RECORD OF DECISION FOR OPERABLE UNIT 8 (OU 8) SITE 3 OIL AND SLUDGE DISPOSAL PIT NAS CECIL FIELD FL

9/1/1998

BROWN AND ROOT ENVIRONMENTAL

Record Of Decision
Site 3, Operable Unit 8

for

Naval Air Station
Cecil Field
Jacksonville, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 039

September 1998

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RECORD OF DECISION
SITE 3, OPERABLE UNIT 8
FOR

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
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North Charleston, South Carolina 29406

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CONTRACT NUMBER N62467-94-D-0888
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ACRONYM LIST

ABB-ES	ABB Environmental, Inc.
AIMD	Aircraft Intermediate Maintenance Department
ARAR	Applicable or Relevant and Appropriate Requirements
bls	below land surface
BRA	Baseline Risk Assessment
B & R	Brown & Root
BRAC	Base Realignment and Closure
CA	Contamination Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
DCB	Dichlorobenzene
DCE	Dichloroethene
EBS	Environmental Baseline Survey
ELCR	Excess Lifetime Cancer Risk
ERA	Ecological Risk Assessment
FDEP	Florida Department of Environmental Protection
FFA	Federal Facility Agreement
FS	Feasibility Study
ft/ft	feet per foot
ft/yr	feet per year
GAC	Granular Activated Carbon
HI	Hazard Index
HQ	Hazard Quotient
IR	Installation Restoration
IAS	Initial Assessment Study
IZS	Intermediate Zones
K	Hydraulic Conductivity
LZS	Lower Zones
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
NACIP	Naval Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

PL	National Priority List
U	Operable Unit
CB	Polychlorinated biphenyl
SC	potential source of contamination
A	Remedial Action
AB	Restoration Advisory Board
BC	Risk-Based Concentration
CRA	Resource Conservation and Recovery Act
AO	Remedial Action Objective
FI	RCRA Facility Investigation
I/FS	Remedial Investigation/Feasibility Study
OD	Record of Decision
ARA	Superfund Amendments and Reauthorization Act
VOC	Semivolatile Organic Compound
CE	Trichloroethene
RPH	Total Recoverable Petroleum Hydrocarbon
g/kg	microgram per kilogram
g/L	microgram per liter
.S. EPA	U.S. Environmental Protection Agency
SGS	U. S. Geological Survey
ST	Underground Storage Tank
ZH	Upper Zone of the Hawthorn
ZS	Upper Zones
OC	Volatile Organic Compound

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Operable Unit (OU) 8 consists of Site 3, the Oil and Sludge Disposal Pit and affected area (Figure 2-1). The site is situated in the western part of the main base of Naval Air Station (NAS) Cecil Field, Jacksonville, Florida, immediately northeast of the intersection of Perimeter Road and the Lake Fretwell access road leading west from the south end of Lake Fretwell.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Site 3 at NAS Cecil Field. The remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations 300). This decision document was prepared in accordance with the U.S. Environmental Protection Agency (U.S. EPA) decision document guidance (U.S. EPA, 1992). This decision is based on the Administrative Record for Site 3, OU 8.

The U.S. EPA and the State of Florida concur with the selected remedy.

1.3 ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment. Unacceptable human health risks would exist if groundwater from the surficial aquifer is used as a potable water source. Human health and possibly wildlife may incur unacceptable risks if exposed to undiluted Site 3 groundwater.

1.4 DESCRIPTION OF THE SELECTED REMEDY

This ROD is the final action for Site 3, OU 8. Final RODs have been approved for OUs 1, 2, 4, and 7. Remedial Investigations (RIs) and Baseline Risk Assessments (BRAs) have been completed for OUs 5, 6, and 8.

The selected remedy addresses contaminant reduction in groundwater at the site. Remedial alternatives selected for Site 3 include groundwater treatment and monitoring, and the implementation of site controls.

The major components of the selected remedy are as follows:

- In-situ subsurface volatilization, also referred to as air sparging, will be used to remove volatile organic compounds (VOCs) from groundwater in the source area. Pilot studies will be implemented prior to final design to ensure the proper performance of the system. A monitoring plan will be implemented to monitor and evaluate the effectiveness of the air sparging system.

- Following air sparging, long-term sampling and analysis of groundwater will monitor the decrease in contaminant concentrations resulting from natural processes until acceptable levels have been reached.

- Implementation of institutional controls, including deed restrictions, will limit use of contaminated groundwater until natural processes reduce contaminant concentrations to acceptable levels.

- Review of site conditions and groundwater monitoring data every 5 years will verify the effectiveness of the remedy for the protection of human health and the environment.

1.5 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, is cost effective, and complies with Federal and State requirements that are legally applicable or relevant and appropriate to remedial action. The nature of the selected remedy for Site 3 is such that, applicable or relevant and appropriate requirements (ARARs) will be met in the long-term as residual concentration of contaminants in the groundwater are reduced through natural attenuation. The remedy utilizes permanent solutions and satisfies the statutory preferences for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element. Because this remedy would result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years of the commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health.

1.6 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF REMEDY

David L. Porter, P.E.
Base Realignment and Closure
Environmental Coordinator

27 August 1998
Date

2.0 DECISION SUMMARY

2.1 *SITE NAME, LOCATION, AND DESCRIPTION*

As shown on Figure 2-1, NAS Cecil Field is 14 miles southwest of Jacksonville, Florida. Most of Cecil Field is in Duval County; the southernmost part is in Clay County.

NAS Cecil Field was established in 1941 and provides facilities, services, and material support for the operation and maintenance of naval weapons, aircraft, and other units of the operation forces as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission over past years included operation of fuel storage facilities, performance of aircraft maintenance, maintenance and operation of engine repair facilities and test cells for turbo-jet engines, and support of special weapons systems.

NAS Cecil Field is scheduled for closure in 1999. Much of the facility will be transferred to the Jacksonville Port Authority. The facility will have multiple uses, but will be used primarily for aviation-related activities.

Land surrounding NAS Cecil Field is used primarily for forestry with some agriculture and ranching. Small communities and individual homes are in the vicinity of NAS Cecil Field. The closest community, located on Nathan Hale Road, abuts the western edge of the facility. The nearest incorporated municipality, Baldwin, is approximately 6 miles northwest of the main facility entrance.

To the east of NAS Cecil Field, the rural surrounding area grades into a suburban fringe bordering the major east- and west-roadways. Commercial properties, such as convenience stores, and low-density residential areas characterize the land use (ABB Environmental, Inc. [ABB-ES], 1992). A development called Villages of Argyle, when complete, will consist of seven separate villages that will border NAS Cecil Field to the south and southeast. A golf course and residential area also border NAS Cecil Field to the east (Southern Division, Naval Facilities Engineering Command [SOUTHNAVFACENGCOM], 1989).

As shown on Figure 2-2, OU8 is located near the western perimeter of NAS Cecil Field, in the flight path of landing aircraft. It is a vacant, relatively featureless area with no residential, commercial, or industrial functions. Human activity is generally limited to security patrols or joggers on the Lake Fretwell access road and Perimeter Road. Vegetative cover consists of thick brush and briers. A disposal pit, estimated to be approximately 100 feet in diameter and 3 to 5 feet deep, is located immediately northeast of the intersection of Perimeter Road and the Lake Fretwell access road, both of which are unpaved. There is a

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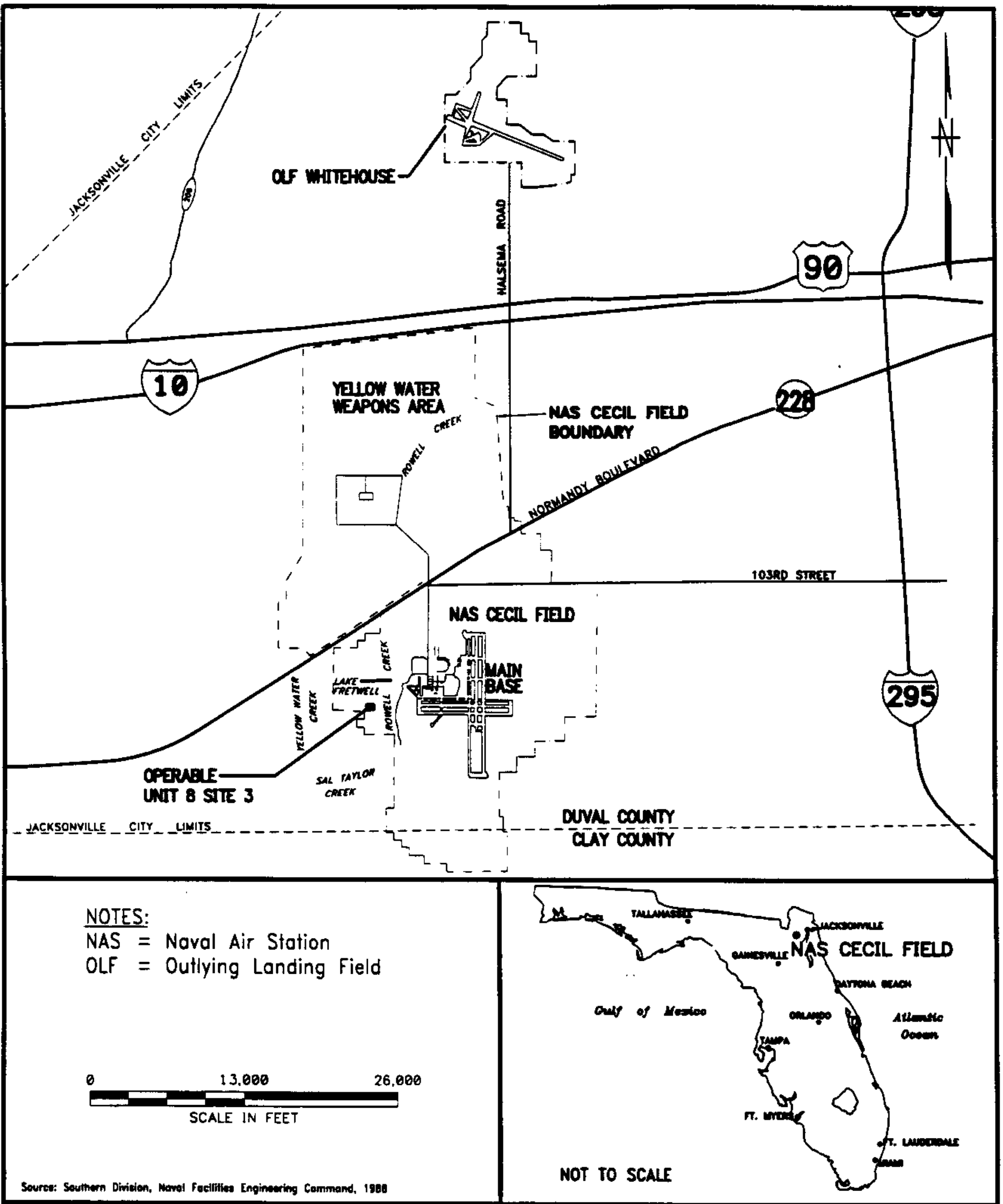

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CHECKED BY / DATE			APPROVED BY / DATE
COST/SCHED-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-1 / REV. 0

