - BASELINE RISK ASSESSMENT. The risk assessment to be performed for sites at NAS Whiting Field will include both a Baseline Public Health Risk Assessment and a Baseline Ecological Risk Assessment. Both assessments will be based on data obtained from the field investigation and will characterize the current and potential public health and ecological risks that could occur if no remedial action alternative is required, as per Section 300.68(f)(v) of the NCP. The Baseline Public Health Risk Assessment will be conducted in accordance with procedures outlined in the EPA Superfund Public Health Evaluation Manual (USEPA, October 1986).

There are two objectives to the Public Health and Ecological Risk Assessments. First, the assessments will provide information that can be used to evaluate the need for remediation based on the potential health and ecological risks posed by the site. Second, the baseline assessments will provide a basis for determining the reduction in risks resulting from the different remedial actions to be evaluated in the feasibility study. Thus, it will assist in selecting a remedial alternative for the site.

The major steps of both the Public Health and Ecological Risk Assessments are:

- selection of contaminants of concern,
- identification of chemical-specific Applicable or Relevant and Appropriate Requirements,
- exposure assessment,
- toxicity assessment, and
- risk characterization.

5.6.1 Data Management/Summarization Data management is critical to all other steps in the risk assessment process as it ensures that the analytical information for the sites is in a suitable format for use in the evaluation of risk. Computerized data will be available for the separate sites. The information will be separated by media (i.e., soil, sediment, groundwater, or surface water) and summarized to represent the level and distribution of chemicals at the sites. Statistical analysis of the data will include the calculation of central tendency (e.g., arithmetic mean or geometric mean) and maximum. These values will be used in the risk assessments to estimate the most probable and worst case conditions. Details on data management are present in the Data Management Plan (Volume III) of this planning document.

5.6.2 Public Health Risk Assessment The purpose of the public health risk assessment is to estimate the probability of potential adverse health effects for individuals who live on or near NAS Whiting Field resulting from exposure to chemicals which originate at any of the sites.

5.6.2.1 Selection of Contaminants of Concern The selection of contaminants of concern will be performed to narrow the list of chemicals detected at each site to those that have the greatest potential to cause adverse health effects or are representative of site conditions. The selection will be based on the distribution and frequency of detection in applicable media, the measured

concentrations at each site and media, the inherent toxicity of the chemicals in chemical classes (e.g., pesticides, inorganics, etc.), and the physical and chemical properties of the chemicals in relationship to mobility and persistence in the environment. Current USEPA guidance will be used to select contaminants of concern.

5.6.2.2 **Identification of Chemical-Specific ARARs** ARARs will be identified for the contaminants of concern. The ARARs will include Maximum Contaminant Levels for drinking water, Maximum Contaminant Level Goals (MCLGs), Ambient Water Quality Criteria (AWQC), the State of Florida groundwater and drinking water regulations, USEPA reference doses (RfDs), USEPA carcinogenic potency factors, and any other applicable ARAR not listed here.

5.6.2.3 **Public Health Toxicity Assessment** The toxicity assessment that will be performed for the contaminants of concern will include a hazard identification and a dose-response assessment. The hazard identification will be a summary of the major toxic properties of the chemicals. The dose-response assessment will present the pertinent Federal and Florida standards, criteria, and guidelines for quantitatively assessing risk to human health. It will include a detailed discussion of the particular studies on which the dose-response values are based and the relevance of the study exposure conditions. This information will be collected from the USEPA Integrated Risk Information System (IRIS) Data Base.

5.6.2.4 **Public Health Exposure Assessment** The purpose of the public health exposure assessment is to estimate body dose levels of contaminants of concern for identified exposure routes. The various steps involved in this assessment are: identification of the human receptors potentially exposed to site-derived contaminants, identification of the major exposure pathways through which individuals could contact the contaminants currently or in the future, and estimation of potential exposure conditions such as the duration and frequency of exposure.

The only verified pathway of exposure at NAS Whiting Field is the ingestion of groundwater from the three production wells. Other potential current routes of exposure which will be considered are dermal contact with (and possible ingestion of) surface water and sediments in Clear Creek by children, past Boy Scouts activities, and adults fishing (which would make Big Coldwater Creek a potential route for exposure). The potential ingestion of contaminated fish from both creeks by adults and children will also be considered. Finally, the baseline assessment will evaluate the potential dermal absorption or inhalation exposures to soils by workers on any of the 13 sites at NAS Whiting Field.

5.6.2.5 **Public Health Risk Characterization** The public health risk characterization will be based on the information generated in the toxicity and exposure assessments. Quantitative risk estimates will be developed if sufficient information exists to adequately characterize the exposure to and toxicity of the contaminants of concern. Otherwise, a qualitative risk assessment will be performed. Risks will be evaluated separately for each of the exposure scenarios identified for the relevant environmental media at each site.

The quantitative risk characterization, if appropriate, will consist of a comparison of the estimated body dose levels to the relevant dose-response

information. For carcinogens, incremental carcinogenic risks will be estimated; for noncarcinogens, hazard indices will be estimated. These numerical estimates of risk will be summarized by media for each site.

The risk characterization will serve as a baseline evaluation of contaminant conditions at the site with respect to the potential for adverse human health impacts. If risks are determined to be unacceptably high, target cleanup levels will be established. The purpose of these levels is to establish contaminant concentrations which will not pose excess human health risks. During the remedial alternatives evaluation in the FS, each alternative will be compared to the baseline to determine whether it effectively reduces the identified risks and achieves the target cleanup levels, thereby adequately protecting public health.

5.6.3 Ecological Risk Assessment The purpose of the Ecological Risk Assessment is to estimate the potential for adverse effects to aquatic and terrestrial wildlife as a result of exposure to contamination emanating from the 16 identified NAS Whiting Field sites.

5.6.3.1 Selection of Contaminants of Concern Contaminants of concern will be selected to narrow the field of contaminants to be considered in the risk assessment from those chemicals detected in site media to those chemicals which potentially pose the greatest hazard to wildlife and are the most representative of site conditions. Chemicals of concern will be selected based upon prevalence, observed concentrations, distribution among sampling locations, toxicity, and persistence.

5.6.3.2 Identification of Chemical-Specific ARARs ARARs for the contaminants of concern will be identified. These will include USEPA Ambient Water Quality Criteria, State of Florida surface water quality standards, and USEPA Interim Sediment Quality Criteria. No ARARs currently exist for soils.

5.6.3.3 Ecological Exposure Assessment

Receptor Identification. The ecological exposure assessment will identify potential biological receptors of site-related chemical contamination based on a review of information in the Initial Assessment Study (Envirodyne Engineers, 1985), information collected from local and State agencies, and information collected during an onsite biological investigation (Section 5.3.5.1).

Exposure Routes and Exposure Levels. Preliminary routes of exposure for receptors were identified in the Preliminary Ecological Risk Assessment (Section 3.1.2). The identified exposure routes will be further evaluated, incorporating new analytical information from the field investigation and the receptor identification. The preliminary routes of exposure and procedures for estimating concentrations of contaminants of concern at each point of exposure are discussed in the following sections.

- Direct Contact and Ingestion of Surface Water. The magnitude of exposure for aquatic receptors to contaminants in surface water will be determined from analytical information obtained during the field investigation. Exposures for terrestrial organisms via ingestion will be estimated based

upon the analytical results and the expected feeding and drinking habits of receptors.

- Direct Contact and Ingestion of Sediments. Levels of exposure for receptors to sediment-bound contaminants will be determined in part from analytical information obtained during the field investigation and modeling of the bioavailability of contaminants from sediments. Bioavailability of contaminants to aquatic biota will be determined by estimations based upon the octanol-water partitioning coefficient or other available partitioning coefficient to partition the contaminant between particle and pore water phases of the sediment. Exposures for fish or mammals by ingestion will be estimated based upon life history information for the particular fish or mammalian receptors near the site in question.

- Direct Contact and Ingestion of Soils. Terrestrial wildlife (mammals, birds and reptiles) are potentially exposed to contaminants in soils by ingestion or direct contact. The magnitude of exposure for these receptors will be evaluated based upon analytical information on surface soils collected during the field investigation.

- Ingestion of Contaminated Food Resources. If site-related contaminants are persistent they may accumulate in organisms exposed by direct contact or ingestion of contaminated soils, sediments or surface water. Other organisms consuming these contaminated individuals will be exposed by ingestion.

Potential pathways of contaminant migration in food chains that may be evaluated for any persistent contaminant include: transfer from contaminated aquatic invertebrates to fish with subsequent transfer from the fish to birds or mammals, and transfer from contaminated terrestrial invertebrates (worms) to birds. Other pathways of contaminant migration will be evaluated as necessary dependant upon the results of the field investigation.

5.6.3.4 Ecotoxicity Assessment An assessment of toxicity of the contaminants of concern to wildlife receptors will be performed. Information from USEPA AWQC documents will be used along with other relevant information to determine the acute and chronic toxic effects of contaminants upon organisms identified in the biological investigation. The results of the ecotoxicity assessment will be presented as a toxicity profile for each contaminant of concern.

5.6.3.5 Ecological Risk Characterization A qualitative ecological risk evaluation will be conducted addressing the potential adverse effects to receptor organisms from exposure to site-related contaminants. In general, the risk evaluation will compare information from the Ecological Exposure Assessment on the magnitude of exposures for receptors (soils, sediments, and surface water) with dose-response information in the Ecotoxicity Assessment.

5.6.4 Identification of Remedial Response Objectives In the course of the FS, preliminary remedial response objectives will be developed to reflect the results of the Baseline Public Health and Ecological Risk Assessments. In consultation with the Navy, final remedial response objectives will be defined.

For each response objective, target clean-up levels, if appropriate, will then be developed. These levels are concentrations of chemical contaminants that are protective of public health and the environment if long-term exposures were to occur after remediation. Methods similar to those described previously for the risk characterization will be used.

5.7 TASK 7 - TREATABILITY STUDY/PILOT TESTING. During the RI, samples of soil, sediments, groundwater, surface water will be analyzed for chemical characteristics. The data generated will be evaluated to help determine the effectiveness and implementability of the remedial technologies that are being screened.

The evaluation of this RI data may indicate that specific treatability or compatibility testing may be required in addition to the physical and chemical data, for evaluation of management of migration technologies as well as source control technologies. These studies would be conducted subsequent to the RI (Task 3) as data becomes available.

Treatability studies are conducted primarily to achieve the following:

- provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis and to support the remedial design of a selected alternative, and

- reduce cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected.

Treatability studies to collect data on technologies identified during the alternative development process are conducted, as appropriate, to provide addition information for evaluating technologies. The RI/FS contractor and Southern Division's EIC will review the existing site data and available information on technologies to determine if treatability investigations are needed. The need for treatability testing will be identified as early in the RI/FS process as possible.

The decision process for treatability investigations consists of the following steps:

- determining data needs;

- reviewing existing data on the site and available literature on technologies to determine if existing data are sufficient to evaluate alternatives;

- performing treatability tests, as appropriate, to determine performance, operating parameters, and relative costs of potential remedial technologies; and

- evaluating the data to ensure that DQOs are met.

