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RECORD OF DECISION FOR OPERABLE UNIT 10 (OU 10) DRAFT AS FINAL NAS PENSACOLA FL

3/8/1996

ENSAFE ALLEN AND HOSHALL

RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
PENSACOLA, FLORIDA

SOUTHNAVFACENGCOM
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Naval Air Station
Pensacola, Florida

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19. Abstract
A record of decision has been prepared from the remedial investigation report, focused feasibility study report, and proposed remedial action plan for Operable Unit 10 at the Naval Air Station (NAS) Pensacola. The purpose of this Record of Decision is to describe the alternative that the U.S. Navy has selected to address potential groundwater and soil contamination at the site. The following summarizes the record of decision.

OU 10 occupies approximately 26 acres on Magazine Point at NAS Pensacola, in Escambia County, Florida. OU 10 comprises three sources of contamination: the former Industrial Sludge Drying Beds (ISDBs) at Site 32, the former Wastewater Treatment Plant Ponds at Site 33, and miscellaneous IWTP-related sites at Site 35. Various facilities at Magazine Point have treated wastewater since 1941. The current wastewater treatment plant was constructed in 1948 to process primarily domestic wastewater. It was upgraded in 1971 to treat both industrial and domestic wastewater separately. Site 32, the drying beds, operated from 1971 until 1984 and was closed in 1989. Site 33, the three ponds, makes up the southern half of OU 10. These ponds operated from 1971 until 1988, when they were cleaned up and closed under the existing RCRA permit. Both Sites 32 and 33 are known sources of soil and groundwater contamination at OU 10. A groundwater treatment system began in 1986 to comply with conditions in the Temporary Operating Permit (No. HT17-68087) issued by the Florida Department of Environmental Regulation (now FDEP). The system installed in the shallowest portions of the underlying aquifer began operating in February 1987. Seven recovery wells along the north-south axis of Magazine Point capture chemical compounds from the former Surge Pond. Extracted groundwater is pretreated, then disposed of at the domestic treatment plant.

Between December 1992 and October 1995, an environmental investigation was conducted. The final report identified soil contaminants. Areas with contaminants at higher levels appear to be isolated "hot spots" near the former IWTP units. The final report also identified contaminants in the site's groundwater. The RI indicates that the main area of groundwater contamination beneath Site 32 is outside the area of clean up of the existing groundwater treatment system.

In the OU 10 BRA, the human health risk associated with exposure to contaminants in surface soil, groundwater, and sediments was assessed for current and future site workers under industrial land use, as well as for future site residents. This study can be found in the *Final Remedial Investigation Report*. Under industrial land use, estimated exposure for current and potential future workers does not result in unacceptable risks. Under residential land use, which is unlikely for this site, two materials in the surface soil present an unacceptable risk above 10^{-6} to a future potential resident child. Several chemicals in site soil exceed Florida levels that protect groundwater. These levels were used to develop performance standards for the site. There is a potential unacceptable risk from exposure to groundwater for future site residents. The risk estimated for unlikely potential residantial use exceeds the acceptable risk threshold of 10^{-6} and the HQ of 1.

Ecological risk also was assessed for the actual or potential effects of contamination at OU 10 to ecological receptors such as plants and animals. This assessment focused on both land at OU 10, and contamination in groundwater that travels to nearby surface water bodies. Potential impacts to wetlands near OU 10 and the southern drainage ditch will be evaluated during the Site 41, NAS Pensacola Wetlands remedial investigation. Potential impacts to Pensacola Bay (Site 42) and Bayou Grande (Site 40) from groundwater contaminants will be assessed during remedial investigations at those sites.

If OU 10 remains industrial, no further action for soil is required to protect human health. However, to address an unlikely potential residential land use at OU 10, performance standards for soil have been established to protect future residents. Performance standards representing contaminant levels in soil that protect groundwater and performance standards for groundwater also have been established.

Four remedial alternatives were identified in the OU 10 FFS for cleaning up soil and groundwater at this site. Alternative 1 is a "no-action" alternative. In the no-action alternative, no remedial actions will be taken to contain, remove, or treat soil. The RCRA groundwater treatment system is operating and will continue to operate in accordance with the RCRA permit. No cost is associated with this alternative.