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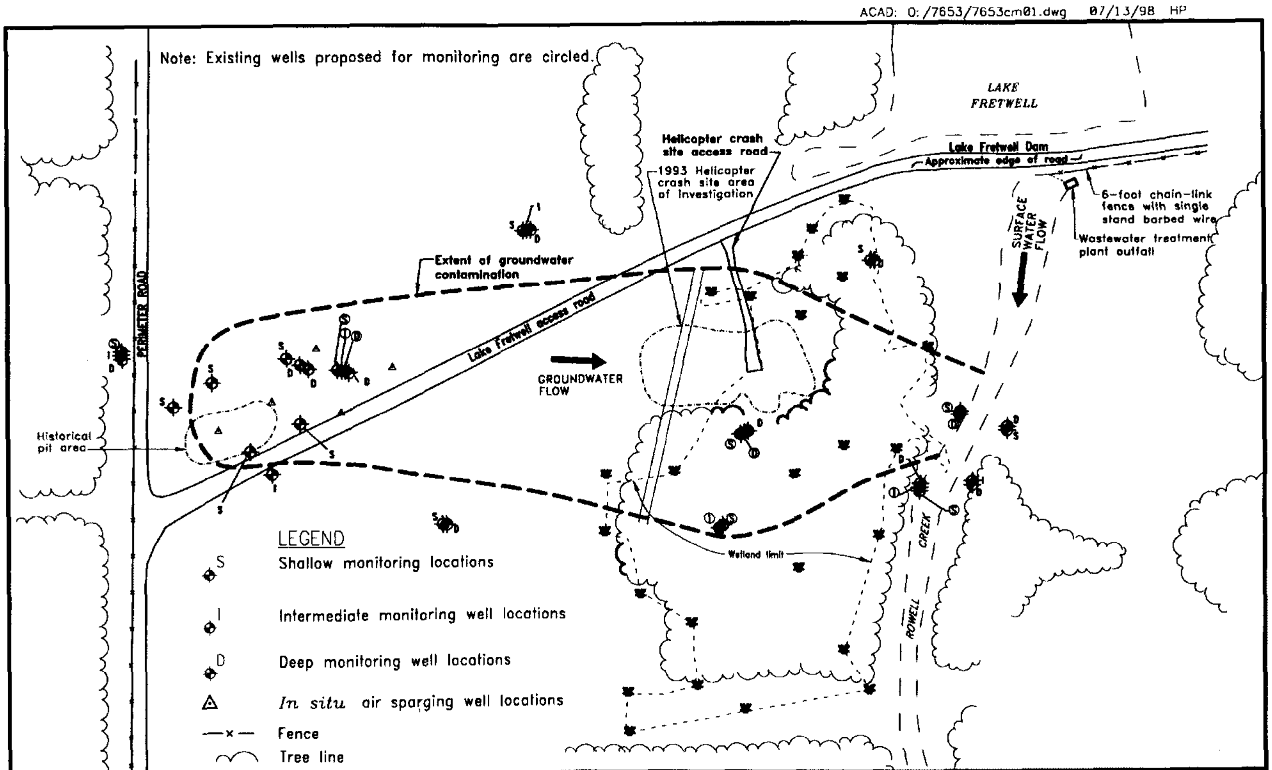

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CHECKED BY	DATE			APPROVED BY	DATE
COST/SCHED-AREA				APPROVED BY	DATE
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FORM CADD NO. SDIV_AH.DWG - REV 0 - 1/20/98 relatively uniform gentle slope toward Rowell Creek and Lake Fretwell over the length of OU8. A 6.7-acre wetland is located approximately 800 feet east of the disposal pit, adjacent to Rowell Creek. Rowell Creek is classified by the state of Florida as Class III freshwater.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The first environmental study for the investigation of waste handling and/or disposal sites at NAS Cecil Field was conducted between 1983 and 1985 by Geraghty & Miller, Inc (Geraghty and Miller, 1983). This study was followed by an Initial Assessment Study (IAS) by Envirodyne Engineers in 1985 (Envirodyne Engineers, 1985). The IAS was completed under the Naval Assessment and Control of Installation Pollutants (NACIP) program, which was the precursor to the Navy's present Installation Restoration (IR) program. In 1988, a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was completed by Harding Lawson Associates (Harding Lawson Associates, 1988). The RFI acted on the recommendations of the IAS. OU8 (Site 3) was included in the IAS and the RFI.

NAS Cecil Field was placed on the National Priority List (NPL) by the U.S. EPA and the Office of Management and Budget in December 1989. A Federal Facility Agreement (FFA) for NAS Cecil Field was signed by the Florida Department of Environmental Protection (FDEP, formerly the Florida Department of Environmental Regulation), U.S. EPA, and the Navy in 1990. Following the listing of NAS Cecil Field on the NPL and the signing of the FFA, remedial response activities at the facility have been completed under CERCLA authority. OU8 (Site 3) is one of eight operable units identified as needing further investigation.

NAS Cecil Field has several sites where hazardous wastes may have been handled, spilled, or buried. The individual sites are currently referred to as potential sources of contamination (PSCs). The term "site" is applied to PSCs that are currently under investigation at NAS Cecil Field as part of the IR program. At the time of the facility's listing on the NPL, 18 sites had been identified. The RFI (Harding Lawson Associates, 1988) identified another site (Site 19). Remedial response activities are currently underway at Sites 1, 2, 3, 5, 7, 8, 10, 11, 14, 15, 16, and 17. Field investigation plans were prepared for the investigation of PSCs 4, 6, 9, 12, 18, and 19 (ABB-ES, 1995). Site 13 was transferred to the underground storage tank (UST) program.

In 1993, NAS Cecil Field was selected for closure by the Base Realignment and Closure (BRAC) Commission. An environmental baseline survey (EBS) was completed as the first step in the closure process. The EBS identified parcels of land for sale, lease, or investigation, depending on the condition of the parcel. OU8 was designated in the November 1994 EBS as "BRAC Category 6" (release of hazardous substances has occurred, but required remedial actions have not yet been taken) (ABB-ES, 1994). This classification was based on the seven categories defined in the BRAC Cleanup Guidance Manual (Department of Defense, 1993).

In October 1993, at the 1994 Fiscal Year Site Management Plan meeting, the U.S. EPA, FDEP, and the Navy decided to identify Site 3 as a separate OU. In previous investigations, Site 3 was part of OU2 (originally composed of Sites 3, 5, and 17). The investigations for Sites 5 and 17 of OU2 were completed at a time when Site 3 still required further investigation. To avoid delay and to facilitate investigation progress on all three sites of OU2, Site 3 was designated as OU8 and the Remedial Investigation/Feasibility Study (RI/FS) for Sites 5 and 17 under OU2 proceeded. The site-specific history is presented below.

A pit, designated as the Oil and Sludge Disposal Pit, was used at Site 3 to dispose of liquid wastes and sludge generated by the facility. The IAS (Envirodyne Engineers, 1985) estimated that disposal operations at Site 3 occurred from as early as the mid-1950s until 1975. However, based on a review of aerial photographs of the area, no disturbance was observed in the pit area on a 1960 photograph; it appears that OU8 disposal operations began between 1960 and 1969. An aerial photograph taken in 1969 shows the basic outline of the pit to be circular and about 100 feet in diameter (8,000 ft^2). It is estimated that the pit was 3 to 5 feet deep. The photograph also shows a linear feature, approximately 10 feet wide and 50 feet long, south of the disturbed area that appears to be a trench filled with liquid. Aerial photographs from 1972, 1973, 1975, and 1984 show that OU8 became progressively more vegetated over this time, indicating that disposal activities were discontinued some time in the early 1970s.

Liquid wastes were typically taken to the site from the individual shops (i.e., the fuel farm, Public Works, Aircraft Intermediate Maintenance Department [AIMD], and the squadrons) in bowsers (trailer-mounted tanks) or 55-gallon drums, drained into the pit, and allowed to seep into the soil or evaporate. The pit wastes were burned when the liquid level approached the top. This procedure was repeated approximately once every 3 months by the fire department (Envirodyne Engineers, 1985).

An estimated 200 to 300 gallons of waste oil, fuel, and tank sludge from the fuel farm were disposed weekly at the site. Although much of this volume consisted of water, it is estimated that between 210,000 and 310,000 gallons of fuel farm wastes were disposed throughout the operation (20 years) of the site.

Other liquid wastes generated by the squadrons, AIMD, and Public Works also were disposed of at Site 3. These wastes included fuel, oil, solvent, paint, and paint stripper. No records were kept on disposal practices, and access to the site was uncontrolled; therefore, the amount of the liquid wastes disposed of at Site 3 from these sources is unknown.

Estimates developed during the IAS (Envirodyne Engineers, 1985) indicate that the total quantity of wastes from all sources disposed during the site operation are: waste paint - 4,200 gallons; spent solvent - 110,000 gallons; paint thinner - 20,000 gallons; petroleum-oil-lubricant wastes - 440,000 gallons; and waste fuel-, oil-, and sludge-contaminated water - 210,000 to 310,000 gallons. Following closure of the site in 1975, the pit was filled soil (Envirodyne Engineers, 1985).

On February 8, 1992, a Navy helicopter crashed into a wooded area approximately 800 feet east of the OU8 disposal pit (see Figure 2-2). The helicopter had a fuel capacity of between 1,800 and 2,000 gallons and ignited on impact. Soil and groundwater contamination as a result of the crash were initially assessed by Environmental Science and Engineering, Inc., in August and September 1993 during a contamination assessment (CA). The results of the CA were presented in a Preliminary Contamination Assessment Report.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The results of the RI and BRA, the remedial alternatives identified in the FS, and the preferred alternative described in the Proposed Plan were presented to the NAS Cecil Field Restoration Advisory Board (RAB) on January 13, 1998. The RAB is comprised of community members as wells as representatives from the Navy and State and Federal regulatory agencies.

Public notice of the availability of the Proposed Plan was placed in the Metro section of the Florida Times Union on January 25, 1998. This local edition targets the communities closest to NAS Cecil Field. Documents pertaining to Site 3 are available to the public at the Information Repository, located at the Charles D. Webb Wesonnett Branch of the Jacksonville Library, 6887 103rd Street, Jacksonville, Florida. A 30-day public comment period was held from January 26 through February 25, 1998. No comments were received during the comment period.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

The environmental concerns at NAS Cecil Field are complex. As a result, work at the 18 sites has been organized into eight installation restoration OUs. More than 100 other areas are undergoing evaluation in the BRAC and UST petroleum programs.

Final RODs have been approved for OUs 1, 2, 4, and 7. RIs, BRAs, and FSs have been completed for OUs 3, 5, 6, and 8.

Assessment of environmental data collected from OU 8, Site 3, the subject of this ROD, indicates groundwater contamination could pose an unacceptable human health risk if the groundwater was used as a potable water source. Future discharge of groundwater to Rowell Creek could potentially cause adverse effects on aquatic organisms. The purpose of this remedial action (RA) is to monitor and remediate the groundwater contamination that pose human health and ecological risks. Ingestion of groundwater from the surficial aquifer poses an excess lifetime cancer risk (ELCR) that exceeds the State of Florida threshold of 1 in 1,000,000 or 1E-06.

The following remedial action objective (RAO) was established for Site 3:

- Prevent exposure to groundwater that contains VOCs at concentrations that are greater than the State of Florida guidance criteria and that cause unacceptable risk to human health.