If evaluation of RI data indicate site-specific treatability or compatibility studies, or other pilot testing, is necessary to complete the FS, a Technical

Directive Memorandum (TDM) for these activities will be prepared for review and approval by the Navy.

5.8 TASK 8 - REMEDIAL INVESTIGATION REPORT. Task 8 covers all work efforts related to the preparation of site characterizations and conclusions after all data have been evaluated under Tasks 5 and 6. It includes reviewing hydrogeologic data, contaminant assessment data, and risk assessment data to formulate a complete understanding of site conditions.

Task 8 includes the preparation of draft and final versions of the RI report. This report will present data gathered during RI Tasks 3 through 7 and conclusions regarding how data from the individual tasks interact to affect overall site conditions. The RI report will be written in accordance with Southern Division guidance. A suggested RI Report format is presented in Table 5-14.

5.9 TASK 9 - REMEDIAL ALTERNATIVE SCREENING. In this task, remedial alternatives will be screened as the first step in the FS process. This task will employ data collected in the RI field investigation (Task 3) and Risk Assessment (Task 6). The subtasks comprising Task 9 include:

- development of remedial response objectives and general response actions,
- identification and screening of remedial technologies,
- assembly of remedial alternatives, and
- screening of remedial alternatives.

This task can be initiated immediately, but needs to be started no later than the start of Task 3 (Field Investigation). During this task, the work developed in Task 5 (Data Evaluation) and Task 6 (Risk Assessment) will be used to screen the technologies. The specific subtasks comprising Task 9 are described in greater detail in the following sections.

5.9.1 Development of Remedial Response Objectives and Response Actions Based on data collected in the RI, the remedial response objectives identified during the scoping process under Task 1 will be developed more fully and finalized. Prior to the development of these objectives, significant site, environmental and health concerns, and ARARs will have been identified. These include the remedial response objectives that address unacceptable risks to public health and the environment, and ARARs, with consideration given to site-specific conditions. General response actions will be delineated to address each of the site problem area response objectives. These response actions will form the foundation for the technology screening.

5.9.2 Identification and Screening of Remedial Technologies The remedial response objectives and general response actions form the basis for identifying and screening remedial technologies. For the NAS Whiting Field, preliminary applicable technologies for groundwater/surface water and soil/sediment treatment have been identified based on existing information (Section 3.4). Technologies may be added or deleted from the list based on the FS team's more detailed understanding of site conditions requiring remediation. These individual technologies will be screened on their ability to meet remedial action objectives, as well as with respect to their implementability and cost.

TABLE 5-14
RI REPORT FORMAT
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

Executive Summary

1. Introduction
   - 1.1 Purpose of Report
   - 1.2 Site Physical Description
     - 1.2.1 Site Description
     - 1.2.2 Site History
     - 1.2.3 Previous Investigations
   - 1.3 Report Organization

2. Study Area Investigation
   - 2.1 Includes field activities associated with site characterization. These may include physical and chemical monitoring of some, but not necessarily all, of the following.
     - 2.1.1 Surface Features (topographic mapping, etc.) natural and manmade features
     - 2.1.2 Contaminant Source Investigations
     - 2.1.3 Meteorological Investigations
     - 2.1.4 Surface Water and Sediment Investigations
     - 2.1.5 Geological Investigations
     - 2.1.6 Soil and Vadose Zone Investigations
     - 2.1.7 Groundwater Investigations
     - 2.1.8 Human Population Surveys
     - 2.1.9 Ecological Investigations
   - 2.2 If technical memoranda documenting field activities were prepared, they may be included in an appendix and summarized in this report chapter.

3. Physical Characteristics of the Study Area
   - 3.1 Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following.
     - 3.1.1 Surface Features
     - 3.1.2 Meteorology
     - 3.1.3 Surface Water Hydrology
     - 3.1.4 Geology
     - 3.1.5 Soils
     - 3.1.6 Hydrogeology
     - 3.1.7 Demography and Land Use
     - 3.1.8 Ecology

4. Nature and Extent of Contamination
   - 4.1 Presents results of site characterization, both natural chemical components and contaminants, in some, but not necessarily all, of the following media.

TABLE 5-14 (Cont.)
RI REPORT FORMAT
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

- 4.1.1 Sources (lagoons, sludges, tanks, etc.)
- 4.1.2 Soils and Vadose Zone
- 4.1.3 Groundwater
- 4.1.4 Surface Water and Sediments
- 4.1.5 Air

5. Contaminant Fate and Transport
   - 5.1 Potential Routes of Migration (i.e., air, groundwater, etc.)
   - 5.2 Contaminant Persistence
     - 5.2.1 If they are applicable (i.e., for organic contaminants), describe estimated persistence in the study area environment and the physical, chemical, and/or biological factors of importance for the media of interest.
   - 5.3 Contaminant Migration
     - 5.3.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption on soils, solubility in water, movement of groundwater, etc.)
     - 5.3.2 Discuss modeling methods and results, if applicable

6. Baseline Risk Assessment
   - 6.1 Human Health Evaluation
     - 6.1.1 Exposure Assessment
     - 6.1.2 Toxicity Assessment
     - 6.1.3 Risk Characterization
   - 6.2 Environmental Evaluation

7. Summary and Conclusions
   - 7.1 Summary
     - 7.1.1 Nature and Extent of Contamination
     - 7.1.2 Fate and Transport
     - 7.1.3 Risk Assessment
   - 7.2 Conclusions
     - 7.2.1 Data Limitations and Recommendations for Future Work
     - 7.2.2 Recommended Remedial Action Objectives

Appendices

A - Technical Memoranda on Field Activities (if available)
B - Analytical Data and QA/QC Evaluation Results
C - Risk Assessment Methods

Source: USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. Interim Final. EPA/540/G-89/004.

5.9.3 Assembly of Applicable Technologies into Remedial Alternatives Assembly of remedial alternatives will begin after the completion of the RI. In this subtask, technologies will be combined to formulate remedial alternatives for the groundwater, surface water, soils, and sediments at the NAS Whiting Field sites. Only those technologies that are compatible with one another will be combined to form alternatives.

Alternative assembly will be governed by target cleanup levels, water discharge limits, and site remediation requirements. Target cleanup levels and discharge limits will influence the quantity of groundwater required to be extracted, treated, and then discharged. Analytical data resulting from the RI will further clarify remediation requirements (e.g., source control or soil treatment).

Remedial alternatives will span a performance range in terms of remediation levels and rate of site restoration. The following categories will be addressed by the remedial alternatives:

- no-action;
- containment involving minimal or no treatment;
- treatment that permanently and significantly reduces the toxicity, volume, or mobility of the waste;
- off-site treatment, disposal, or storage at a RCRA facility;
- alternatives that vary in the need for long-term operation maintenance; and
- alternatives that attain ARARs.

5.9.4 Screening of Remedial Alternatives The objective of screening is to reduce the list of potential remedial actions requiring detailed analysis. Alternatives that have undesirable results with respect to cost, implementability, and effectiveness will be eliminated from further consideration. The list of alternatives being considered will be reduced, after consultation with the Navy, by eliminating the following:

- alternatives that are not implementable or technically applicable;
- alternatives that are not effective because they would have adverse environmental impacts, would not provide adequate protection to public health, or would not attain ARARs or discharge limits; and
- alternatives that are significantly more costly than other alternatives, but do not provide greater environmental or public health benefits, reliability, or effectiveness (however, cost will not be used as criteria when comparing treatment and non-treatment alternatives).

The rationale for eliminating an alternative during the initial screening process will be documented in the FS. Remedial alternatives that contain innovative technologies will pass initial screening if they have the potential for better treatment performance or implementability, fewer adverse effects, or lower costs than other treatment alternatives. Results of the screening of remedial alternatives will be presented to the Navy in a technical memorandum to obtain input before proceeding with the treatability studies or the evaluation. This technical memorandum will list the remedial alternatives, and will briefly describe why any alternatives were eliminated during the screening process.

5.10 TASK 10 - REMEDIAL ALTERNATIVES EVALUATION. Remedial alternatives that pass the initial screening process (see Task 9) will be further evaluated and compared in accordance with the NCP, as required by CERCLA. As part of the FS process, SARA requires that waste, site, and technical and operational limitations, as well as the ability of each alternative to meet Federal and State ARARs, be considered. Factors that will receive special consideration during the detailed evaluation of remedial alternatives include:

- long-term uncertainties of land disposal;
- ability to achieve a permanent and significant reduction in the toxicity, volume, or mobility of waste;
- goals and requirements of the Solid Waste Disposal Act;
- short- and long-term potential for adverse human health effects;
- potential for future remedial action costs if the remedial alternatives fails; and
- potential threat to human health and the environment from the excavation, transportation, and redisposal or containment of hazardous substances, pollutants, or contaminants.

Nine evaluation criteria have been developed to address the considerations listed above, as well as technical and policy factors likely to be important for selecting remedial alternatives. The nine evaluation criteria encompass technical, cost, and institutional considerations; compliance with specific statutory requirements; and State and community acceptance. Specific criteria used to evaluate the remedial alternatives are summarized in Table 5-15. These evaluation criteria serve as the basis for conducting the detailed analysis during the FS and for subsequently selecting an appropriate remedial action. The following sections describe the nine evaluation criteria.

Short-term Effectiveness. This evaluation criterion addresses effects of the alternative during the construction and implementation phase until remedial action objectives are achieved. Under this criterion, alternatives are evaluated with respect to effects on human health and the environment during implementation of the remedial action.

TABLE 5-15
CRITERIA FOR DETAILED
ANALYSIS OF REMEDIAL ALTERNATIVES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

SHORT-TERM EFFECTIVENESS

- Protection of the community during remedial actions
- Protection of workers during remedial actions
- Environmental impacts from remedial actions
- Time until remedial action objectives are achieved

LONG-TERM EFFECTIVENESS

- Magnitude of residual risk at the conclusion of remedial activities
- Adequacy of controls to manage treatment residuals or untreated wastes
- Reliability of controls for providing continued protection from residuals

REDUCTION OF MOBILITY, TOXICITY, AND VOLUME

- The treatment processes, the remedies they will employ, and the materials they will treat
- The amount of hazardous materials that will be destroyed or treated
- The degree of expected reduction in mobility, toxicity, or volume
- The degree to which the treatment will be irreversible
- The type and quantity of residuals remaining after treatment

IMPLEMENTABILITY

- Ability to construct and operate the technology
- Reliability of the technology
- Ease of undertaking additional remedial actions, if necessary
- Ability to monitor effectiveness of the remedy
- Ability to obtain approvals from agencies
- Activities needed to coordinate with other offices and agencies
- Availability and capacity of off-site treatment, storage, and disposal services
- Availability of necessary equipment and specialists
- Availability of prospective/innovative technologies under consideration

COST

- Capital costs
- Operating and maintenance (O&M) costs
- Present worth cost
- Costs of 5-year review, if required
- Potential future remedial action costs

TABLE 5-15 (Cont.)
CRITERIA FOR DETAILED
ANALYSIS OF REMEDIAL ALTERNATIVES
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

COMPLIANCE WITH ARARs

- Compliance with chemical-specific ARARs
- Compliance with action-specific ARARs
- Compliance with location-specific ARARs
- Compliance with appropriate criteria, advisories, and guidance

OVERALL PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT

- How alternative provides human health and environmental protection

STATE ACCEPTANCE

- Components of the alternatives that the state supports
- Components of the alternatives about which the state has reservations
- Components of the alternatives that the state strongly opposes

COMMUNITY ACCEPTANCE

- Components of the alternatives that the community supports
- Components of the alternatives about which the community has reservations
- Components of the alternatives that the community strongly opposes

Long-term Effectiveness and Permanence. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

Reduction of Mobility, Toxicity, and Volume. This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

Implementability. The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.