Alternative 2 would zone the OU 10 area for industrial use only on the Base Master Plan and prohibit Magazine Point from being used for residential use. A leachability study will be conducted to demonstrate whether contaminants found in soil above Florida levels are contributing significantly to groundwater contamination onsite. The leachability study will be conducted. This alternative eliminates the risk to potential child residents by not allowing the site to be residential. If the leachability study demonstrates that groundwater is being impacted by contaminants in soil, Alternative 4 would be the contingency remedy. In addition, the Navy will meet the RCRA requirements by modifying the existing recovery system to contain the contaminated groundwater. Because the RCRA system is operating and can be modified to meet the remedial goals for groundwater at the site, no other alternatives for groundwater are evaluated. Costs for groundwater treatment, therefore, are not included in this estimate. The cost of this alternative is estimated at $100,000. Assuming a 30% contingency, total direct and indirect costs are $130,000.

In Alternative 3, capping, all four areas will be capped with asphalt. The caps will reduce the risk of contact with contaminated soil and reduce the quantity of leachate generated when rainwater filters through contaminated soil. The present cost of this alternative is estimated at $185,000, assuming 30 years of maintenance.

In Alternative 4, the excavation and offsite disposal alternative, soil exceeding performance standards will be removed from OU 10 and disposed at an approved Subtitle D landfill to remove all current and future threats to human health and the environment posed by soil contamination. Soil would be sampled at the extent of the excavation to verify that soil remaining meets the performance standards. The excavation would be refilled with

clean fill. The present cost of this alternative is estimated at $90,000, excluding dewatering; dewatering will cost approximately $10,000 per week. Indirect costs, including engineering services/report preparation cost, and contingencies (30%), are expected to increase the Alternative 4 total project costs to $247,000. Operating, maintaining, and sampling costs will not be required under this alternative.

The Navy evaluated each alternative by the nine criteria shown below to determine which would best reduce risk posed by OU 10.

- Overall Protection of Human Health and the Environment
- Compliance with Federal/State ARARs
- Long-Term Effectiveness and Permanence
- Treatment to Reduce Toxicity, Mobility, or Volume
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

Based on the comparison of the alternatives in the FFS, the Navy has identified Alternative 2 as its preferred course of action for remediating soil and groundwater at OU 10, with Alternative 4 as a contingency remedy if the leachability analysis indicates groundwater is at risk. Alternative 2 will reduce risk from soil to the potential resident by designating the area as industrial on the Base Master Plan. Groundwater would be treated by modifying the existing RCRA groundwater treatment system. This alternative would be protective, cost-effective, and would attain all federal and state requirements.

The U.S. Navy's preferred alternative represents consensus opinion that is fully accepted by the USEPA and the FDEP. The U.S. Navy relied on public comments to ensure that the remedial alternatives being evaluated and selected for its sites are fully understood and that the concerns of the local community have been considered. The U.S. Navy held a public comment period from May 30 to June 30, 1995 to encourage public participation in the selection process. No comments were received and no objections to the remedy were noted.

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Table of Contents

List of Figures

List of Tables

List of Appendices

List of Abbreviations

The following list contains many of the abbreviations, acronyms and symbols used in this document. A glossary of technical terms is provided in Appendix A.

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
BEHP	Bis(2-ethylhexyl)phthalate
BRA	Baseline Risk Assessment
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSF	Cancer Slope Factor
CY	Cubic Yard
DERA	Defense Environmental Restoration Account
DOD	Department of Defense
FDER	Florida Department of Environmental Regulation (since renamed Florida Department of Environmental Protection (FDEP)
FFA	Federal Facilities Agreement
FGGC	Florida Groundwater Guidance Concentration
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
HRS	Hazard Ranking System
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
ISDB	Industrial Sludge Drying Bed
IWTP	Industrial Wastewater Treatment Plant
lwa	Lifetime Weighted Average
MCL	Maximum Contaminant Level
NAS	Naval Air Station
NPL	National Priorities List

List of Abbreviations (Continued)