The RA documented in this ROD will achieve this RAO.

2.5 SUMMARY OF SITE CHARACTERISTICS

2.5.1 Hydrogeology

At NAS Cecil Field, there are three water-bearing systems: the surficial aquifer, the intermediate aquifer, and the Floridan aquifer systems. Each system is separate from the next by an aquitard or less permeable unit. The Floridan aquifer system was not encountered during the investigation at OU8.

2.5.1.1 Surficial Aquifer System

The undifferentiated sediments in the surficial aquifer system in the area of OU8 consist of mostly quartz sand with some clayey sand and up to 10 percent silt and clay. Well screens were placed to investigate conditions in the upper (UZS), intermediate (IZS), and lower (LZS) zones of the surficial aquifer system. The surficial aquifer system is under water table conditions (unconfined).

The general groundwater flow direction in the surficial aquifer is to the east-southeast toward Rowell Creek. There is also a downward flow gradient that is evident at the waste disposal pit area and continues for approximately 900 to 1,000 feet downgradient of the pit. At this point, the vertical flow potential becomes upward. Both the upward and horizontal gradients become increasingly steep over the remaining 300 to 400 feet eastward to Rowell Creek. The pronounced upward gradients indicate that the surficial aquifer discharges to Rowell Creek. In the wetlands west of Rowell Creek, the water table is near the land surface, but groundwater has not been observed discharging to the land surface.

The seepage velocity, or the rate at which groundwater moves through the aquifer, was calculated for each gradient area of the surficial aquifer. For the entire distance from the waste disposal pit area to Rowell Creek, the seepage velocity is estimated at 88 feet per year (ft/yr). At the waste disposal pit area, the seepage velocity is estimated at 27 ft/yr. In the last 300 feet before Rowell Creek, a seepage velocity of 190 ft/yr is estimated.

2.5.1.2 Intermediate Aquifer System

In the NAS Cecil Field area, the intermediate aquifer system or confining unit consists of sediments assigned to the Miocene Hawthorn Group. In addition to its clay-rich sediments, the Hawthorn includes near its top, a locally continuous carbonate-rich unit of dolomite with significant secondary (e.g., fractures) porosity, possibly including shell hash or sand bodies. This carbonate-rich unit forms the historic "rock aquifer" or "secondary artesian aquifer," a water-bearing unit widely used in this region as a private drinking water source. For this ROD, this unit will be referred to as the upper zone of the Hawthorn (UZH). The unit is approximately 20 to 25 feet thick and occurs at a depth of 100 to 125 feet below land surface (bls). The top of this unit is irregular and may represent an erosional unconformity. The total thickness of the entire Hawthorn Group (including the underlying clayey confining beds) exceeds 300 feet in this area (Scott et al., 1991).

At OU8, the groundwater flow direction in the intermediate aquifer is to the east-southeast, toward Rowell Creek. A vertical upward gradient from the intermediate aquifer to the surficial aquifer is present. For the intermediate aquifer, a seepage velocity of 0.20 ft/day or 73 ft/yr was calculated.

2.5.2 <u>Contaminant Sources</u>

At OU8, the primary source of contamination is considered to be the liquid wastes (described earlier) that were deposited in the disposal pit. Another possible source area of contamination, unrelated to the waste disposal pits, is the helicopter crash site.

The OU8 RI, completed in 1994, investigated surface soil, subsurface soil, groundwater, sediment, and surface water. Field screening and confirmatory sampling programs were conducted for soil and groundwater at OU8. The evaluation of investigative results indicates that contaminants were found in samples from all media sampled, though not all detected constituents were attributable to waste disposal activities at Site 3.

The results of the RI are summarized, by medium, in the following paragraphs.

2.5.2.1 Soil

The results of the confirmatory soil sampling and analytical program indicate the presence of VOCs, semivolatile organic compounds (SVOCs), total recoverable petroleum hydrocarbons (TRPH), pesticides, polychlorinated biphenyls (PCBs), and inorganics in both surface and subsurface soil.

In the 1994 investigation, an extensive surface and subsurface soil sample screening program was undertaken (Figures 2-3 and 2-4); confirmatory soil sampling and chemical analysis followed the screening program (Figure 2-5). Between the 1991 and 1994 investigations, 37 subsurface soil samples were used to evaluate the nature and extent of contamination at OU8.

Surface Soil

The most frequent VOC detected in the 24 surface soil samples (0 to 1 foot bls) was xylene (12 of 24 samples), a common component of fuel, at concentrations ranging from 3 to 8 micrograms per kilogram (µg/kg). All other VOCs had a frequency of detection of 2 out of 24 samples or less and were detected at concentrations below 5 µg/kg. None of these detections exceeded the FDEP residential Soil Cleanup Goals (SCGs). VOC detected in both surface and subsurface soil is depicted on Figure 2-6.

Several SVOCs were detected in surface soil, although no single SVOC was detected in more than four of the 24 samples collected. Many of the detected SVOCs are commonly found in fuel and waste oil, both of which were reportedly disposed at OU8. The maximum concentration of benzo(a)pyrene (565 µg/kg) exceeded the FDEP residential SCG (148 µg/kg).

TRPH was detected in 6 of the 24 surface soil samples; detections were in both the disposal pit area and the helicopter crash area. The presence of TRPH at OU8 is likely attributable to historic activities at these areas.

A few pesticides and one PCB isomer (Aroclor-1254) were detected in surface soil. None of these detections exceed the FDEP residential SCGs. Because of wide distribution and low concentrations of the pesticides and PCB, the detections are interpreted to be the result of former basewide pesticide

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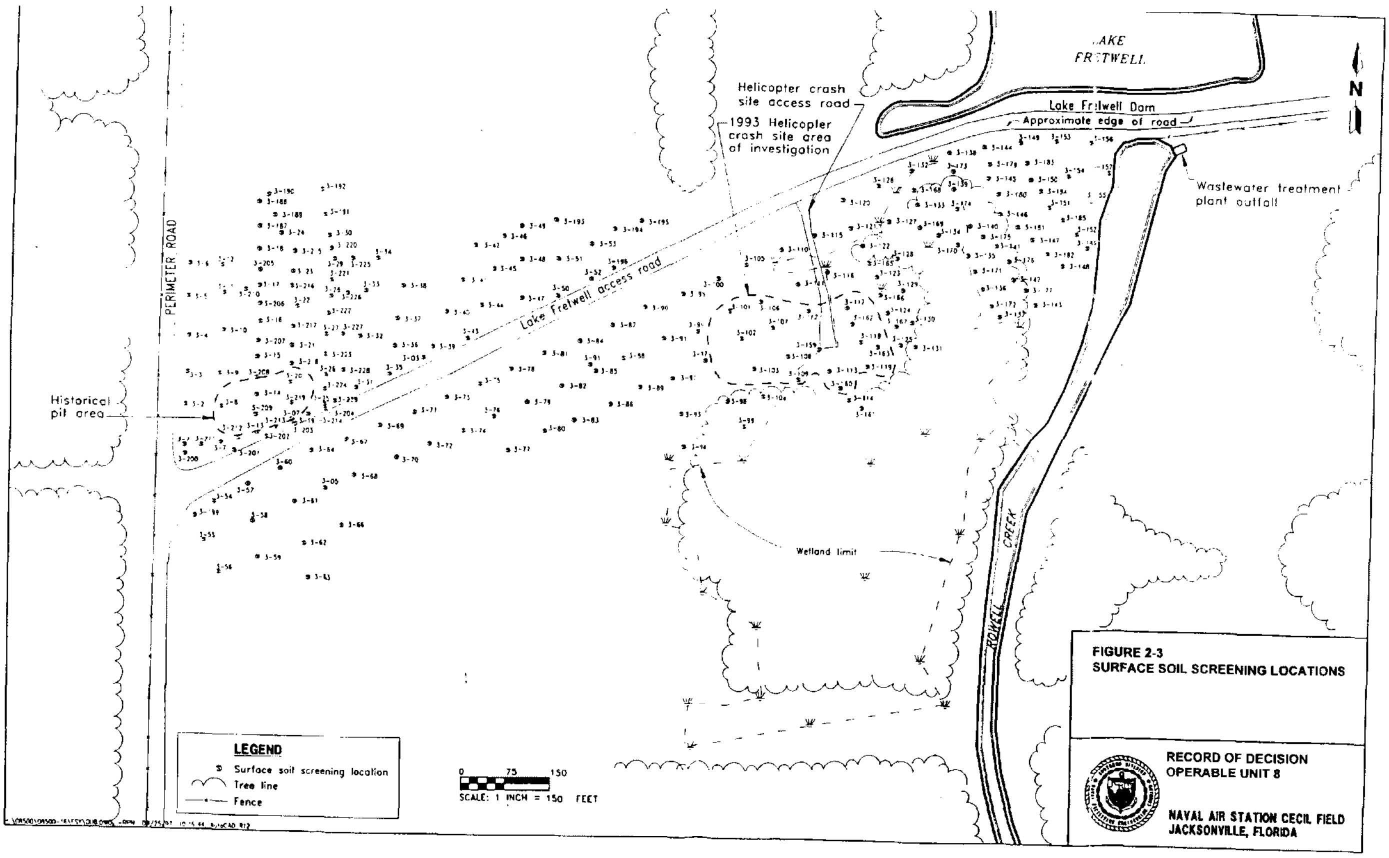

FIGURE 2-3
SURFACE SOIL SCREENING LOCATIONS

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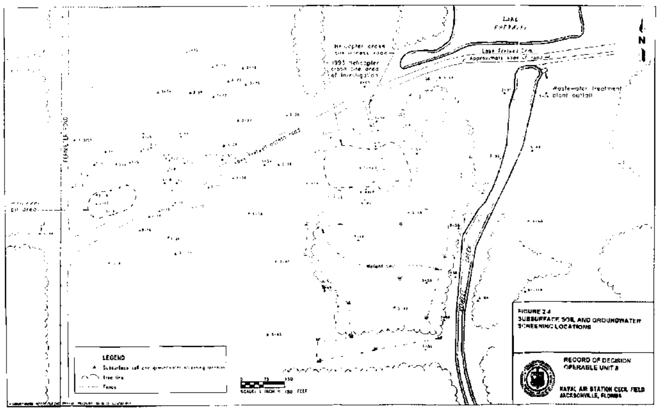