Cost. Detailed cost estimates will be conducted in accordance with the Remedial Action Costing Procedures Manual (USEPA, 1985). Cost estimates to be developed in the FS will be based on the conceptual engineering and analysis performed for each remedial alternative. In the analysis of each remedial alternative, cost estimates will include five principal elements:

- capital costs,
- operation and maintenance costs,
- 5-year review costs,
- present worth analysis, and
- potential future remedial action costs.

Compliance with ARARs. This evaluation criterion is used to determine how each alternative will comply with State and Federal ARARs, as defined in CERCLA Section 121. The detailed analysis will summarize which requirements are applicable or relevant and appropriate to an alternative, and describe how the alternative meets these requirements. The three general categories of ARARs (i.e., chemical-, location-, and action-specific) will be discussed for each alternative, along with the alternative's compliance with appropriate criteria, advisories, and guidance.

Overall Protection of Human Health and the Environment. This criteria assesses whether each alternative will meet the requirement for protection of human health and the environment. Potential public health risks of each remedial alternative will be compared to the public health risks for baseline site conditions, which represent the no action alternative. Public Health Evaluations (PHE) will be conducted following guidance provided in the USEPA Superfund Public Health Manual.

Environmental impacts from each remedial alternative will also be compared to current (baseline) conditions. Beneficial effects of each remedial alternative will be evaluated in terms of contamination levels expected in environmental media during and after implementation of the remedial alternative, improvement in the biologic environment as a result of decreased contamination levels, and improvement in human use resources (if applicable). Attainment of chemical- and

location-specific ARARs will also be addressed, when appropriate. Adverse effects associated with construction and operation of each remedial alternative will be described in terms of direct effects (e.g., loss of habitat) or indirect effects (e.g., increased erosion and sedimentation). Inevitable effects will be distinguished from reversible effects, where appropriate. Measures to mitigate adverse effects will also be discussed herein.

State Acceptance. This assessment evaluates the technical and administrative issues and concerns that the State of Florida may have regarding each alternative.

Community Acceptance. This assessment incorporates public input into the analysis of alternatives. Formal public comments are provided during the 21-day public comment period on the RI/FS report and proposed plan. Specific public concerns or comments will be addressed in the Record of Decision (ROD) and the Responsiveness Summary.

5.11 TASK 11 - FEASIBILITY STUDY REPORTS. Task 11 will consist of the reporting of all FS deliverables. Reporting will be in the form of an interim technical memorandum to report the results of Task 9, the Remedial Alternatives Screening, and draft and final FS reports. The FS report will include the results for Task 9, as well as Task 10, the Remedial Alternatives Evaluation. The Navy will be provided with an outline of the FS report for approval prior to report preparation. The FS report format, as suggested in the Southern Division Report Format Guidance Manual, 1989 and the USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988) will be followed. Formats for tables and other data presentations will also be discussed with Navy prior to data compilation. A suggested FS report format is presented in Table 5-16.

5.12 TASK 12 - POST-RI/FS SUPPORT. The Contractor will provide support to the Navy in activities occurring after the RI/FS has been completed. Such support may include community relations, assistance in preparing the ROD or Responsiveness Summary, and assistance during the remedial design and remedial action.

6.0 PROJECT MANAGEMENT PROGRAM

Figure 6-1 shows the program organization and its principal lines of communication for the NAS Whiting Field RI/FS. The responsibilities of the Jordan program positions and support organizations are summarized below.

Regional Officer. The Regional Officer (RO) is James R. Wallace, P.E., Southeast Division Manager. He is responsible for committing the corporate resources necessary to conduct the program work activities, for supplying corporate-level input for quality assurance and problem resolution, and for assisting the Program Manager, Project Manager, and Technical Director as needed in project implementation.

Program Manager. The Program Manager (PM), R. Anthony Allen, CPSS, is responsible for the overall Southern Division multi-facility program. Some specific responsibilities of his role include:

TABLE 5-16
FS REPORT FORMAT
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

Executive Summary

1. Introduction
   - 1.1 Purpose and Organization of Report
   - 1.2 Background Information (Summarized from RI Report)
     - 1.2.1 Site Description
     - 1.2.2 Site History
     - 1.2.3 Nature and Extent of Contamination
     - 1.2.4 Contaminant Fate and Transport
     - 1.2.5 Baseline Risk Assessment

2. Identification and Screening of Technologies
   - 2.1 Introduction
   - 2.2 Remedial Action Objectives-
     Presents the development of remedial action objectives for each medium of interest (i.e., groundwater, soil, surface water, air, etc.). For each medium, the following should be discussed:
     - Contaminants of interest
     - Allowable exposure based on risk assessment (including ARARs)
     - Development of remediation goals
   - 2.3 General Response Actions-
     For each medium of interest, describes the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.
   - 2.4 Identification and Screening of Technology Types and Process Options-
     For each medium of interest, describes:
     - 2.4.1 Identification and Screening of Technologies
     - 2.4.2 Evaluation of Technologies and Selection of Representative Technologies

3. Development and Screening of Alternatives
   - 3.1 Development of Alternatives-
     Describes rationale for combination of technologies/media into alternatives. Note: This discussion any be by medium or for the site as a whole.
   - 3.2 Screening of Alternatives (if conducted)
     - 3.2.1 Introduction
     - 3.2.2 Alternative 1
       - 3.2.2.1 Description
       - 3.2.2.2 Evaluation
     - 3.2.3 Alternative 2
       - 3.2.3.1 Description
       - 3.2.3.2 Evaluation
     - 3.2.4 Alternative 3

TABLE 5-16 (Cont.)
FS REPORT FORMAT
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

4. Detailed Analysis of Alternatives
   - 4.1 Introduction
   - 4.2 Individual Analysis of Alternatives
     - 4.2.1 Alternative 1
       - 4.2.1.1 Description
       - 4.2.1.2 Assessment
     - 4.2.2 Alternative 2
       - 4.2.2.1 Description
       - 4.2.2.2 Assessment
     - 4.2.3 Alternative 3
   - 4.3 Comparative Analysis

Bibliography
Appendices

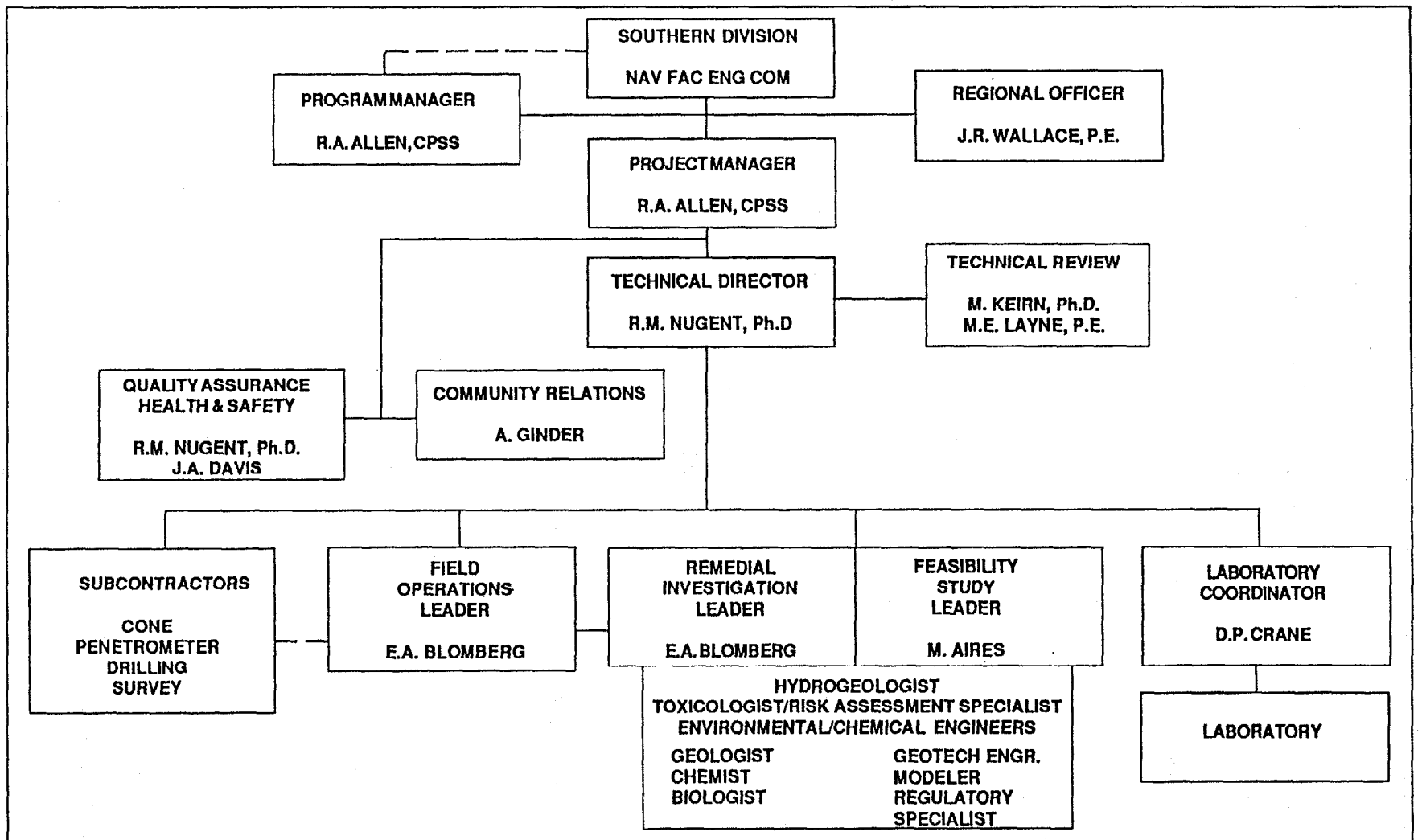


FIGURE 6-1

PROJECT ORGANIZATION

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

- oversee and manage of the overall multi-installation Navy environmental program for the southeast region;
- identify overall program needs and facilitate meeting those needs;
- direct resources as appropriate for effective and timely completion of program activities;
- ensure overall program quality assurance;
- monitoring Southern Division's satisfaction with Jordan's services;
- promote technical and programmatical information transfer; and
- contract establishment and amendment negotiations.