O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polyaromatic Hydrocarbon
PCB	Polychorinated Biphenyl
PP	Proposed Plan
ppb	part per billion
ppm	part per million
PRG	Preliminary Remediation Goal
PWC	Public Works Center
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RGO	Remedial Goal Option
RME	Reasonable Maximum Exposure
RI	Remedial Investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TEF	Toxicity Equivalency Factor
TRC	Technical Review Committee
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

DECLARATION OF THE RECORD OF DECISION

Site Name and Location

Operable Unit 10, Industrial Wastewater Treatment Plant
Naval Air Station Pensacola
Pensacola, Florida

Statement of Purpose

This decision document presents the remedial action that the U.S. Navy, as the lead agency, has selected for addressing groundwater and soil contamination at Operable Unit 10 — Industrial Wastewater Treatment Plant. The decision was made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the Administrative Record for Operable Unit 10.

The United States Environmental Protection Agency and the Florida Department of Environmental Protection concur with the selected remedy.

Assessment of the Operable Unit

Actual or threatened releases of hazardous substances from Operable Unit 10, if not addressed by implementing the response action selected in this Record of Decision (ROD), may imminently and substantially endanger public health, welfare, or the environment.

Description of the Selected Remedy

This action is the first and final action planned for the operable unit. This alternative calls for the design and implementation of response measures that will protect human health and the environment. The action addresses the sources of contamination as well as soil and groundwater contamination.

The major components of the selected remedy include:

- Institutional controls, such as record notices and deed, zoning, and land-use restrictions. A leachability study would also be conducted during the Remedial Design/Remedial Action period to assess whether the soil is contributing unacceptable contaminant levels to site groundwater.

- A contingency remedial action, which includes excavating the soil-source areas and disposing of the soil at an approved landfill, if the leachability study indicates that soil is contributing unacceptable contaminant levels to groundwater.

- Use of institutional control for pumping and treating groundwater by modifying the existing Resource Conservation and Recovery Act groundwater treatment system to capture the groundwater contamination and to reach the groundwater performance standards.

Statutory Determinations

The selected remedy with a soil excavation contingency is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy with contingency satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Finally, this remedy uses a permanent solution and treatment technology to the maximum extent practicable.

Because this remedy may result in hazardous substances remaining onsite, a review will be conducted within five years after it commences to ensure that it continues to adequately protect human health and the environment.

Signature (Commanding Officer, NAS Pensacola) Date

1.0 SITE LOCATION AND DESCRIPTION

Operable Unit (OU) 10 is on Magazine Point at the Naval Air Station (NAS) Pensacola, in Escambia County, Florida, as shown on Figure 1-1. Ordnance and munitions are stored and domestic wastewater generated on station is treated on Magazine Point, which is bounded to the north and west by Bayou Grande and east by Pensacola Bay. South of Magazine Point is the former Chevalier Field, which is currently being converted to Naval Recruit Training Facilities. Except for the Industrial Wastewater Treatment Plant (IWTP) conversion to domestic wastewater treatment only in October 1995, no other use changes are expected for Magazine Point.

OU 10 comprises three sites which are shown on Figure 1-2: the former Industrial Sludge Drying Beds (ISDBs; Site 32); the former Wastewater Treatment Plant Ponds including the former surge pond, stabilization pond, and polishing pond (Site 33); and miscellaneous IWTP Solid Waste Management Units (SWMUs; Site 35) which are listed below.

- Industrial grit chamber
- Industrial comminutor
- Industrial sludge thickener
- Industrial sludge presses
- Waste oil storage tanks
- Acid storage tanks
- Sludge bed pumping station
- Pump dock
- Ancillary piping, pumps, junction boxes, etc.
- Industrial primary clarifier and oil/water separator
- Aerobic sludge digester
- Aeration (activated sludge) tank
- Surge tank
- Sludge truck loading station
- Parallel flocculators
- Parallel final clarifiers
- Chlorine contact chamber

OU 10 occupies approximately 26 acres in an industrialized section of NAS Pensacola. The former Chevalier Field area, south of OU 10, is being converted to Naval Recruit Training Facilities that will contain barracks. Other residential areas are approximately 0.8 to 1.2 miles north and northwest of OU 10 across Bayou Grande.