FIGURE 2-4
SUBSURFACE SOIL AND GROUNDWATER SCREENING LOCATIONS

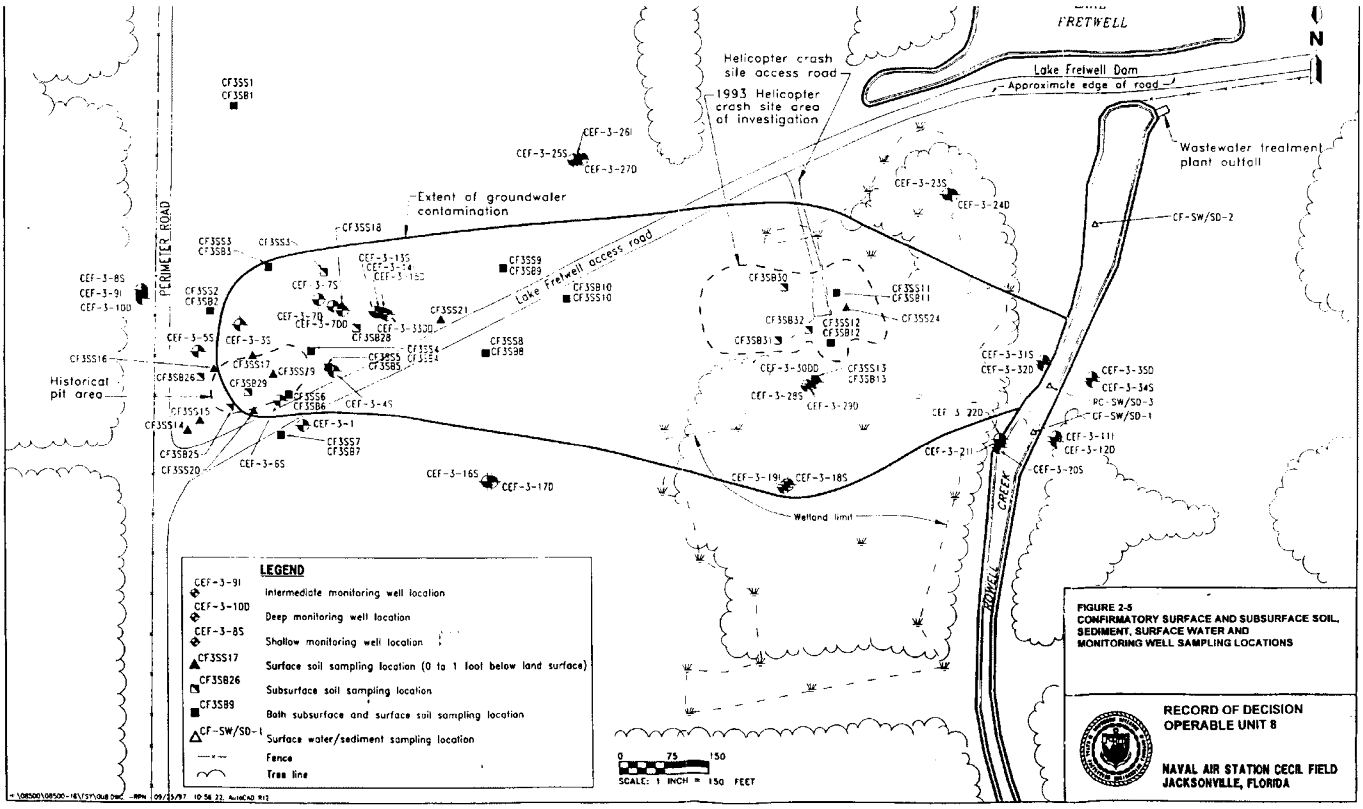

FIGURE 2-5
CONFIRMATORY SURFACE AND SUBSURFACE SOIL, SEDIMENT, SURFACE WATER AND MONITORING WELL SAMPLING LOCATIONS

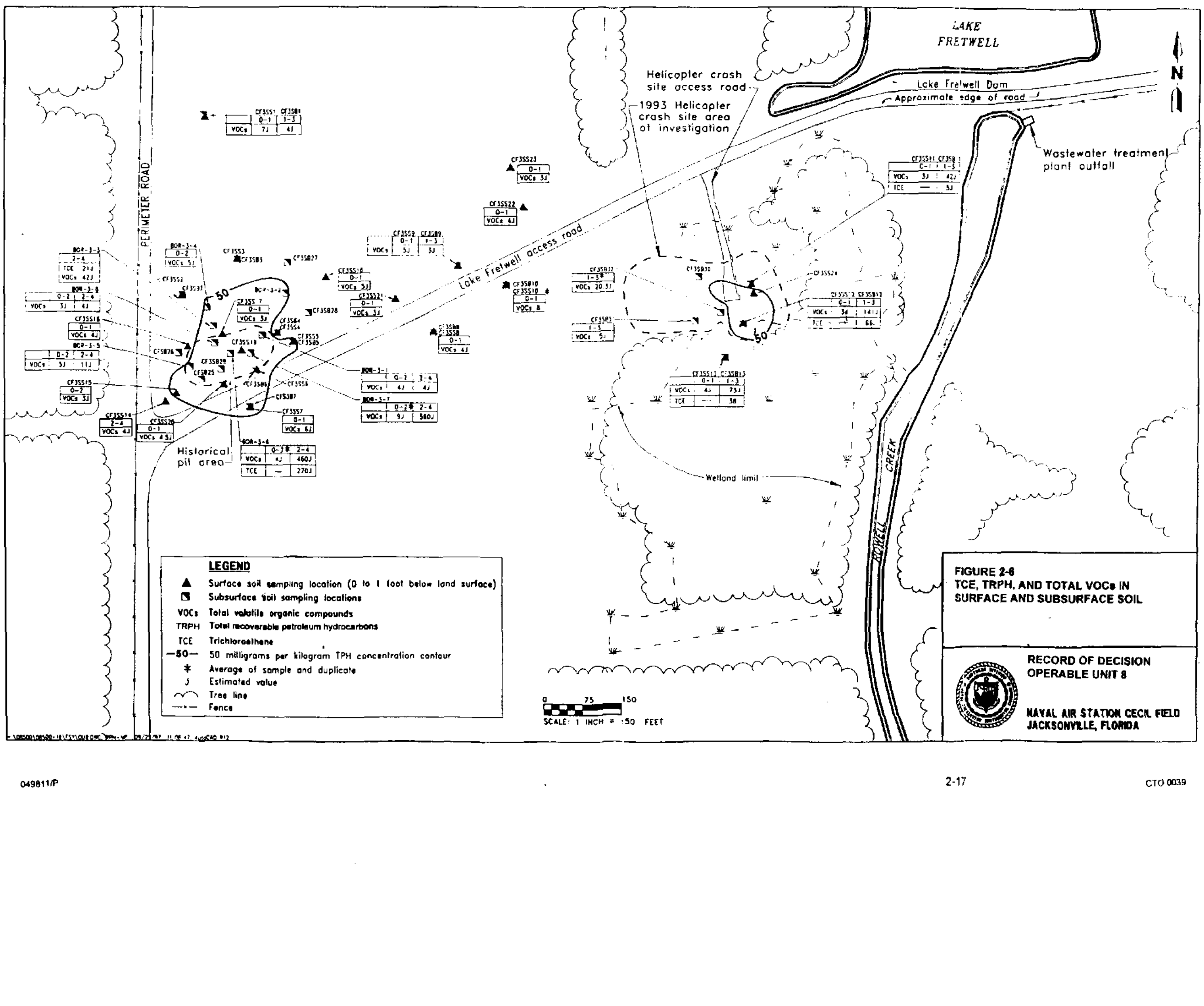

FIGURE 2-6
TCE, TRPH, AND TOTAL VOCs IN SURFACE AND SUBSURFACE SOIL

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applications and the suspected past practice of using oil that contained PCBs for dust control along unpaved roads, and are not attributed to disposal operations at OU8. Sampling of road dust has been conducted, and no PCBs were identified. Contaminants present along roadways at NAS Cecil Field are being investigated under the BRAC program.

Five inorganics in OU8 surface soil exceeded background screening concentrations specific to NAS Cecil Field and referred to as Hi-Cut values. These inorganics include cadmium, copper, mercury, silver, and zinc. The inorganics most frequently detected and with the highest concentrations were located within or near the former disposal pit. The helicopter crash area typically had inorganic concentrations near or below the background screening concentrations and also had fewer total inorganic contaminants detected than the disposal pit area. None of the metals detected exceeded the FDEP residential SCGs.

Subsurface Soil

Evaluation of results for the subsurface soil samples indicates that VOCs, SVOCs, and inorganics appear to be related to past disposal practices and the helicopter crash because the highest concentrations were detected near the disposal pit area and the helicopter crash site. Pesticides and PCBs were not detected frequently and have a sporadic distribution, indicating that they are probably not related to historic disposal activities at the disposal pit area.

The VOC detections were primarily chlorinated solvents and fuel-related VOCs and appear to be related to the previous waste disposal operations at OU8. Detections of these compounds in subsurface soil near the helicopter crash site are believed to be the result of volatilization of VOCs in groundwater, which is within two feet of the land surface in this area.

Trichloroethlene (TCE) was detected in 5 out of 37 subsurface soil samples. There were two TCE detections in subsurface samples located in the vadose zone in the disposal pit area, with the highest detection of 270 μg/kg occurring in the sample from soil boring CEF-3-BOR-6. The maximum concentration of TCE (270 μg/kg) exceeded the FDEP SCG based on leachability from soil to groundwater (1.46 μg/kg). These two TCE detections were the only subsurface soil detections that were in the vadose zone. The other detections were in the saturated zone. The Summers model and the U.S. EPA Batch model (U.S. EPA, 1989) were used to assess whether vadose zone soil contaminated with TCE (i.e., vadose zone soil in the disposal pit area) would continue to act as a source of groundwater contamination (i.e., would produce leachate containing TCE above the State of Florida groundwater guidance concentration of 3 micrograms per liter [μg/l]) and, if so, to determine how long it would take for vadose zone soil in the disposal pit area to be flushed so that TCE in subsurface soil would no longer act as a source. The Summers and Batch model results indicated that it would take 23 years to flush the vadose zone soil in the disposal pit area so that the TCE in the upper 10 feet of the surficial aquifer would be less than 3 μg/l.

Several SVOCs were detected in subsurface soil at OU8. The most commonly detected SVOCs included 1,4-dichlorobenzene (DCB) and bis(2-ethylhexyl)phthalate. None of these detections exceeded the FDEP SCG based on leachability from soil to groundwater. Of these two compounds, bis(2-ethylhexyl)phthalate had the most detections (15) and was detected at the highest concentrations (6,800 μg/kg). As with VOCs, SVOCs appear to have the highest concentrations at locations within the disposal pit boundary and are most likely attributable to past disposal activities.

TRPH was detected in 20 of 37 subsurface soil samples from both the disposal pit area and the helicopter crash site, with a maximum detection of 1,600 milligrams per kilogram (mg/kg). The presence of TRPH is believed to be linked to historic activities in these areas.

The most frequently detected inorganics exceeding Hi-Cut values were barium, calcium, chromium, copper, magnesium, and nickel. In addition, cadmium, cyanide, and zinc were detected in at least one subsurface soil sample at the site above Hi-Cut values.

Based on the results of the confirmatory soil sampling and analysis, it is estimated that an average TCE concentration of 146 μg/kg remains in the vadose zone soil near the disposal pit at OU8 over an area of approximately 8,000 ft^2 and that this contaminated soil will continue to act as a source of groundwater contamination for 23 years. This is a conservative assumption based on two detections of TCE in vadose zone soil in the disposal pit area.