Project Manager. Mr. Allen will also hold the position of the Project Manager (PrM). In this role he is responsible for the management of scope, schedule and budget for the NAS Whiting Field project. Some specific responsibilities of his role include:

- assuring overall responsibility for the project to Southern Division;
- establishing and overseeing all subcontracts for support services;
- initiating project activities;
- implementing the subcontracting plan to significantly involve small and/or disadvantaged business in the program;
- participating in the work plan preparation and staff assignments;
- identifying and fulfilling equipment and other resource requirements;
- monitoring task activities to ensure compliance with established budgets, schedules, and the scope of work;
- regularly interacting with the Southern Division EIC, the Facility Commanding Officer, and others, as appropriate, on the status of the project;
- preparing monthly technical/management/cost progress reports; and
- ensuring that appropriate financial record and reporting requirements are met.

Contracts Administrator. Ms. Ada Pinson will hold the position of Contracts Administrator for the NAS Whiting Field RI/FS project. This position is established to assist the PrM with the important tasks of day-to-day scope, schedule, and budget monitoring both within Jordan and between Jordan and the IR Program EIC. It is expected that project decisions will be occurring frequently; therefore, it is necessary to anticipate and immediately implement the

administrative actions (initiate internal work orders, follow-up on support needs, amend subcontracts, track cost-charges, etc.) to carry out the program plans.

Technical Director. Each activity investigated under Jordan's multi-facility program is assigned a Technical Director (TD). Mr. R. Michael Nugent, Ph.D., has been assigned the TD for NAS Whiting Field.

The TD is responsible for the following:

- the appropriateness and adequacy of the technical or engineering services provided;
- development of the technical approach and level of effort required to address each of the tasks and subtasks;
- the day-to-day conduct of the work, including the integration of the input of supporting disciplines and subcontractors (i.e., drilling and laboratory subcontractors);
- ongoing quality control during performance of the work; and
- the technical integrity as well as the clarity and usefulness of all project work products.

Technical Review Board. A Technical Review Board (TRB), made up of senior technical staff from the Jordan team, will assist the PrM and TD by providing review of the technical aspects of the project to assure that the services reflect the accumulated experience of the firm; that they are produced in accordance with the corporate policy; and meet the intended needs of the IR Program EIC. The primary function of this board is to assure the application of technically sound methodologies and the development of litigatively defensible data, interpretations and conclusions. Members of the TRB are Mr. Michael Keirn, Ph.D., and Ms. Margaret E. Layne, P.E.

Quality Assurance/Health and Safety Coordinators. The PrM is also supported by a Quality Assurance Officer (QAO) and a Health and Safety Officer (HASO). Mr. R. Michael Nugent, Ph.D., has been assigned as QAO and Mr. J.A. Davis as HASO for the RI/FS at NAS Whiting Field. The QAO will assure that appropriate IRP and USEPA protocols are followed and will be responsible for the development of the site-specific quality assurance addendum. The QAO works with the PrM/TD to ensure that established quality control procedures are implemented. The HASO is responsible for ensuring that the project team complies with Jordan's Health and Safety Program. He is also responsible for seeing that a health and safety plan is developed for each site activity.

Other key line positions are the technical activity leaders, i.e., the senior or most-experienced individual in each technical area of the project. These technical activity leaders are identified on the project organization chart (see Figure 6-1).

The following is a list of key project staff. Revisions and identification of additional personnel may be made prior to the initiation of RI activities. Any revision/additions will be approved by the Southern Division's EIC for NAS Whiting Field. A list of emergency numbers is also contained in the HASP.

E.C. Jordan Co.
Tony Allen, Program Manager and Project Manager
Michael Nugent, Technical Director
Jack Davis, Health and Safety Officer

Southern Division
Ted Campbell, Engineer in Charge

NAS Whiting Field
Cindy Black, Environmental Coordinator

6.1 PROJECT SCHEDULE. The need for schedule planning, tracking and reporting are important requirements of the NCP/CERCLA/SARA process for Federal facilities on the NPL. To meet this need Jordan will use the PC-based Project Management Information System (PROMIS) to plan, track, and report the status of schedule on the RI/FS at NAS Whiting Field.

For the purpose of this work plan, the schedule is presented in two formats. Figures 6-2 and 6-3 present the entire RI/FS project and the Phase I RI field investigation in terms of duration in months. Additionally, a PROMIS Gantt chart (Figure 6-4) presents the entire RI/FS project by calendar dates assuming a 1 March 1990 notice to proceed.

A PROMIS detailed time-scale diagram presenting actual project dates and duration is presented in Appendix A.

The PROMIS schedule reports will be updated to reflect actual progress during the project and will be forwarded to the Southern Division EIC, NAS Whiting Field, and USEPA (if required). As actual task finish dates are entered into the computer, PROMIS will automatically recalculate new future tasks start/finish dates and project milestone events (i.e., TRC meeting dates, RI Report, RS Report, etc.). Upon Notice to Proceed the duration and PROMIS schedules will be revised so that real dates will replace the numbered months. The schedule assumes ready access to the sites and close cooperation between Jordan and NAS Whiting Field.

6.2 PROJECT DELIVERABLES. In addition to the two major deliverables, the RI Report and the FS Report, continuous written communication and reporting shall be maintained with Southern Division throughout the course of the RI/FS for NAS Whiting Field. Required documents to be forwarded to Southern Division's EIC shall consist of the follow reports:

- monthly progress reports (MPRs) from both the contractor and the analytical laboratory,
- technical memoranda discussing each data set,
- copies of field performance audits,

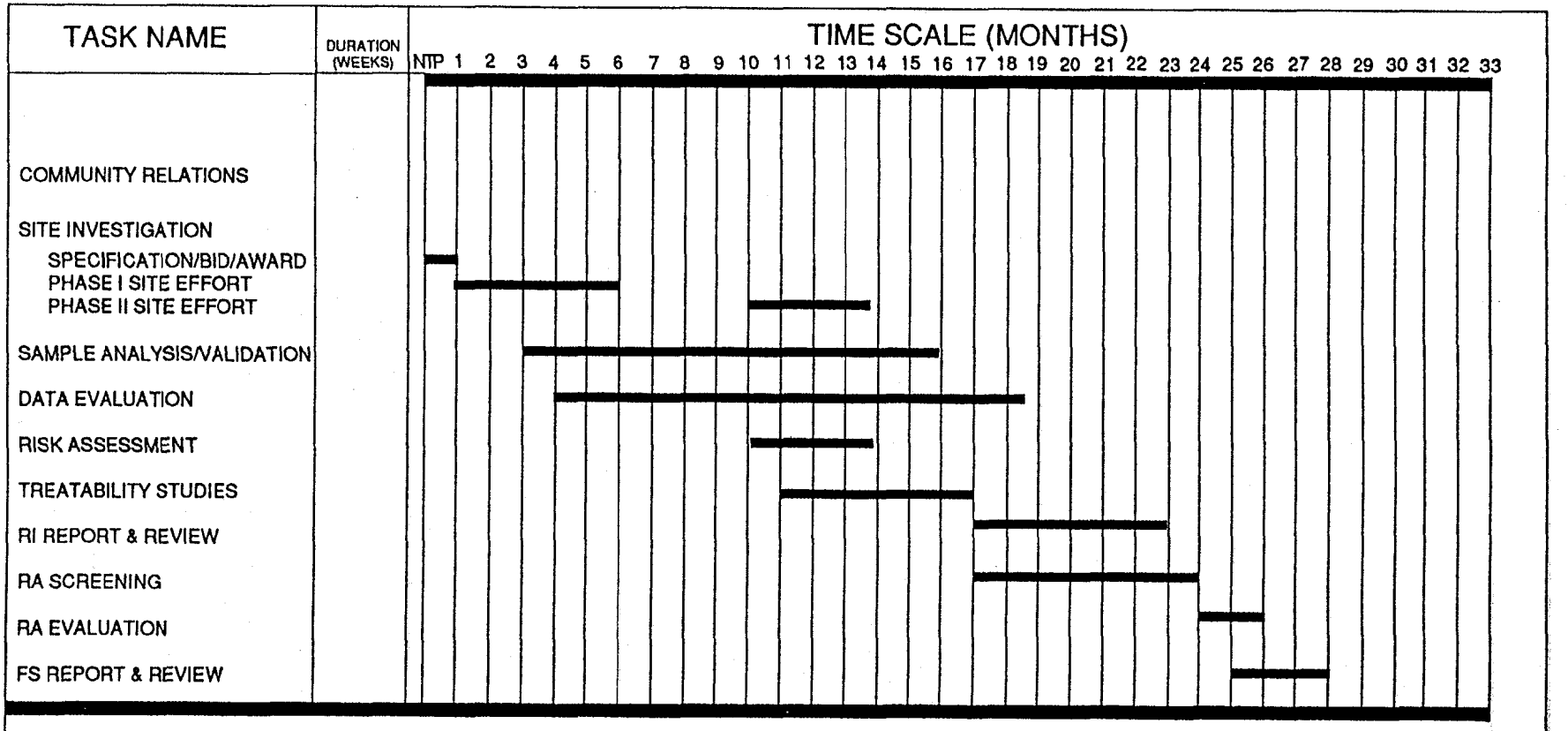


FIGURE 6-2

ANTICIPATED PROJECT SCHEDULE
RI/FS

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

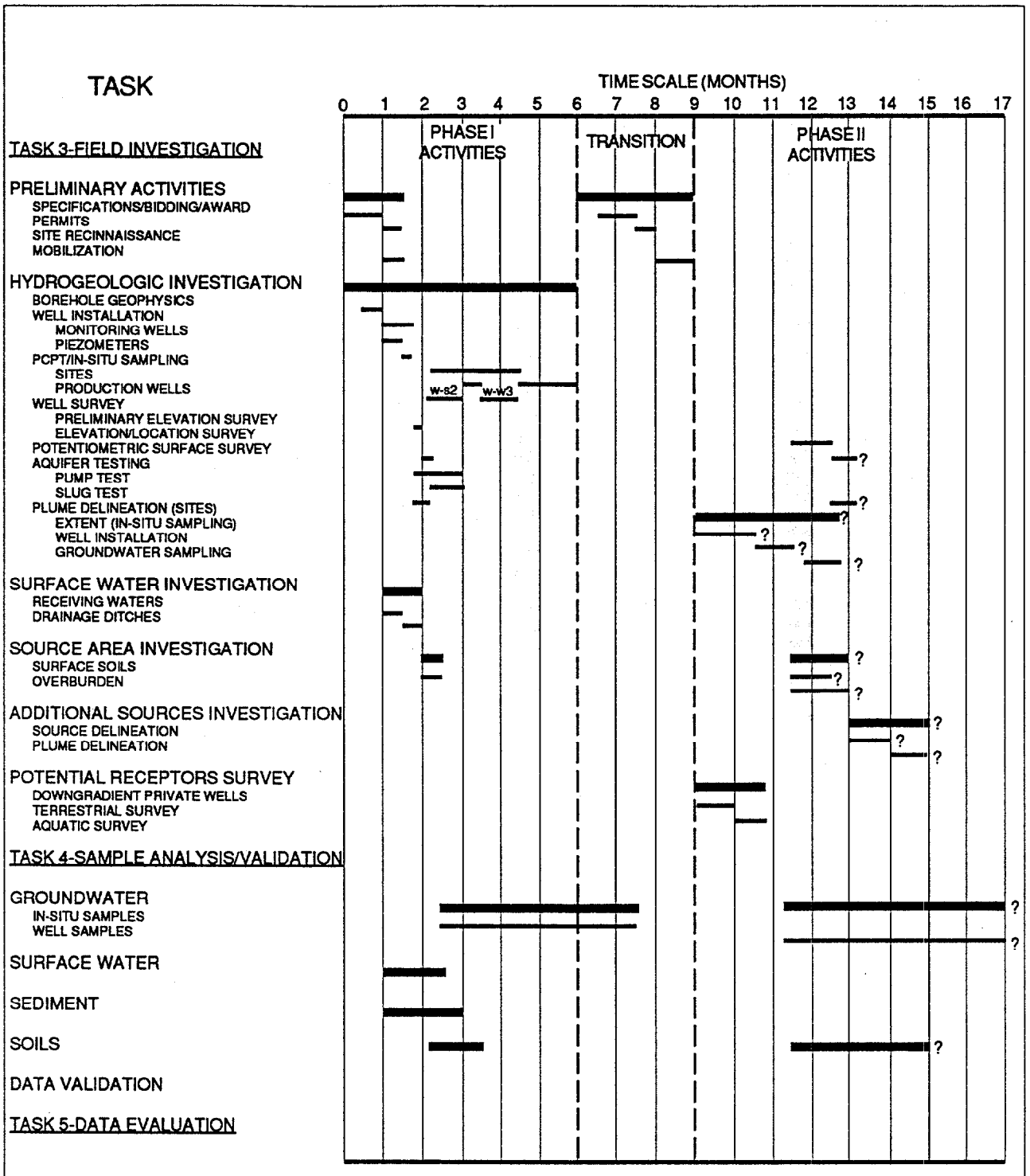


FIGURE 6-3

ANTICIPATED PROJECT SCHEDULE
RI FIELD INVESTIGATION

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

RDFB 8/28/94 row 1 col 1

WHITING FIELD

JOB# 5898-00

GANTT CHART

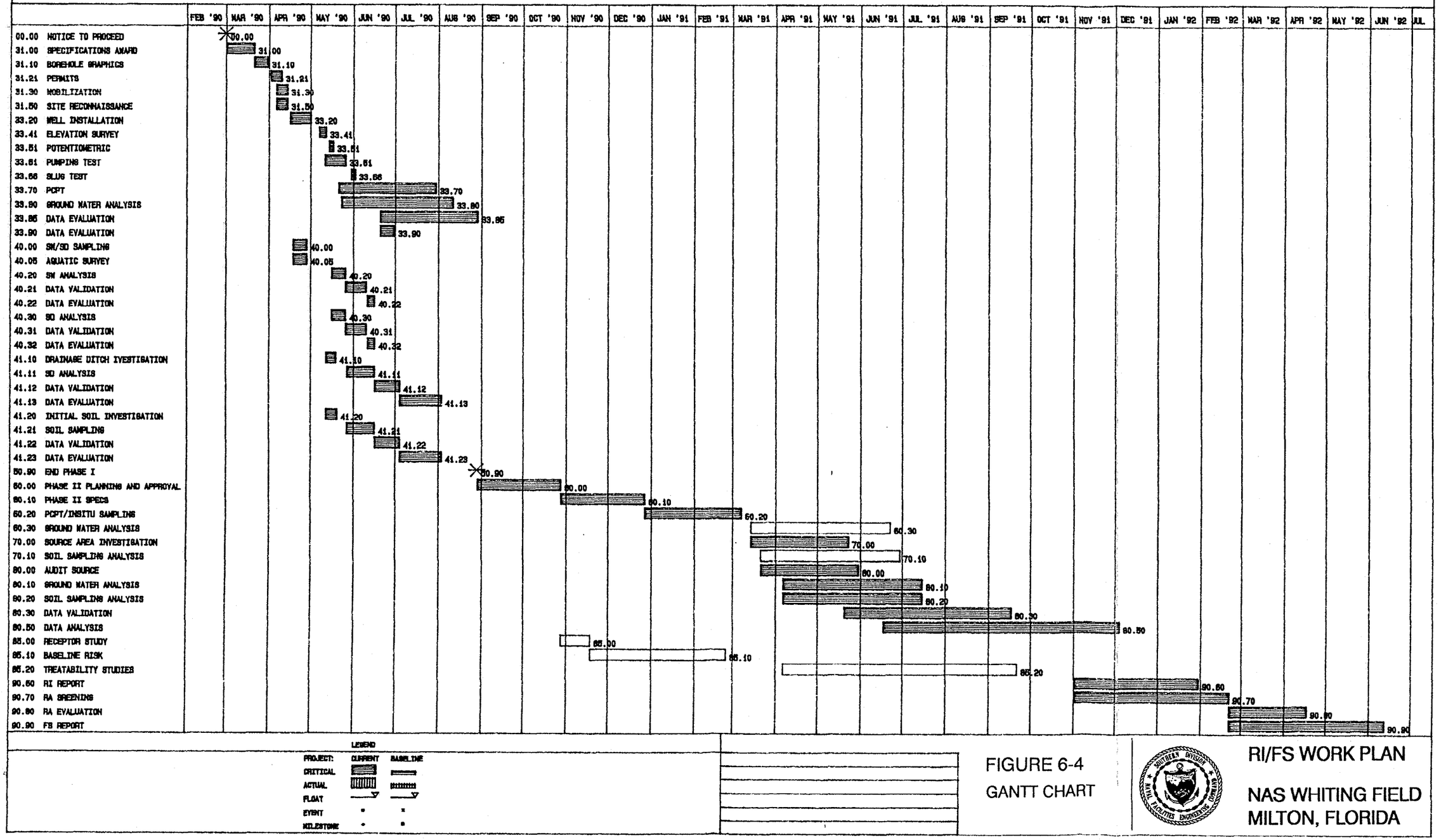


FIGURE 6-4
GANTT CHART

RI/FS WORK PLAN

NAS WHITING FIELD
MILTON, FLORIDA

00181B08Z

- copies of laboratory QC documentation,
- copies of laboratory coordinator's report, and
- final QC report

MPRs will be required of both the contractor and the laboratory. Requirements for inclusion in laboratory MPRs are as follows:

1. site name and contract number;

2. numbers, types, and locations of samples collected and analyzed for Navy project only;

3. data for blanks, spikes, laboratory duplicates, and controls related to Navy samples;

4. new methods used for analyses and changes in old methods;

5. copies of all control charts pertinent to Navy samples and to which results have been added over the reporting period;

6. summaries of out-of-control incidents during the reporting period, including references to documentation and corrective action reports;

7. descriptions of and justifications for significant changes in the QA;

8. changes in laboratory quality control personnel and other key technical personnel, resumes of new personnel must be submitted; and

9. completed sample data.

Much of the information presented in an MPR is incremental in nature and relates to changes and findings since the previous MPR. These include:

1. control charts from the minimizing control charts program and any additional control charts from monitoring matrix spikes, duplicates, or other QC parameters;

2. personnel changes relating to QA responsibilities;

3. method changes (e.g., a minor modification with an attached USEPA variance); and

4. procedural changes in establishing control limits and/or the preparation and use of control charts.

Since the first such report for each laboratory has no precedent, more explanation and detail may be necessary; subsequent MPRs will likely not require as much detail in some areas.

MPRs from the contractor shall discuss details of the previous month's activities. Elements within the contractor's MPR will consist of project status, schedule, budget, proposed scope changes, activities undertaken, and activities

to be undertaken during the upcoming month and difficulties encountered and actions taken to overcome them.

Approximately 1 month after each data set has been generated and has undergone a preliminary analysis, a technical memorandum shall be issued. The memorandum shall present a summary of the data generated from the particular activity and the preliminary analysis of that data. Incorporated into each technical memorandum will be any necessary graphical presentation of the data and the method(s) for analysis.
The first technical memorandum shall present a geologic assessment of conditions underlying NAS Whiting Field. Information to be included in this initial technical memorandum will include results of the downhole geophysics program, PCPT explorations, and the boring logs for the new monitoring well installations. Information derived from these programs will be used to assess the geology underlying both NAS Whiting Field, *in toto*, and each of the individual sites or site groupings investigated.

Technical memorandum number 2 will present an assessment of the hydrogeologic conditions underlying NAS Whiting Field. Information to be included in this memorandum will include that obtained from the potentiometric surface survey, pumping test, slug tests, and the PCPT explorations.

The third technical memorandum shall present the results of the soil sampling and analysis task. Laboratory results derived from soil samples collected at Sites 6, 12, 15, and 16 will be presented and discussed.

Upon receipt of the laboratory results from the surface water and sediment sampling program, the data will be summarized and a fourth technical memorandum issued. This memorandum will detail the results of the field and laboratory program for Clear Creek, Big Coldwater Creek, and the "Y" and old "A" drainage ditches.

The fifth technical memorandum shall address groundwater quality. It will present results from the *in-situ* groundwater sampling and analysis program and will assess groundwater quality in the vicinity of each site and site grouping.

The sixth technical memorandum will present a complete and concise summary of the Phase I RI and present the recommended scope of work for the Phase II RI. At this point data gaps will be identified and ARARs updated and presented.

The Phase II RI Work Plan will address each site separately and provide the recommended Phase II RI approach. Within the Work Plan the data and rationale for the proposed Phase II RI also will be presented.

A final QC Data Report shall be developed and sent to Southern Division's EIC at least 4 weeks prior to submittal of the RI Final Report. As outlined in the Naval Energy and Environmental Support Activity Guidance Document 20.2-047B (Oak Ridge Diffusion Plant, 1988) the Final QC Data Report shall contain the following.

For Navy Level D QC, the contractor shall submit a subset of data from the CLP data packages. For 20 percent of the water and 20 percent of the soil samples, the subcontractor shall submit the full CLP package.

For Navy Level C QC, the deliverables listed in Table 6-1 will be presented.

For Navy Level E QC, the initial and continuing calibration forms, method blank, and blank spike control chart are required.

The report shall indicate the duration and location of storage for the data. The stored data consists of all raw data, QC charts, corrective action, logs, sample lists, Chain of Custody information, notebooks, work sheets, automated data processing system output, and calibration.