2.5.2.2 Groundwater

A total of 37 monitoring wells were installed at OU8 during field investigations. One well, CEF-3-2, was abandoned because of an inappropriate screen length (30 feet). Of the 36 remaining wells, 33 are screened in the surficial aquifer and 3 are screened in the intermediate aquifer (UZH). Of the 33 wells installed in the surficial aquifer, 16 are screened in the shallow zone (UZS water table to approximately 30 feet bls), 6 are screened in the intermediate zone (IZS: 30 to 77 feet bls), and 11 are screened in the deep or lower zone (LZS: 60 to 100 feet bls). Evaluation of the analytical results indicates that groundwater in the surficial aquifer at OU8 contains VOCs, SVOCs, pesticides, PCBs, and inorganics. Not all constituents detected in groundwater appear to be related to past disposal activities at OU8. Discussion of groundwater results is limited to unfiltered samples.

Ten VOCs were detected in groundwater samples collected from the surficial aquifer. Five of these 10 compounds exceeded human health risk criteria: 1,1-dichloroethane, 1,1-dichloroethene (DCE), 1,2-DCE, TCE, and benzene. The maximum detected concentrations of 1,1,1-trichloroethane, 1,1-DCE, 1,2-DCE (total), benzene, and TCE exceeded the FDEP groundwater guidance concentrations. No VOCs were detected in the intermediate aquifer at OU8.

VOCs in the surficial aquifer appear to have migrated with the natural flow of groundwater approximately 1,400 feet, from the former waste disposal pit area to Rowell Creek. The assumption that the surficial aquifer discharges to Rowell Creek is supported by the fact that no VOCs were detected in monitoring wells located east of Rowell Creek.

The migration pattern of VOCs from the disposal pit area at OU8 is confirmed by the vertical distribution of TCE and 1,1-DCE, two constituents detected in both screening and confirmatory groundwater samples. Representative Aquaprobe™ screening samples were used to help delineate the vertical extent of VOC contamination at the center of the OU8 plume where no groundwater monitoring wells exist. Contaminants are understood to have migrated downward and eastward through the aquifer from the disposal pit, to a maximum depth of approximately 70 feet bls (in the approximate center of the plume 500 to 800 feet downgradient of the pit), and to have continued to move eastward and upward with the natural groundwater flow until discharged to Rowell Creek. Solvent contamination detected in surface soil and groundwater at the helicopter crash site is understood to be attributable to contaminant migration rather than to the crash.

It is estimated that all groundwater presently containing more than 3 µg/l of TCE would flush to Rowell Creek in approximately 39 years. TCE concentrations were modeled because this chemical is widely distributed at OU8. The estimate assumes that it would take approximately 17 years to flush one plume volume of groundwater from OU8 to Rowell Creek, using an effective porosity of 0.20 and a TCE retardation factor of 2.3. This time estimate does not take into account any leaching of TCE from soil into groundwater. As discussed previously, soil in the disposal area containing an average TCE concentration of 146 µg/kg will continue to leach to groundwater over a 23-year period. Therefore, it is estimated that the total amount of time that TCE would leach into groundwater (at concentrations higher than 3 µg/l) and flush into Rowell Creek ranges from 39 to 62 years.

A total of 14 SVOCs were detected in groundwater samples collected from the surficial aquifer. A limited number of SVOCs were detected in the intermediate aquifer but not in shallow UZS wells nearby (Figure 2-7) . Of the 14 compounds detected in the surficial aquifer, 6 were identified as characteristic of disposal

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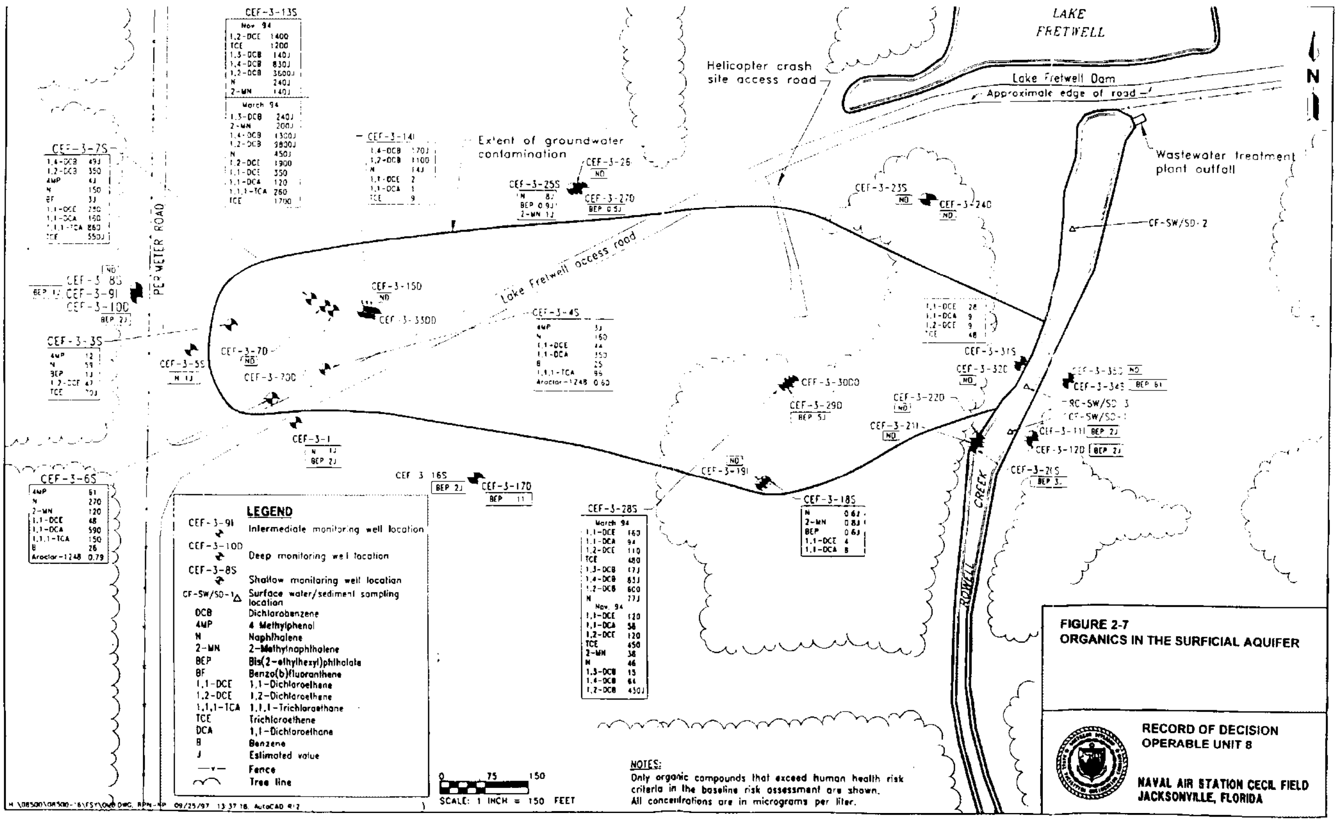

FIGURE 2-7
ORGANICS IN THE SURFICIAL AQUIFER

practices at OU8: 1,2-DCB, 1,4-DCB, benzo(b)flouranthene, naphthalene, 4-methylphenol, and bis(2-ethylhexyl)phthalate. The maximum concentration of 1,2-DCB, 1,4-DCB and 4-methylphend exceeded FDEP groundwater guidance concentrations.

The only pesticides and PCBs detected in the groundwater at OU8 were the pesticides endosulfan II and beta-benzene hexachloride and the PCB Arcolor-1248. Aroclor-1248 was detected in samples from two monitoring wells, both of which are located in the disposal pit area, at concentrations of 0.6 µg/l (CEF-3-4S) and 0.79 µg/l (CEF-3-6S). These concentrations exceed FDEP groundwater guidance concentrations. PCB detections may be related to the disposal of waste oil.

Eighteen inorganics were detected in unfiltered groundwater samples collected from the surficial aquifer. Of these 18 inorganics, arsenic, chromium, manganese, and vanadium exceeded human health risk criteria and appeared to have elevated concentrations in the vicinity of the disposal pit. The maximum concentrations of aluminum, iron, and manganese exceed FDEP groundwater guidance concentrations. Arsenic concentrations are higher in the LZS as opposed to the UZS, where most site-related contaminants were detected. Therefore, arsenic is believed to be indigenous to the aquifer in this area and unrelated to disposal practices at OU8. Manganese was widely distributed throughout the surficial aquifer and was present in an upgradient well; its presence is also interpreted as not attributable to disposal practices at OU8. Chromium may be related to disposal practices because it was detected in UZS wells in the disposal pit area.

Arsenic and manganese also were detected in the intermediate aquifer; however, they were below surficial aquifer Hi-Cut values and are not believed to be related to disposal practices at OU8. The maximum concentration of aluminum exceeded the FDEP groundwater concentration, which is well below the surficial aquifer Hi-Cut value.

Based on the vertical and lateral distribution of organic contaminants, and a porosity of 0.20, the volume of contaminated groundwater in the surficial aquifer is estimated at 50 million gallons.

2.5.2.3 Surface Water and Sediment

Three surface water and sediment samples were collected from three locations in Rowell Creek. Four organic compounds were detected in the surface water samples collected for OU8: bromodichloromethane, dibromochloromethane, methylene chloride, and chloroform. With the exception of methylene chloride (a common laboratory contaminant that was not detected in groundwater at OU8), these VOCs are most likely attributable to the wastewater treatment plant effluent, which enters Rowell

Creek near the base of the Lake Fretwell dam upstream of these sampling locations. These VOCs are common by-products of the chlorination process used during the treatment of wastewater. All concentrations were below FDEP water quality standards.

Organics detected in groundwater at OU8 (TCE in particular) were most likely not detected in surface water because of biodegradation as the groundwater migrates through streambed sediment or dilution of the groundwater as it discharges to Rowell Creek. It is estimated that groundwater discharging to surface water is diluted 99.2 percent, or 133 times. Appendix K of the RI report (ABB-ES, 1997c) contains calculations for estimating this dilution.

Three organic compounds were detected in the sediment samples collected at OU8: one VOC, 2-butanone, and two SVOCs, di-n-butylphthalate and bis(2-ethylhexyl)phthalate. Due to their absence in nearby surface soil samples and groundwater samples from the UZS west of Rowell Creek, the presence of these compounds in sediment is not believed to be linked to the disposal pit area.

One pesticide was detected in the background surface water sample CEF-SW/SD-2. Four pesticides and one PCB isomer were detected in sediment samples. The presence of these compounds is believed to be attributable to basewide pesticide use and the past practice of using oil containing PCBs as a road dust suppressant.

Five inorganic contaminants detected in surface water samples were identified as chemicals of potential concern (COPCs) in the RI: aluminum, antimony, iron, lead, and silver. Of these five inorganics, only iron was detected in the upstream background sample CF-SD-2. Antimony, lead, and silver were not detected in samples from nearby monitoring well CEF-3-31S. The concentrations of all these inorganics were less than Hi-Cut values. The single detection of silver exceeded the FDEP water quality standard.

Four inorganic contaminants detected in sediment samples were identified as COPCs in the RI: barium, copper, lead, and zinc. Barium, copper, and zinc were not detected in the upstream background sample CF-SD-2. Lead was detected in both sediment sample locations and the upstream background sample. The upstream background screening lead concentration of 5.8 mg/kg is nearly the same as that at RC-SD-3 (6.2 mg/kg). The concentrations of all these inorganics were less than the Hi-Cut values.