TABLE 6-1
DATA SET DELIVERABLES FOR LEVEL C QA
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	METHOD REQUIREMENTS	DELIVERABLES
Organics	- Method blank spikes with results and control charts. Run with each batch of samples processed.	Control Chart
	- Results to be reported on CLP Form 1 or spreadsheet. Sample results using CLP data flags.	Form 1 or Spreadsheet 1, Sample chromatograms and mass spectra
	- Surrogate recovery from samples reported on CLP Form 2. Surrogates to be used in volatiles, semivolatiles, pesticides/PCB. For volatiles by GC, the names of surrogates should be changed to reflect the surrogate used.	Form 2
	- Matrix spike/spike duplicate 1 spike and spike duplicate per 20 samples of similar matrix reported on Form 3.	Form 3
	- Method blank reported on CLP Form 4 For volatiles by GC, a similar format will be used as CLP Form 4 for blanks.	Form 4
	- GC/MS tuning for volatiles/semivolatiles. Reporting results on Form 5.	Form 5
	- Initial calibration data reported on Form 6 For volatiles by GC, the initial calibration data with response factors must be reported. For pesticide/PCB data Form 9 must be used for calibration data.	Form 6
	- Continuing calibration GC/MS data reported on Form 7.	Form 7
	For volatiles, GC data, the response factors and their percent differences from the initial must be reported.	No Form

Source: Oak Ridge Gaseous Diffusion Plant (1988)

TABLE 6-1 (Cont.)
DATA SET DELIVERABLES FOR LEVEL C QA
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	METHOD REQUIREMENTS	DELIVERABLES
Organics Cont.	Internal Standard Area for Volatiles and Semivolatiles.	Form 8
	- For pesticides/PCB data, the CLP Form 9 must be presented.	Form 9
	No chromatograms or mass specta are presented for calibration. These data should be filed in the laboratory and available if problems arise in reviewing/validating the data. The calibration information should be available for checking during on-site audits.	
	- Internal standard area for GC/MS analyses CLP Form VIII shall be supplied.	
	- Second column confirmation shall be done for all GC work when compounds are detected above reporting limits. Chromatograms of confirmation must be provided.	Chromatograms
Metals	- Level C, requirements	Deliverables
	- Sample results with CLP flagging system	CLP Form 1
	- Initial and continuing calibration	CLP Form 2 Part 1 only
	- Blanks 10% frequency	Form 3
	- Method blank take through digestion (1/20 samples of same matrix)	Form 3
	- ICP interference check sample	Form 4
	- Matrix spike recovery (1 per 20 samples of similar matrix)	Form 5, Part 1
	- Postdigestion spike sample recovery for ICP metals. Only done if predigest spike recovery exceed CLP limits.	Form 5, Part 2 (never used for GFAA work)

Source: Oak Ridge Gaseous Diffusion Plant (1988)

TABLE 6-1 (Cont.)
DATA SET DELIVERABLES FOR LEVEL C QA
RI/FS WORK PLAN
NAS WHITING FIELD, FLORIDA

	METHOD REQUIREMENTS	DELIVERABLES
Metals Cont.	- Postdigest spike for GFAA	Recovery will be noted on raw data
	- Duplicates (1 per 20 samples will be split and digested as separate)	Form 6 samples
	- Method blank spike information will be plotted on control chart, one per batch of samples processed.	Control chart
	- Standard addition. The decision process outlined in CLP page E-3 will be used to determine when standard additions are required.	Form 8
	Holding times	Form 10
Wet Chemistry	Level C	
	- Blank spike 1/batch	Control Chart
	- Method Blank 1/batch	Report result No format
	- Sample results	Report result No format
	- Matrix spike/spike duplicate or calibration information	Report result if applicable
	- Calibration check report percent RSD or percent difference from initial calibration.	Report percent or difference No format

Source: Oak Ridge Gaseous Diffusion Plant (1988)

REFERENCES

Bouwer, H., and J. Rice, 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resource Research 12(3): 423-428.

City of Milton, April 1978. Santa Rosa County 201 Facility Plan.

Cooper, H.H., J.D. Bredehoeft, and I.S. Papadopolis, 1967. Response of a finite-diameter well to an instantaneous change in water. Water Resource Research 3(1): 263-269.

E.C. Jordan Co., 1989. Storage Systems Management Plan for Naval Air Station Whiting Field, Milton, Florida, Final Report. 27 p., plus Appendices.

Envirodyne Engineers, May 1985. Initial Assessment Study of Naval Air Station, Whiting Field, Milton, Florida. NEESA No. 13-072.

Geraghty & Miller, Inc., November 1985. Detection and Monitoring Program, Battery Shop Site, NAS Whiting Field, Florida. 23 p., plus Appendices.

Geraghty & Miller, Inc., December 1986. Verification Study: Assessment of Potential Ground-Water Pollution at Naval Air Station Whiting Field, Florida. 73 p., plus Appendices.

Hendon Engineering Associates, Inc., 1988. Treatment of Water Supply Wells, Phase II-Long Term Solution, NAS Whiting Field, Milton, Florida. 47 p., plus Appendices.

Marsh, O.T., 1966. Geology of Escambia and Santa Rosa Counties, Western Florida Panhandle. Florida Geological Survey Bulletin No. 46. 140 p.

Musgrove, R.H., J.T. Barraclough, and R.G., Grantham, 1965. Water Resources of Escambia and Santa Rosa Counties, Florida. Florida Geological Survey Report of Investigations No. 40. 102 p.

Naval Facilities Engineering Command, 1988. Master Plan, NAS Whiting Field and Outlying Landing Fields. 72 p., plus Appendices.

Oak Ridge Gaseous Diffusion Plant, 1988. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program NEESA 20.2-047B. 89 p.

Southern Division, April 1983. Master Plans for NAS Whiting Field, NETPOC Saufley Field and Outlying Fields.

Southern Division, 1984. Pesticide Management Plan for NAS Whiting Field.

USEPA, May 1986. Quality Criteria for Water, 1986. EPA 440/5-86-001.

USEPA, October 1986. Superfund Public Health Evaluation Manual (SPHEM). EPA/540/1-86/060, OSWER Directive 9285.4-1. USEPA, Washington, D.C.

REFERENCES (Cont.)

USEPA, March 1987. Data Quality Objectives for Remedial Response Activities. EPA 540/G-87/003A. OSWER Directive 9335.0-7B (also called DQO Guidance). USEPA, Washington, D.C.

USEPA, March 1987. Guidance for Coordinating ATSDR Health Assessment Activities with the Superfund Remedial Process. OSWER Directive No. 9285.4-02.

USEPA, September 1987. Compendium of Superfund Field Operations Methods. OSWER Directive 9355.0-14, EPA/540/P-87/00/a.

USEPA, October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final. EPA/540/G-89/004 (OSWER Directive 9355.3-01).

USEPA, March 1989. Risk Assessment Guidance for Superfund - Environmental Evaluation Manual, Interim Final. EPA/5400/1-89/001A (OSWER Directive 9285.7-01)

USEPA, March 1989. Risk Assessment Guidance for Superfund. Volume II Environmental Evaluation Manual, Interim Final. EPA/540/1-89/001. 57 p.

USEPA, March 1989. Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference. EPA/600/3-89/013.

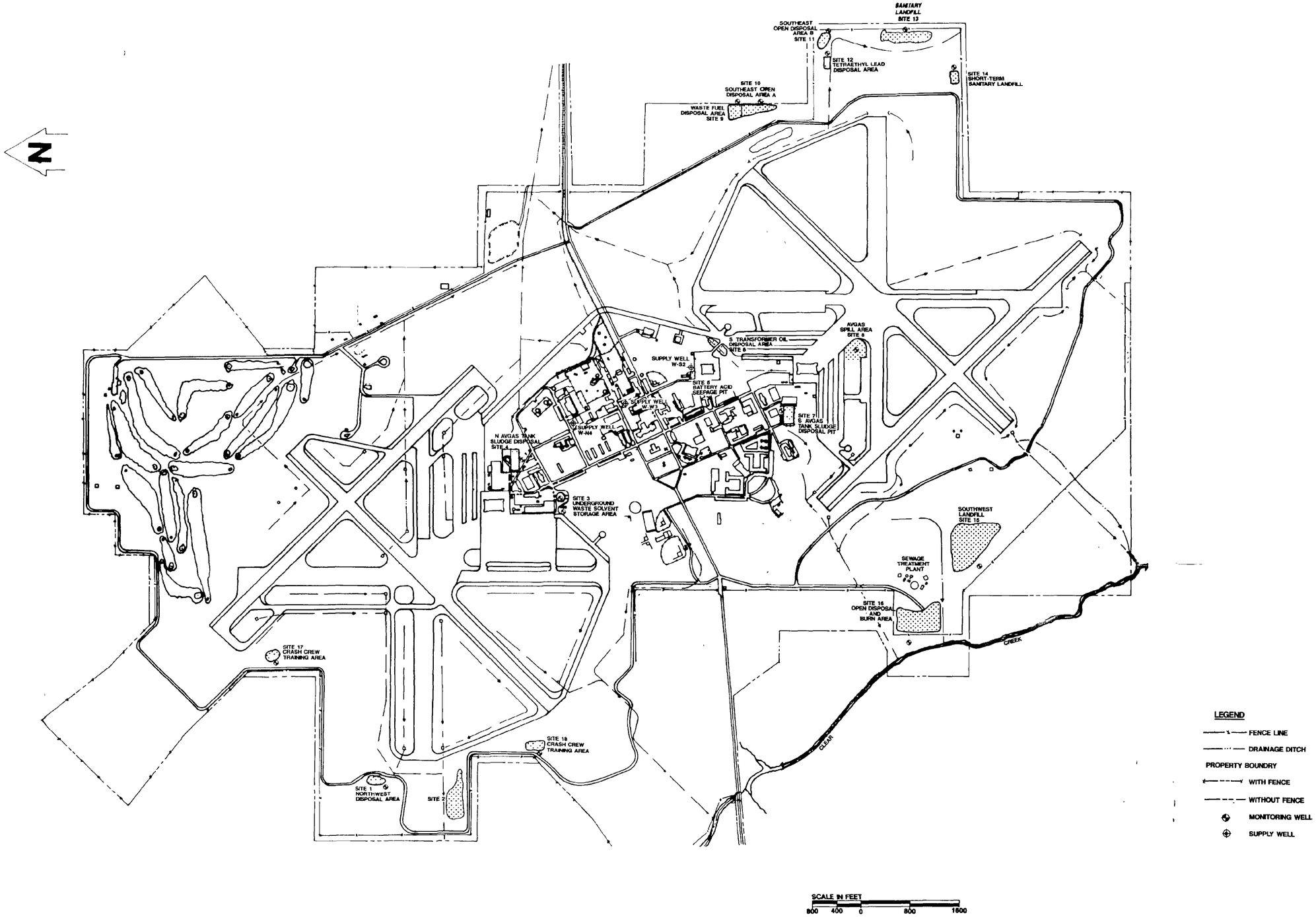
USEPA, December 1989. Risk Assessment Guidance for Superfund. Volume I Human Health Evaluation Manual (Part A), Interim Final. EPA/540/1-89/002.

U.S. Geological Survey, 1984. Element Contamination Content in Soils and other Surficial Materials of the Conterminous United Stations. U.S. Geological Survey Professional Paper 1270.

APPENDIX A

OVERSIZE DRAWINGS
NAS WHITING FIELD, FLORIDA

2-6	Site Locations
5-4	Production Well W-S2, Exploration Program
5-11	Site Plan, Sites 5 & 6
5-12	Site 6, Exploration Program
5-24	Production Well W-W3, Exploration Program
6-5	Time Scale Diagram



1	NAVAL AIR STATION, WHITING FIELD, MILTON, FLORIDA, KEY MAP, GENERAL DEVELOPMENT MAP. NAVFAC DRAWING NO. 5054569, 15 JANUARY 1978.	SURVEY BY / DATE								
		SURVEY FILE NO								
No	REFERENCE DRAWINGS	FIELD BOOK No.	REV	DATE	STATUS	MF	BY	CHKD	APPD	

E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

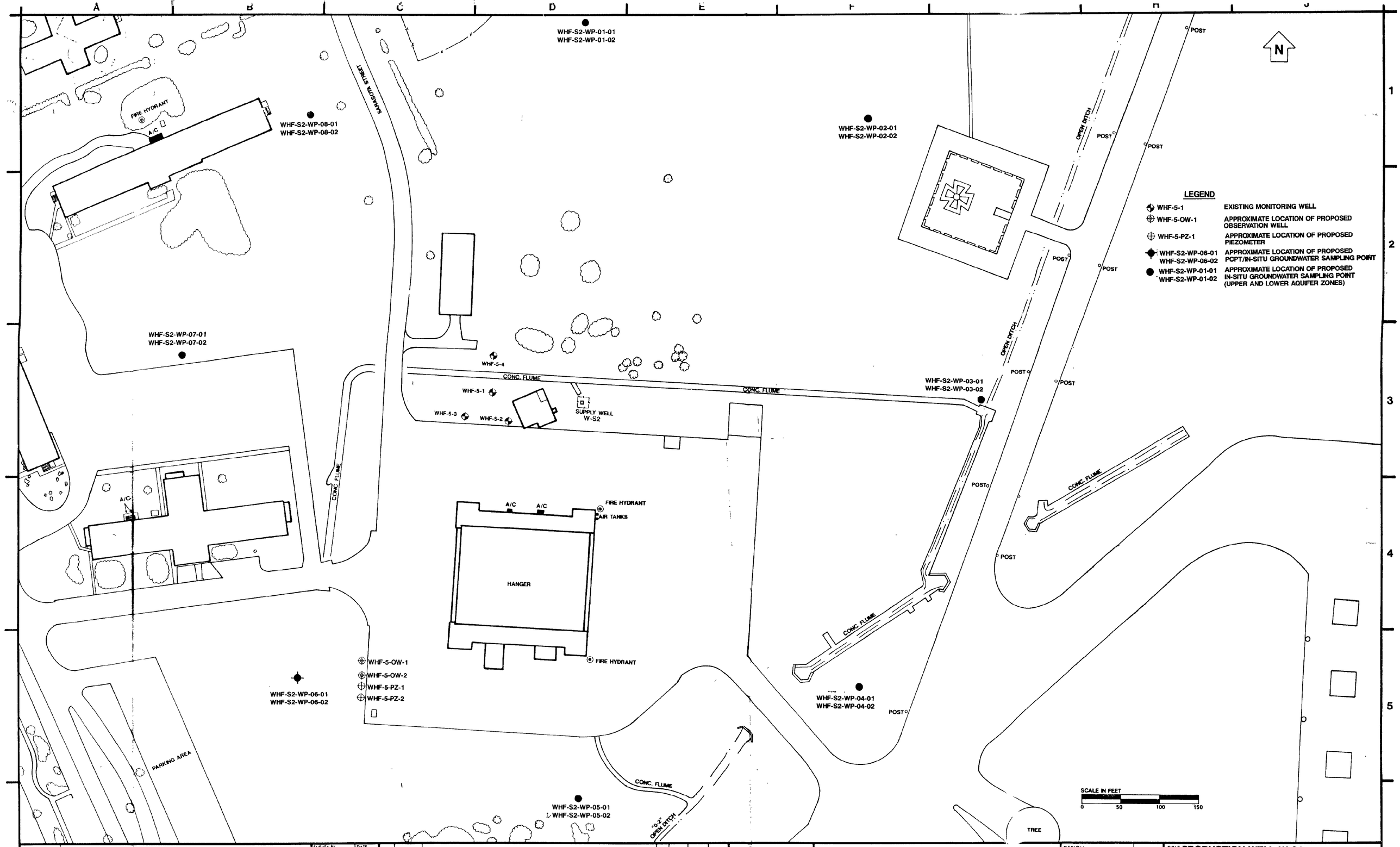
CLIENT
SOUTHERN DIVISION NAVFACENGCOM

DESIGN	
DRAWN	W.W.
CHKD.	
DEPT HD	
PROCESS	
PROJ. MGR.	
CLIENT	
SCALE 1 INCH TO 800 FEET	

TITLE
SITE LOCATIONS
NAS WHITING FIELD
MILTON, FLORIDA

		REV.
PROJ. NO.	5898-01	
DWG. NO.	2-6	

COISIBE.IX



80091	WHITING FIELD - EXISTING CONDITION MAP	SURVEY BY	DATE								
		SURVEY FILE NO									
No	REFERENCE DRAWINGS	FIELD BOOK No	REV	DATE	STATUS	MF	BY	CHKD	APPD		

E.C. JORDAN CO.
CONSULTING ENGINEERS

CLIENT
SOUTHERN DIVISION
NAVFACENGCOM

DESIGN		
DRAWN	M.M.	4-23-89
CHKD		
DEPT HD		
PROCESS		
PROJ MGR		
CLIENT		
SCALE 1 INCH TO 50 FEET		

TITLE **PRODUCTION WELL W-S2 EXPLORATION PROGRAM**

NAS WHITING FIELD
MILTON, FLORIDA

PROJ NO 5898-01 REV.
DWG NO 5-4

A B C D E F H J

N

FIRE HYDRANT
A/C
SARASOTA STREET
BUILDING 2866
WHF-5-4
CONC. FLUME
WHF-5-1
SITE 5
WHF-5-3
WHF-5-2
BUILDING 1478
(BATTERY SHOP)
SUPPLY WELL W-S2
OPEN DITCH
POST
A/C
A/C
FIRE HYDRANT
AIR TANKS
BUILDING 1454 (HANGER)
FIRE HYDRANT
PARKING AREA
SITE 6
10-2" OPEN DITCH
TREE

LEGEND

WHF-5-4 EXISTING MONITORING WELL

SCALE IN FEET
0 50 100 150

EXISTING CONDITIONS MAP (NO. 11 OF 20) NO DATE

SURVEY BY | DATE

SURVEY FILE NO.

No | REFERENCE DRAWINGS | FIELD BOOK No

REV | DATE | STATUS | MF | BY | CHKD | APPD

E.C. JORDAN CO.
CONSULTING ENGINEERS

CLIENT
SOUTHERN DIVISION
NAVFACENGCOM

DESIGN		
DRAWN	JW	4-23-89
CHKD		
DEPT HD		
PROCESS		
PROJ MGR		
CLIENT		

SCALE 1 INCH TO 50 FEET

TITLE
SITE PLAN SITES 5 & 6
NAS WHITING FIELD MILTON, FLORIDA

PROJ NO 5898-01 REV.

DWG NO 5-11

A B C D E F

1 2 3 4 5 6

N

SARASOTA STREET

FIRE HYDRANT

A/C

A/C

CONC. FLUME

A/C

A/C

FIRE HYDRANT

AIR TANKS

HANGER

FIRE HYDRANT

CONC FLUME

CONC. FLUME

SUPPLY WELL

PARKING AREA

OPEN DITCH

POST

POST

POST

POST

POST

POST

POST

POST

POST

POST

OPEN DITCH

CONC. FLUME

CONC. FLUME

CONC. FLUME

WHF-6-SL-12-01

WHF-6-SL-09-01

WHF-6-SL-10-01

WHF-6-SL-11-01

WHF-6-SL-06-01

WHF-6-SL-07-01

WHF-6-SL-05-01

WHF-6-SL-08-01

WHF-6-SL-01-01

WHF-6-SL-02-01

WHF-6-SL-04-01

WHF-6-SL-03-01

"D-2" OPEN DITCH

TREE

LEGEND

△ SURFACE SOIL SAMPLING LOCATION

SCALE IN FEET

0 50 100 150

EXISTING CONDITIONS MAP (NO. 11 OF 20) NO DATE

SURVEY BY | DATE

SURVEY FILE NO

No.	REFERENCE DRAWINGS	FIELD BOOK No.

REV	DATE	STATUS	MF	BY	CHKD	APPD

E.C. JORDAN CO.

CONSULTING ENGINEERS

CLIENT

SOUTHERN DIVISION
NAVFACENGCOM

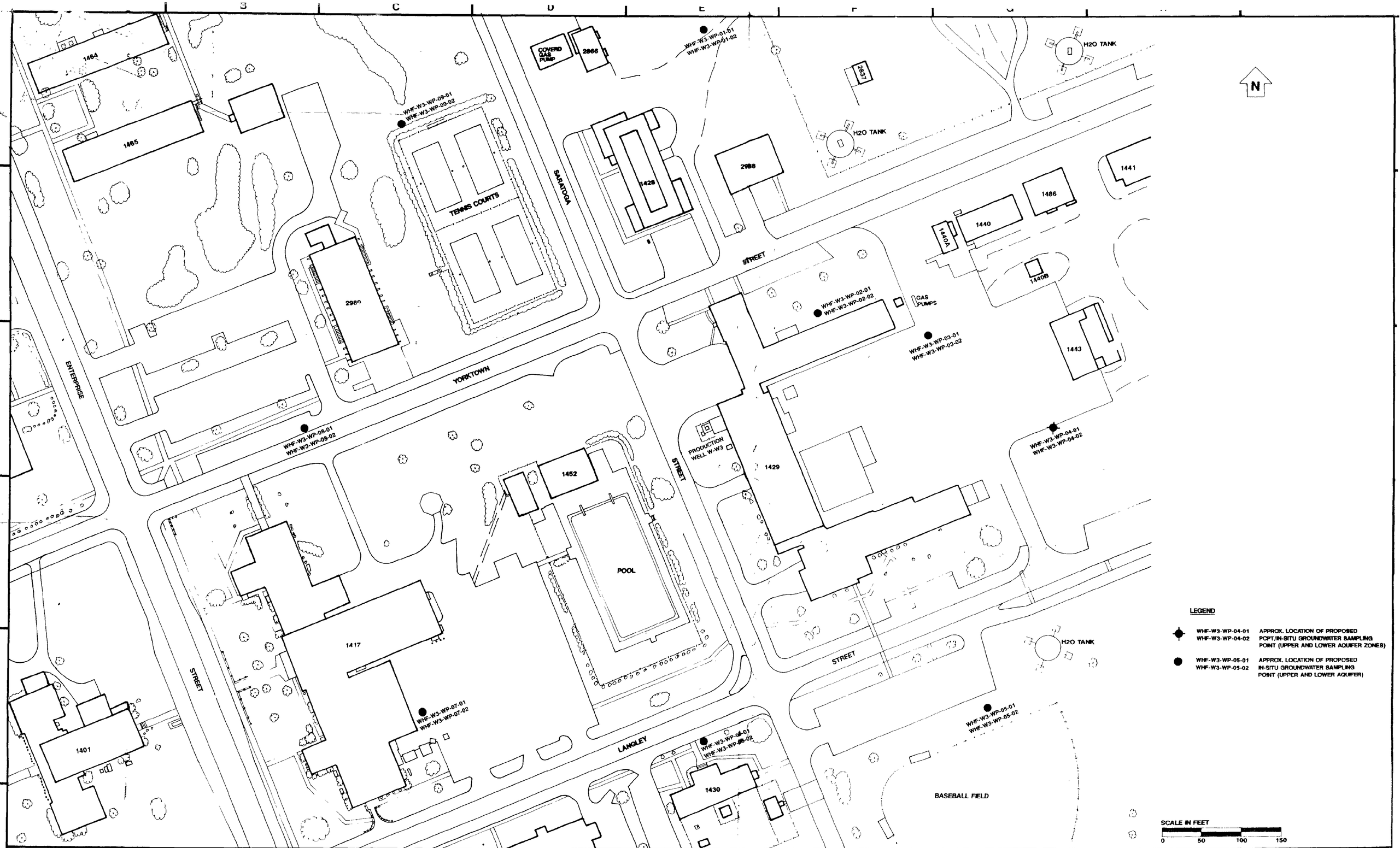
DESIGN	
DRAWN	M.M. 4-23-89
CHKD	
DEPT HD	
PROCESS	
PROJ MGR	
CLIENT	
SCALE 1 INCH TO 50 FEET	

TITLE SITE 6
EXPLORATION PROGRAM

NAS WHITING FIELD
MILTON, FLORIDA

PROJ NO 5898-01 REV.