Although barium and lead were detected in surface soil samples collected from the helicopter crash site area, the concentrations did not exceed the Hi-Cut values. Therefore, surfaces soil does not appear to be the source of the analytes detected in the sediment samples. Copper also was detected in surface soil samples at the helicopter crash site but at concentrations lower than those detected in sediment.

2.6 SUMMARY OF SITE RISKS

The BRA (ABB-ES, 1997b) provides the basis for taking action and indicates the exposure pathways to be addressed by the remedial action. This section of the ROD reports the result of the BRA conducted for this site. Information on identification of chemicals of concern, exposure assessment, toxicity assessment, and risk characterization are provided in detail in the RI (ABB-ES, 1997c). The BRA results, indicate that unacceptable risks could exist if no action were taken at the site. Human health risks and potential ecological risks were identified at Site 3. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the RA selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, and the environment.

Human health threats include both a cancer risk and a noncancer hazard index (HI) in accordance with the NCP. The NCP establishes 1 in 1,000,000 (1E-06) to 1 in 10,000 (1E-04) as an "acceptable" excess lifetime cancer risk (ELCR) from chemicals of potential concern (COPCs) (U.S. EPA, 1990). For noncarcinogenic chemicals, an HI of equal to or less than one is acceptable. The State of Florida established an acceptable ELCR as equal to or less than 1E-06 and an HI equal to or less than one.

2.6.1 <u>Human Health Risk Assessment</u>

Adverse health effects from carcinogens and noncarcinogens associated with current land use at OU8 are not of concern. Cancer risk estimates associated with future use of OU8 surface soil, subsurface soil, surface water, sediment, and intermediate aquifer groundwater are all below or within the acceptable risk range defined by U.S. EPA. However, risks to a future resident exposed to surface soil, intermediate aquifer groundwater, and sediment exceeded the State of Florida acceptable ELCR. In addition, the ELCR associated with ingestion of groundwater from the surficial aquifer under a potential future land-use scenario (adult resident) is 3E-03, which exceeds U.S. EPA and the State of Florida acceptable cancer risk ranges. The major contaminants contributing to the ELCR for the future adult resident are 1,1-DCE (ELCR = 3E-03), TCE (ELCR = 2E-04), 1,4-DCB (ELCR = 2E-04), and arsenic (ELCR = 2E-04). A summary of the human heath risks is provided in Table 2-1.

Noncancer HI estimates associated with future use of OU8 surface soil, subsurface soil, surface water, sediment, and intermediate aquifer groundwater are all equal to or less than one. The noncancer HI associated with ingestion of groundwater from the surficial aquifer under the potential future land-use scenario (adult resident) is 20. Major contributors to this HI are TCE (hazard quotient [HQ] = 7.8), 1,2-DCE (total) (HQ = 5.8), 1,2-DCB (HQ = 3.0), and 1,1-DCE (HQ = 1.1).

TABLE 2-1

HUMAN HEALTH RISK SUMMARY
OPERABLE UNIT 8, SITE 3
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Medium	Risks Above U.S. EPA Risk Range?[1]		Risks Above FDEP Risk Range?[4]		Concentrations Above Florida Soil Cleanup Goals on Groundwater Guidance Criteria?[5]
	Current Land Use[2]	Future Land Use[3]	Current Land Use[2]	Future Land Use[3]	
Surface Soil	No	No	No	Yes	Yes[6]
Subsurface Soil	NA	No	NA	No	Yes[7]
Surface Water	No	No	No	No	NA
Sediment	No	No	No	Yes	NA
Surficial Aquifer Groundwater	NA	Yes	NA	Yes	Yes[8]
Intermediate Aquifer Groundwater	NA	No	NA	No	Yes[9]

1 U.S. EPA has established an acceptable ELCR range of 1E-06 to 1E-04 (U.S.EPA, 1990) and a maximum non-carcinogen HI of 1.0.

2 Current land uses evaluated in this report include nonresidential exposures with no current use of groundwater.

3 Potential future land uses evaluated in this report include residential exposures with the use of groundwater as drinking water.

4 FDEP has established an acceptable ELCR threshold of 1E-06 and a maximum non-carcinogen HI of 1.0.

5 Florida Soil cleanup goals are identified in the Florida Department of Environmental Protection (FEDP) memorandum dated September 29, 1995 (FDEP, 1995). Florida guidance concentrations are taken from Chapter 6 (Guidance Concentrations Index) of the FDEP groundwater concentrations issued in June 1994 (FDEP, 1994).

6 In surface soil, the maximum concentration of benzo(a)pyrene exceeded the Florida soil cleanup goal.

7 In subsurface soil, the maximum concentration of trichloroethene exceeded the Florida guidance concentration for leaching to groundwater.

8 In the surficial aquifer, the maximum detected concentrations of 1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene (total), benzene, trichloroethene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, Aroclor-1248, aluminum, antimony, iron, manganese exceeded their respective Florida guidance concentrations.

9 In the intermediate aquifer, the maximum concentration of aluminum exceeded the Florida guidance concentration.

Note: U.S. EPA = U.S. Environmental Protection Agency
NA = not applicable

Concern over the contamination in the surficial aquifer may be warranted because of the possibility of adverse health effects (cancer and noncancer) associated with assumed future use of the groundwater as a potable water supply. However, use of the surficial aquifer as a potable water supply at OU8 may never occur because NAS Cecil Field is served by a community water supply system.

An analysis was conducted to determine if there would be any human health risk associated with discharge of surficial aquifer groundwater to Rowell Creek. The maximum detected concentration of chemicals in surficial aquifer groundwater were divided by a dilution factor of 133 to obtain an estimated surface water concentration. These surface water concentrations were then compared to the U.S. EPA Region III risk-based concentrations (RBCs) for tap (potable) water (U.S. EPA, 1994) and background screening concentrations. Any analyte that exceeded either of these screening criteria was retained as an human health COPC. Exposure to surface water by an adult and child resident was evaluated because these are the most conservative scenarios for surface water exposure. The ELCR for a future resident (child and adult) was 2E-06, which is within the U.S. EPA acceptable risk range. The HIs associated with the child (HI = 0.5) and adult (HI = 0.3) were both below the threshold level of one. In summary, discharge of the surficial aquifer groundwater into Rowell Creek is not associated with any unacceptable human health effects.

Based on the results of the human health BRA, the development of remedial action strategies are necessary for the surficial aquifer groundwater at OU8.

2.6.2 Ecological Risk Assessment

Potential risks to ecological receptors were evaluated for chemicals in surface soil, surface water, sediment, and groundwater at OU8. Results indicate that ecological receptors are not likely to be at risk from exposure to OU8 surface soil, surface water, or sediment. Adverse effects to aquatic organisms were observed in laboratory toxicity studies from exposure to undiluted OU8 groundwater. A summary of potential risks to ecologic receptors is provided in Table 2-2.

TABLE 2-2

SUMMARY OF RISK CHARACTERIZATION FOR WILDLIFE, PLANT, AND INVERTEBRATE RECEPTORS
SITE 3 OPERABLE UNIT 8
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Receptor	Biological Parameters	Risk Estimated (per Medium)			
		Surface Soil	Surface Water	Sediment	Future Groundwater Discharge
Terrestrial and wetland wildlife	Food web modeling	None	None	None	NA
Terrestrial and wetland plants	Toxicity tests with lettuce seeds	None(1)	NA	NA	NA
Soil invertebrates	Toxicity tests with earthworms	None	NA	NA	NA
Aquatic organisms	Benchmark comparison	NA	Minimal to none	Minimal to none	Adverse effects possible(2)
Aquatic organisms	Macroinvertebrate community structure analysis	NA	Poor habitat quality	Poor habitat quality	NA
Aquatic organisms	Laboratory toxicity tests with water fleas and fathead minnows	NA	NA	NA	Reduced reproduction, growth, and survival observed(3)

1 Slight reduction of lettuce seed germination believed to be associated with a noncontaminant stressor.

2 Adverse effects from dichlorobenzene, bis(2-ethylhexyl)phthalate, Aroclor-1248, aluminum, chromium (unfiltered only), copper, and iron were estimated for current undiluted concentrations of groundwater. Adverse effects from only 1,2-dichlorobenzene and possibly aluminum were estimated for future diluted concentrations of groundwater.

3 Concentrations of 1,1-dichloroethane, dichlorobenzene, aluminum, chromium, copper, iron, and lead detected in the groundwater used for the toxicity tests exceed available benchmarks. It is believed that dichlorobenzene is the primary chemical causing adverse effects to the water flea and fathead minnow.

Notes: None = no effect.
NA = not applicable.

2.7 DESCRIPTION OF REMEDIAL ALTERNATIVES

2.7.1 Available Remedial Alternatives

Four types of general response actions were evaluated during the RI/FS for Site 3:

1) Take limited or no action: Leave the site as it is, or restrict access and monitor it. While the no action alternative would cost the least, it would not ensure the protection of human health and the environment since it would leave a source of future contamination and would not monitor the effectiveness of natural attenuation. Long-term natural attenuation monitoring and analysis of groundwater and surface water would ensure that site remediation goals are being achieved and that there are no adverse human health or environmental impacts from the potential spread of contamination.

2) Contain contamination: Leave contamination where it is and cover or contain it in some way to prevent exposure to, or spread of, contaminants. This method reduces risks from exposure to contamination, but does not destroy or reduce the contamination.

3) Move contamination off site: Remove contaminated material (soil, groundwater, etc.) and dispose or treat and then dispose in an offsite licensed disposal facility.

4) Treat contamination on site: Use chemical, physical, and/or natural processes to destroy, remove, or reduce the contamination. Treated material can be left on site. If needed, contaminants captured by the treatment process are disposed in an offsite licensed waste disposal facility.

2.7.2 Groundwater Remedial Alternatives for Operable Unit 8, Site 3

The results of the BRA and the ecological risk assessment (ERA) indicate that adverse impacts to human health and the environment are present only under the future use scenario for exposure to Site 3 groundwater. Therefore, only remedial action alternatives related to groundwater were evaluated.

2.7.2.1 No Action

Alternative MM-1: No Action

Evaluation of the no-action alternative is required by law to provide a baseline against which other alternatives can be compared. Under this alternative, no remedial activities would occur to address groundwater contamination and contaminant concentrations would be reduced only through natural attenuation. No controls would be implemented to reduce exposure by human receptors. Contaminants would attenuate naturally; however, periodic monitoring would not be performed to evaluate the effectiveness of the no-action alternative in meeting clean-up goals and preventing the potential migration of contaminants into Rowell Creek.

This alternative would not protect human health because risks from direct exposure to contaminated groundwater would continue to exist. This alternative would not achieve the RAOs or comply with ARARs. There would be no reduction of contaminant mobility and reduction in toxicity and volume would occur only through long-term natural attenuation and would not be monitored. Because no remedial action would take place, this alternative would not result in any short-term risks and would be very easy to implement. There would be no cost associated with this alternative.

2.7.2.2 Natural Attenuation

Alternative MM-6: Natural Attenuation with Institutional Controls

This alternative would involve natural attenuation to reduce contaminant levels and the imposition of deed/land use restrictions to reduce the potential for exposure to elevated levels of contaminants.

Under this alternative, limited action would be taken to reduce risks to human receptors. Groundwater would be monitored to determine the degree of contaminant removal achieved through long-term natural attenuation, administrative measures, such as deed restrictions, would be implemented to restrict land use and prevent use of the surficial aquifer groundwater. Site reviews would be conducted every 5 years to determine whether continued implementation of this alternative is appropriate.

This alternative would protect human health because it would reduce the risk from direct exposure to contaminated groundwater. This alternative would achieve the RAOs and groundwater monitoring would establish achievement of long-term compliance with ARARs through natural attenuation of residual contaminants. There would be no reduction of contaminant mobility but long-term natural attenuation would reduce the contaminant toxicity. There would be minimal short-term risk associated with the performance of groundwater monitoring activities, which would be addressed through appropriate health and safety procedures. It is estimated that the action levels would be met in 62 years. All of the activities for this alternative would be easy to perform but their continued implementation, especially after the site is no longer under military control, would require careful oversight. The present-worth cost would be approximately $606,000.

2.7.2.3 In-situ Treatment

Alternative MM-2: Enhanced Biodegradation

This alternative relies on naturally-occurring microorganisms in the subsurface soil to breakdown the organic contaminants. This alternative would enchance these naturally-occurring microorganisms by ingestion of nutrients (nitrogen and phosphorus compounds) in the surficial aquifer, increasing their abundance and thereby increasing the efficiency of their degradation of contaminants.

Bench-scale treatability studies would be performed to determine optimum nutrient composition. This alternative also would include groundwater monitoring to evaluate the rate of biodegradation, implementation of administrative measures to prevent groundwater use until compliance with action levels had been achieved, and performance of 5-year reviews to determine whether continued implementation of this alternative is appropriate.

Alternative MM-2 would protect human health because it would biodegrade the site contaminants and prevent groundwater use until action levels were met. This alternative would achieve the RAOs and comply with ARARs. Significant, permanent, and irreversible reduction of contaminant mobility, toxicity, and volume would be achieved through biodegradation. Groundwater monitoring would determine the rate and effectiveness of this reduction. Minimal short-term risk would be associated with the installation and operation of the nutrient injection system and with the performance of groundwater monitoring activities. These risks would be addressed through proper engineering controls and health and safety procedures. This alternative would achieve compliance with action levels within approximately 12 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $3,652,000

Alternative MM-3: In-situ Air Stripping with Enhanced Biodegradation.

Alternative MM-3 is similar to Alternative MM-2, but would remove the high concentrations of VOCs from the source area as an additional method of treatment. VOCs are removed from groundwater by forcing air under pressure into the aquifer and volatilizing them. The extracted vapors are treated above ground with a regenerative thermal oxidation process that removes the VOCs. The enhanced biodegradation portion of this alternative would occur in the downgradient part of the contaminant plume only, not the entire plume as in Alternative MM-2. This alternative also would include groundwater monitoring to evaluate the effectiveness of the remediation process, implementation of administrative measures to prevent groundwater use until compliance with action levels has been achieved, and 5-year reviews to determine whether continued implementation was appropriate.

Alternative MM-3 would protect human health because it would remove organic contaminants from the groundwater and prevent groundwater use until action levels were met. It would achieve the RAOs and comply with ARARs. Significant, permanent, and irreversible reductions in contaminant mobility, toxicity, and volume would occur through volatilization and off-gas treatment. Groundwater monitoring would determine the rate and effectiveness of this reduction. Some short-term risks would be associated with the installation and operation of the air injection and vapor extraction and treatment system and with the performance of groundwater monitoring activities. These risks would be addressed through proper engineering controls and health and safety procedures. This alternative would achieve compliance with action levels within approximately 12 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $3,322,000.

Alternative MM-7: In-situ Permeable Reactive Wall and Hydraulic Barriers

This alternative would use reactive materials installed as a permeable wall in the pathway of the groundwater contaminant plume. Contaminants would be broken down into less harmful products through chemical reactions with the zero-valent iron material within the wall during the migration of groundwater through the wall. Hydraulic barriers or impermeable walls would be installed parallel to the plume movement to serve as a "funnel" to direct the groundwater plume through the reactive, permeable wall. This alternative also would include groundwater monitoring to evaluate the effectiveness of the remediation process, implementation of administrative measures, to prevent use of groundwater until compliance with action levels had been achieved, and performance of 5-year reviews to determine whether continued implementation of the alternative is appropriate.

Alternative MM-7 would protect human health because it would reduce the concentrations of the COPCs within the groundwater and prevent its use until action levels were met. This alternative would achieve the RAOs and would likely comply with ARARs. Significant, permanent, and irreversible reductions in contaminant mobility, toxicity, and volume would be achieved. Groundwater monitoring would determine the rate and effectiveness of this reduction. Some short-term risks would be associated with the construction and operation of the hydraulic barrier/treatment system and with the performance of groundwater monitoring activities. These risks would be addressed through engineering controls and health and safety procedures. Alternative MM-7 would achieve compliance with action levels within approximately 62 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $2,170,000.

Alternative MM-8: In-situ Air Stripping with Phytoremediation Followed by Natural Attenuation

This alternative would use Alternative MM-3, described earlier, and phytoremediation. Phytoremediation is the use of selected plant species to absorb and degrade contaminants taken up with groundwater through their roots. To enhance the remediation of groundwater migrating toward Rowell Creek, selected plants and trees would be planted over the contaminant plume migration pathway. This alternative also would include groundwater monitoring to evaluate the effectiveness of the remediation process, implementation of administrative measures to prevent groundwater use until compliance with action levels had been achieved, and performance of 5-year reviews to determine whether continued implementation of this alternative is appropriate.

Alternative MM-8 would protect human health because it would remove organic contaminants from the groundwater and prevent groundwater use until action levels have been met. This alternative would achieve the RAOs and comply with ARARs. Significant, permanent, and irreversible reductions in contaminant mobility, toxicity, and volume would occur through volatilization and plant uptake and absorption. Groundwater monitoring would determine the rate and effectiveness of this reduction. Short-term risks would be associated with the installation and operation of the air injection system and with the performance of groundwater monitoring activities. These risks would be addressed through engineering controls and health and safety procedures. Alternative MM-8 would achieve compliance with action levels within approximately 30 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $1,867,000.

2.7.2.4 Treatment Following Groundwater Extraction

Alternative MM-4: Pump-and-Treat with Discharge to Rowell Creek

Alternative MM-4 would consist of extracting the contaminated groundwater and vapors from the soil followed by treatment in a facility that would be constructed on site. The treatment facility would remove the organic contaminants from the groundwater by volatilization and adsorption on to activated charcoal columns. The treated water would be discharged to Rowell Creek.

The extracted groundwater would be filtered to remove suspended solids, air-stripped, and percolated through granular activated carbon (GAC) to remove organic COPCs. The need to treat of the air stripping emissions would be determined at the conceptual design stage. The treated water would be discharged to Rowell Creek. This alternative also would include groundwater monitoring to evaluate the effectiveness of the remediation process, implementation of administrative measures to prevent groundwater use until compliance with action levels had been achieved, and performance of 5-year reviews to determine whether continued implementation of this alternative is appropriate.

Alternative MM-8 would protect human health because it would remove COPCs from the groundwater and prevent groundwater use until action levels have been met. This alternative would achieve the RAOs and comply with ARARs. Significant, permanent, and irreversible reductions in contaminant mobility, toxicity, and volume would occur. Groundwater monitoring would determine the rate and effectiveness of this reduction. Some short-term risks would be associated with the construction and operation of the groundwater extraction and treatment system and with the performance of groundwater monitoring activities. These risks would be addressed through engineering controls and health and safety procedures. Alternative MM-4 would achieve compliance with action levels within approximately 9 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $2,970,000.

Alternative MM-5: Pump-and-Treat with Reinjection for Enhanced Biodegradation

This alternative is similar to Alternative MM-4 with the exception that the treated water would be mixed with nutrients and returned to the aquifer. It would remove contaminants in an above ground treatment facility (as in Alternative MM-4) and enhances subsurface biodegradation (described under Alternative MM-3). This alternative also would include groundwater monitoring to evaluate the effectiveness of the remediation process, implementation of administrative measures to prevent groundwater use until compliance with action levels had been achieved, and performance of 5-year reviews to determine whether continued implementation is appropriate.

Alternative MM-5 would protect human health because it would remove COPCs from the groundwater and prevent groundwater use until action levels have been met. This alternative would achieve the RAOs and comply with ARARs. Significant, permanent, and irreversible reductions in contaminant mobility, toxicity, and volume would occur. Groundwater monitoring would determine the rate and effectiveness of this reduction. Some short-term risks would be associated with the construction and operation of the groundwater extraction and treatment system and with the performance of groundwater monitoring activities. These risks would be addressed through engineering controls and health and safety procedures. Alternative MM-5 would achieve compliance with action levels within approximately 12 years and would be relatively easy to implement. The necessary equipment, materials, and construction contractors are readily available. The present-worth cost would be approximately $4,072,000.

2.8 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section evaluates and compares the alternatives with respect to the nine criteria outlined in Section 300.430(s) of the NCP (U.S. EPA, 1990). These criteria are categorized as threshold, primary balancing, or modifying. Table 2-3 lists and explains these evaluation criteria.

A detailed comparative analysis of the alternatives using the nine criteria was performed as part of the FS (ABB-ES, 1997a). This analysis was used to identify preferred remedies for Site 3 in the Proposed Plan (B & R Environmental, 1998). Table 2-4 presents a summary of the comparative analysis of alternatives.

2.9 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and U.S. EPA, FDEP, and public comments, a remedy was selected to address the contaminants in the groundwater at Site 3. A combination of Alternatives MM-3 and MM-6 was selected for application.

In-situ Air Stripping of Source Area Groundwater by Air Sparging. - The volatile organic contaminants that are present at concentrations that exceed cleanup goal concentrations will be reduced to the extent necessary for natural attenuation to effectively occur. These contaminants will be removed by a process of in-situ, subsurface volatilization, called air sparging, which uses clean air under pressure. Air sparging also may enhance the removal of less volatile organics by stimulating biological activity. During pilot studies prior to final design and implementation of the system, the VOCs will be captured in the gas phase and their concentration measured to ensure that levels comply with Florida and U.S. EPA standards. Requirements for vapor and off-gas treatment will be determined at that time. A monitoring plan will be implemented to monitor and evaluate the effectiveness of air sparging and to determine the appropriate time to begin site-wide natural attenuation.