DWG NO. 5-12



LEGEND

- WHF-W3-WP-04-01 / WHF-W3-WP-04-02 — APPROX. LOCATION OF PROPOSED PCPT/IN-SITU GROUNDWATER SAMPLING POINT (UPPER AND LOWER AQUIFER ZONES)
- WHF-W3-WP-05-01 / WHF-W3-WP-05-02 — APPROX. LOCATION OF PROPOSED IN-SITU GROUNDWATER SAMPLING POINT (UPPER AND LOWER AQUIFER)

SCALE IN FEET
0 50 100 150

WHITING FIELD - EXISTING CONDITIONS MAP

SURVEY BY | DATE
SURVEY FILE NO

No	REFERENCE DRAWINGS	FIELD BOOK No

REV	DATE	STATUS	MF	BY	CHKD	APPD

E.C. JORDAN CO.
CONSULTING ENGINEERS

CLIENT
SOUTHERN DIVISION
NAVFACENGCOM

DESIGN	
DRAWN	W.W.
CHKD	
DEPT HD	
PROCESS	
PROJ MGR	
CLIENT	
SCALE 1 INCH TO 50 FEET	

TITLE PRODUCTION WELL W-W3 EXPLORATION PROGRAM
NAS WHITING FIELD
MILTON, FLORIDA

PROJ NO 5898-01 REV
DWG NO 5-24

HARLEY ELLIS DEVEREAUX INC 13687

0 1 2 3 4 5 6 INCHES
0 2 3 4 5 6 CENTIMETERS

NOTICE TO PROCEED

SPECIFICATIONS AWARD

AERIAL PHOTOGRAPHS

PERMITS

MOBILIZATION

SITE RECONNAISSANCE

WELL INSTALLATION

ELEVATION SURVEY

POTENTIOMETRIC

PUMPING TEST

SLUG TEST

TEST

GROUND WATER ANALYSIS

DATA EVALUATION

DATA EVALUATION

SW/SD SAMPLING

HYDRATIC SURVEY

SW ANALYSIS

DATA VALIDATION

DATA EVALUATION

SD ANALYSIS

DATA VALIDATION

DATA EVALUATION

DRAINAGE DITCH INVESTIGATION

SD ANALYSIS

DATA VALIDATION

DATA EVALUATION

INITIAL SOIL INVESTIGATION

SOIL SAMPLING

DATA VALIDATION

DATA EVALUATION

CMS PHASE I

PHASE II PLANNING AND APPROVAL

PHASE II SPECS

PORT/PIEZOMETER SURVEY

GROUND WATER ANALYSIS

SURFACE AREA INVESTIGATION

SOIL SAMPLING ANALYSIS

PLANT SOURCE

DATA ANALYSIS

GROUND WATER ANALYSIS

SOIL SAMPLING ANALYSIS

DATA VALIDATION

RECEPTOR STUDY

BASELINE RISK

TREATABILITY STUDIES

FS REPORT

RA EVALUATION

RA DESIGNS

FS REPORT

LEGEND

CRITICAL

ACTUAL

EVENT

REVISIONS

*** Beginning Plot: 5898-1.PLT
*** Total Time 0: 1110

FIGURE 6-5
TIME SCALE DIAGRAM

APPENDIX B

LITHOLOGIC LOGS OF EXISTING WELLS
NAS WHITING FIELD, FLORIDA

Source: Geraghty & Miller, Inc., 1986
Verification Study
Assessment of Potential Ground-Water
Pollution at Naval Air Station Whiting Field, Florida

LITHOLOGIC LOG FOR WELL NUMBER (WHF-1-1)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Sand, fine to coarse grained, buff; gravel; organics (0-5 ft.)	0.0 - 85.0	85.0
Sand, fine to coarse grained, buff; gravel	85.0 - 95.0	10.0
Clay, buff, brown, tan; sand, fine to coarse grained, buff; gravel	95.0 - 108.0	13.0
Sand, fine to coarse grained, buff; gravel	108.0 - 120.0	12.0
Clay, yellow, buff, brown; sand, fine to coarse grained, buff	120.0 - 125.0	5.0

LITHOLOGIC LOG FOR SITE 3-SOIL BORING

Clay, red; sand, fine to medium grained	0.0 - 20.0	20.0
Sand, fine to medium grained, white	20.0 - 25.0	5.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-3-1)

Clay, red; sand, fine to medium grained	0.0 - 20.0	20.0
Sand, fine to coarse grained, buff; clay, gray	20.0 - 45.0	25.0
Sand, fine to coarse grained, buff	45.0 - 102.0	57.0
Clay, gray; sand, very fine grained	102.0 - 122.0	20.0
Sand, fine to coarse grained, buff; gravel	122.0 - 152.0	30.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-3-2)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Clay, red; sand, fine to medium grained	0.0 - 22.0	22.0
Sand, fine to coarse grained, buff; clay, gray	22.0 - 45.0	23.0
Sand, fine to coarse grained, buff;	45.0 - 110.0	65.0
Clay, gray; sand, very fine grained	110.0 - 130.0	20.0
Sand, fine to coarse grained, buff; gravel	130.0 - 152.0	22.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-4-1)

Clay, red; sand, fine to medium grained; gravel	0.0 - 30.0	30.0
Sand, fine to coarse grained, buff; gravel	30.0 - 98.0	68.0
Clay, gray; sand fine to medium grained	98.0 - 119.0	21.0
Sand, fine to coarse grained, buff; gravel	119.0 - 152.0	33.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-7-1)

Clay, red; sand, fine to medium grained; @ 10 ft. large black rock (limonite)	0.0 - 24.0	24.0
Sand, fine to coarse grained, buff; gravel	140.0 - 148.0	8.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-8-1)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Clay, red; sand, fine to medium grained	0.0 - 35.0	35.0
Sand, fine to medium grained, buff; clay streaks	35.0 - 110.0	75.0
Sand, fine to coarse grained buff; gravel	110.0 - 118.0	8.0
Clay, light gray; sand, fine to coarse grained, streaks	118.0 - 128.0	10.0
Sand, fine to coarse grained, white; gravel	128.0 - 138.0	10.0
Sand, fine to coarse grained, white; clay, light gray, streaks	138.0 - 180.0	42.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-9-1)

Clay, red, brown; sand, fine to medium grained, red, brown	0.0 - 15.0	15.0
Clay, red, white; sand, fine to medium grained, white streaks	15.0 - 50.0	35.0
Sand, fine to medium grained, white; clay, red, white, streaks	50.0 - 75.0	25.0
Clay, red, white	75.0 - 90.0	15.0
Sand, fine to coarse grained, white; gravel; streaks of clay	90.0 - 116.0	26.0
Clay, red, white	116.0 - 120.0	4.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-10-1)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Clay, red, white, yellow, light gray; sand, fine to medium grained	0.0 - 40.0	40.0
Sand, fine to coarse grained, white; clay, red, white, streaks	40.0 - 75.0	35.0
Clay, red, white, gray	75.0 - 98.0	23.0
Sand, fine to coarse grained, white; clay red, white, streaks	98.0 - 117.0	19.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-11-1)

Clay, red, gray; sand, fine to medium grained	0 - 36.0	36.0
Clay, red, blue gray, light gray, orange yellow, white	36.0 - 72.0	36.0
Sand, fine to coarse grained white; clay streaks	72.0 - 100.0	28.0
Sand, fine to medium grained, white; clay streaks	100.0 - 115.0	15.0
Sand, fine to coarse grained, white; gravel, few mafics	115.0 - 127.0	12.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-12-1)

Clay, brown, red; sand, fine to medium grained	0.0 - 26.0	26.0
Sand, fine to coarse grained, white; clay, red, white, streaks	26.0 - 55.0	29.0
Clay, red, white, light gray; sand, fine to coarse grained, white, streaks	55.0 - 95.0	40.0
Sand, fine to coarse grained, white; gravel; clay, red, white, streaks	95.0 - 112.0	17.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-13-1)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Clay, red, gray; sand, fine to medium grained	0 - 50.0	50.0
Clay, light gray; sand, fine grained, buff	50.0 - 78.0	28.0
Sand, fine to coarse grained, buff	78.0 - 80.0	2.0
Clay, light gray	80.0 -105.0	25.0
Sand, fine to coarse grained, buff; gravel, some mafics; clay, light gray, streaks	105.0 -124.0	19.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-14-1)

Clay, red, gray; sand, fine to medium grained	0.0 - 50.0	50.0
Sand, fine to coarse grained, buff	50.0 - 75.0	25.0
Sand, fine to medium grained, buff; clay, streaks, orange, yellow, light gray	75.0 - 90.0	15.0
Sand, fine to coarse grained, buff; gravel some mafics	125.0 -152.0	27.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-15-1)

Clay, red, gray, tan; sand, fine to medium grained	0.0 - 42.0	42.0
Sand, fine to coarse grained, buff; clay, light gray	42.0 - 65.0	23.0
Sand, fine to coarse grained, buff; gravel, mafics	65.0 - 72.0	7.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-16-1)

DESCRIPTION	DEPTH (ft)	THICKNESS (ft)
Sand, fine to medium grained, yellow; clay, yellow	0.0 - 9.0	9.0
Clay, red, white	9.0 - 15.0	6.0
Sand, fine to coarse grained, white; gravel	15.0 - 42.0	27.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-17-1)

Clay, red; sand, fine to medium grained; some small cobbles, gray black	0.0 - 35.0	35.0
Clay, light gray; sand, fine grained	35.0 - 85.0	50.0
Sand, fine to coarse grained, buff; gravel	85.0 - 152.0	67.0

LITHOLOGIC LOG FOR WELL NUMBER (WHF-18-1)

Sand, fine to medium grained, red; clay, red; gravel	0.0 - 20.0	20.0
Sand, fine to coarse grained, buff; gravel	20.0 - 78.0	58.0
Clay, interbedded with sand, red, white and buff	78.0 - 80.0	2.0
Sand, fine to coarse grained, buff; gravel	80.0 - 122.0	42.0