Natural Attenuation of Downgradient Groundwater - Concentrations of organic and inorganic contaminants exceeding groundwater cleanup goals in the treated source area and downgradient plume will be reduced through natural attenuation processes, including biodegradation, dilution and dispersion, known to be occurring at the site. Natural attenuation studies have previously been performed at the site and have shown it to be effective in reducing contaminant levels. Additional groundwater modeling will be

TABLE 2-3

EXPLANATION OF EVALUATION CRITERIA
RECORD OF DECISION
SITE 3, OPERABLE UNIT 8
NAS, CECIL FIELD
JACKSONVILLE, FLORIDA

Criteria	Description
Threshold	**Overall Protection of Human Health and the Environment.** This criterion evaluates the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls(e.g., access restrictions). **Compliance with State and Federal Regulations.** The alternatives are evaluated for compliance with environmental protection regulations determined to be applicable or relevant and appropriate to the site conditions.
Primary Balancing	**Long-Term Effectiveness.** The alternatives are evaluated based on their ability to maintain reliable protection of human health and the environment after implementation. **Reduction of Contaminant Toxicity, Mobility, and Volume Through Treatment**. Each alternative is evaluated based on how it reduces the harmful nature of the contaminants, their ability to move through the environment, and the amount of contamination. **Short-Term Effectiveness.** The risks that implementation of a particular remedy may pose to workers and nearby residents (e.g., whether or not contaminated dust will be produced during excavation), as well as the reduction in risks that results by controlling the contaminants, are assessed. The length of time needed to implement each alternative is also considered. **Implementability**. Both the technical feasibility and administrative ease (e.g., the amount of coordination with other government agencies needed) of a remedy, including availability of necessary goods and services, are assessed. **Cost.** The benefits of implementing a particular alternative are weighted against the cost of implementation.
Modifying	**U.S. EPA and FDEP Acceptance.** The final Feasibility Study and the Proposed Plan, which are placed in the Information Repository, represent a consensus by the Navy, U.S. EPA, and FDEP. **Community Acceptance.** The Navy assesses community acceptance of the preferred alternative by giving the public an opportunity to comment on the remedy selection process and the preferred alternative and then responds to those comments.

SUMMARY OF COMPARATIVE EVALUATION OF ALTERNATIVES
RECORD OF DECISION - OPERABLE UNIT 8, SITE 3
NAS CECIL FIELD - JACKSONVILLE, FLORIDA
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Alternatives	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health & the Environment	Compliance with ARARs & TBCs	Long-Term Effectiveness	Reduction in Contaminant Toxicity, Mobility, & Volume	Short-Term Effectiveness	Implementability	Cost (Present Worth)
MM-1: No Action	Would not protect human health.	No ARARs. Chemical-specific TBCs would not be met.	Would not be effective long-term.	Would not reduce contaminant mobility. Natural reduction in toxicity and volume would not be monitored and would be unknown.	Would create no short-term risks.	No action to implement.	$427,000
MM-2: Enhanced Biodegradation	Would protect human health through treatment of contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would require 12 years to complete	Would be easy to implement.	$3,652,000
MM-3: In-situ Air Stripping with Enhanced Biodegradation	Would protect human health through treatment of contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would require 12 years to complete.	Would be easy to implement.	$3,322,000
MM-4: Pump and Treat with Discharge to Rowell Creek	Would protect human health through treatment of contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would require 9 years to complete.	Would be easy to implement.	$2,970,000
MM-5: Pump and Treat with Reinjection for Enhanced Biodegradation	Would protect human health through treatment of contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would require 12 years to complete.	Would be easy to implement.	$4,072,000
MM-6: Natural Attenuation with Institutional Controls	Would protect human health by preventing exposure to contaminated groundwater.	No ARARs. Eventual compliance with chemical-specific TBCs would be determined by monitoring.	Would be effective long-term.	Would not reduce contaminant mobility. Natural reduction in toxicity and volume would be monitored.	Would require 62 years to complete	Would be relatively easy to implement.	$606,000

TABLE 2-4

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TABLE 2-4

SUMMARY OF COMPARATIVE EVALUATION OF ALTERNATIVES
RECORD OF DECISION - OPERABLE UNIT 8, SITE 3
NAS CECIL FIELD - JACKSONVILLE, FLORIDA

Alternatives	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection of Human Health & the Environment	Compliance with ARARs & TBCs	Long-Term Effectiveness	Reduction in Contaminant Toxicity, Mobility, & Volume	Short-Term Effectiveness	Implementability	Cost (Present Worth)
MM-7: In-Situ Permeable Reactive Well and Hydraulic Barriers	Would protect human health by treatment of contaminated groundwater.	Would meet ARARs.	Long-term effectiveness to be evaluated.	Would likely reduce contaminant mobility, toxicity and volume of VOCs.	Would require 62 years to complete	Would be easy to implement.	$2,170,000
MM-8: In-situ Air Stripping with Phytoremediation followed by Natural Attenuation	Would protect human health by treatment of contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would create minimal and manageable short-term risks. Would require 30 years to complete	Would be easy to implement.	$1,867,000
Proposed Remedy: In-Situ Air Stripping followed by Natural Attenuation and Institutional Controls	Would protect human health by treatment of contaminated groundwater and prevention of exposure to contaminated groundwater.	Would meet ARARs.	Would be effective long-term.	Would reduce contaminant mobility, toxicity and volume.	Would create minimal and manageable short-term risks. Would require 30 years to complete	Would be easy to implement. Would require oversight after facility comes under civilian control.	$1,708,000

NOTE: The proposed remedy incorporates components of Alternatives MM-3 and MM-6.

ARAR = Applicable or Relevant and Appropriate Requirement
TBC = "To Be Considered" Criteria

performed during the remedial design, and a long-term monitoring plan will be implemented to further evaluate and monitor the effectiveness of natural attenuation.

Implementation of Institutional Controls - Institutional controls will consist of administrative measures taken to prevent exposure of human receptors to the groundwater of the surficial aquifer. Use of this groundwater will be controlled through deed restrictions or land use plans. A formal request will be made to the agency administrating the well installation permit program in Duval County to not issue permits for installation of drinking water wells which would pump water from the surficial aquifer.

2.10 STATUTORY DETERMINATIONS

The remedial alternatives selected for Site 3 are consistent with CERCLA and the NCP. The selected remedy provides protection of human health and the environment, attains ARARs, and is cost-effective. Table 2-5 lists and describes Federal and State ARARs to which the selected remedy must comply. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. The selected remedy also provides flexibility to implement additional remedial measures, if necessary, to address RAOs or unforeseen issues.

2.11 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Site 3 was released for public comment in January 1998. The proposed plan identified the use of in-situ air sparging to reduce groundwater contaminants in the source area in conjunction with natural attenuation and the application of institutional controls as the preferred alternative for groundwater. The public was invited to comment during January and February 1998. No public comments were received during that time; therefore, no changes to the proposed remedy, as originally identified in the Proposed Plan, have been made.

TABLE 2-5

**SYNOPSIS OF FEDERAL AND STATE REGULATORY REQUIREMENTS FOR OU8 SITE 3
RECORD OF DECISION, OPERABLE UNIT 8 SITE 3
NAS CECIL FIELD, JACKSONVILLE, FLORIDA
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Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Florida Groundwater Classes, Standards and Exemptions (FAC, 62-520)	Designates the groundwaters of the state into five classes and establishes minimum "free from" criteria. Rule also specifies that Classes I & II must meet the primary and secondary drinking water standards listed in Chapter 62-550.	These regulations may be used to determine cleanup levels for groundwaters that are potential sources of drinking water.	Chemical-Specific
Florida Soil Cleanup Standards, September 1995	Provide guidance for soil cleanup levels that can be developed on a site-by-site basis using the calculations found in Appendix B of the guidance.	These guidelines aid in determining leachability-based cleanup goals for soils.	Chemical-Specific Guidance
Florida Drinking Water Standards (FAC, 62-550)	Adopts Federal primary and secondary drinking water standards.	These regulation apply to remedial activities that involve discharges to potential sources of drinking water.	Chemical-Specific
Florida Groundwater Guidance, Bureau of Groundwater Protection, June 1994.	Provides maximum concentration levels of contaminants for groundwater in the State of Florida. Groundwater with concentrations less than the listed values are considered "free from" contamination.	The values in this guidance should be considered when determining cleanup levels for groundwater.	Chemical-Specific Guidance

Notes: OU = Operable Unit.
CFR = Code of Federal Regulations.
LDR = land disposal restriction.
FAC = Florida Administrative Code.
MCL = maximum contaminant level.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1992. *Technical Memorandum for Supplemental Sampling, Operable Units 1, 2, and 7, Naval Air Station (NAS) Cecil Field, Jacksonville, Florida.* Prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina.

ABB-ES, 1994. *Base Realignment and Closure Environmental Baseline Survey Report, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (November).

ABB-ES, 1995. *Field Investigation Plan, Potential Sources of Contamination (PSC) 4, 6, 9, 12, 18, and 19, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (March).

ABB-ES, 1997a. *Feasibility Study, Operable Unit 8, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

ABB-ES, 1997b. *Baseline Risk Assessment, Operable Unity 8, NAS Cecil Field, Jacksonville Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

ABB-ES, 1997c. *Remedial Investigation, Operable Unit 8, Site 3, Naval Air Station Cecil Field, Jacksonville, Florida.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina (August).

B&R (Brown & Root) Environmental, 1998. *Proposed Plan, Operable Unit 8, Site 3, Naval Air Station Cecil Field, Jacksonville, Florida.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina (March).

Department of Defense, 1993. *BRAC Cleanup Guidance Manual.* Washington, D.C.

EE (Envirodyne Engineers, Inc.), 1985. *Initial Assessment Study, Naval Air Station Cecil Field, Jacksonville, Florida.* Prepared for Navy Assessment and Control of Installation Pollutant Department, Naval Energy and Environmental Support Activity, Port Hueneme, California (July).

Fairchild, R.W, 1972. *The Shallow-Aquifer System in Duval County, Florida.* Florida Bureau of Geology, Report of Investigations No. 59. Tallahassee, Florida (January).

FDEP (Florida Department of Environmental Protection), 1994. "Cleanup Goals for Military Sites in Florida." Memorandum from Ligia Mora-Applegate, Technical Review Section, Bureau of Waste Cleanup. Tallahassee, Florida (July 5).

FDEP, 1995. *Florida Ground Water Guidance Concentrations.* Divisions of Water Facilities, Bureau of Ground Water Protection. Tallahassee, Florida (June).

Geraghty and Miller, 1983. *Hydrogeologic Assessment and Ground-Water Monitoring Plan, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGOM, North Charleston, South Carolina (October).

Harding Lawson Associates, Inc., 1988. *Draft Final RCRA Facilities Investigation (RFI) Report, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (March 17).

Scott, T.M., J.M. Lloyd, and Gary Maddox, 1991. *Florida Groundwater Quality Monitoring Program - Hydrogeological Framework.* Florida Geological Survey, Special Publication Number 32. Tallahassee, Florida.

SOUTHNAVFACENGCOM (Southern Division, Naval Facilities Engineering Command), 1989. *Naval Air Station Cecil Field Master Plan.*

U.S. EPA (United States Environmental Protection Agency), 1989. *Determining Soil Response Action Levels Based on Potential Contaminant Migration to Ground Water: A Compendium of Examples.* EPA/540/2-89/057. Washington, D.C. (October).

U.S. EPA, 1990. *National Oil and Hazardous Substance Pollution Contingency Plan, Final Rule.* 40 Code of Federal Regulations, Part 300; Federal Register, 55(46): 8718 (March 8).

U.S. EPA, 1992. *Guidance on Preparing Superfund Decision Documents.* Preliminary Draft. Office of Solid Waste and Emergency Response (OSWER), Directive 9355.3.02.

U.S. EPA, 1994. *Region III COC Screening Screening Table*. Referenced in Selecting Exposure Routes and Chemicals of Concern by Risk Based Screening, January 1993, EPA/903/R-93-001.

USGS (U.S. Geological Society), 1995. Memorandum from Keith Halford of the USGS to Eric Blomberg of ABB-ES, re. Site 16 Pump and Treat Remedial Alternatives (January 30).