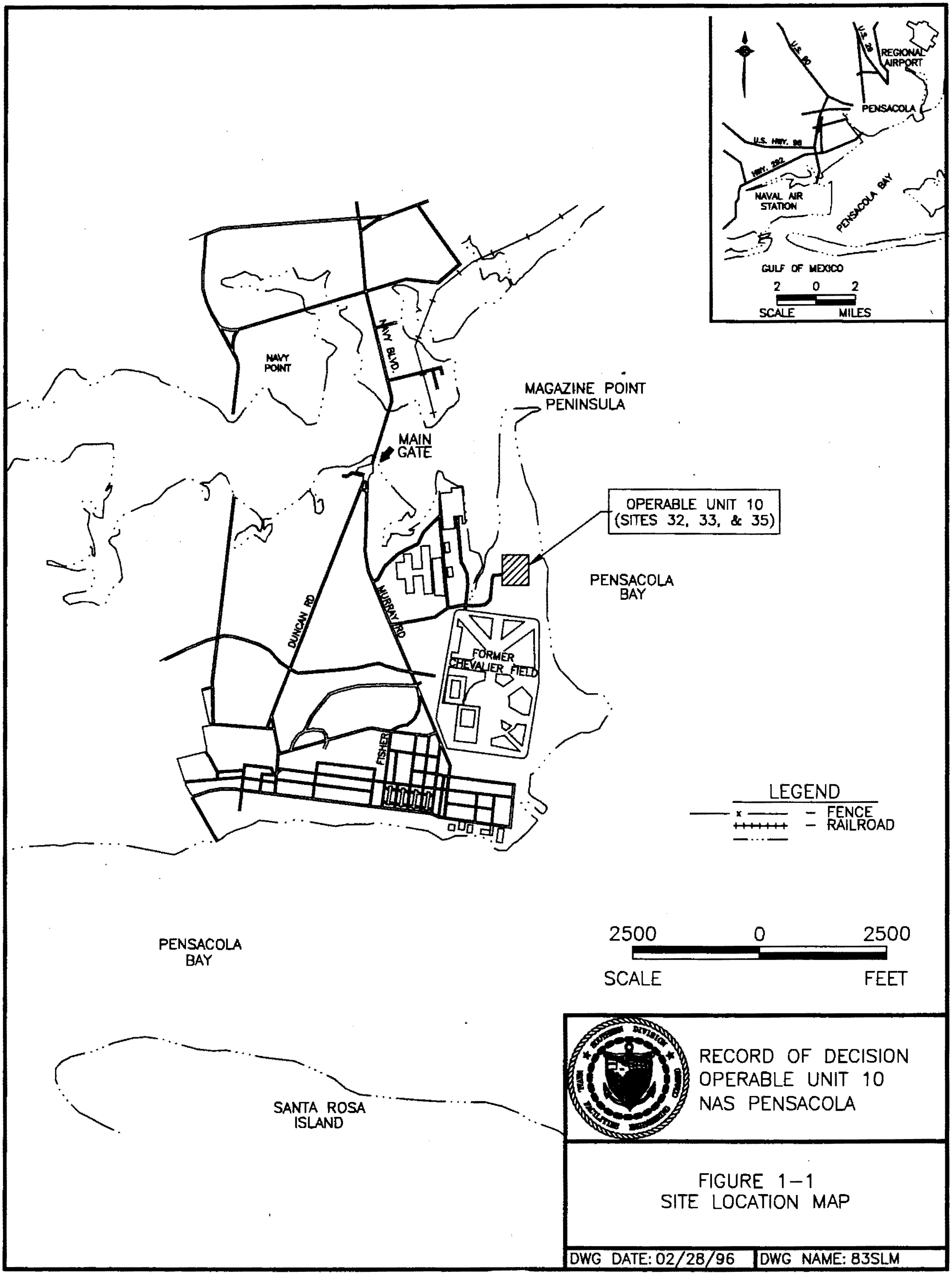
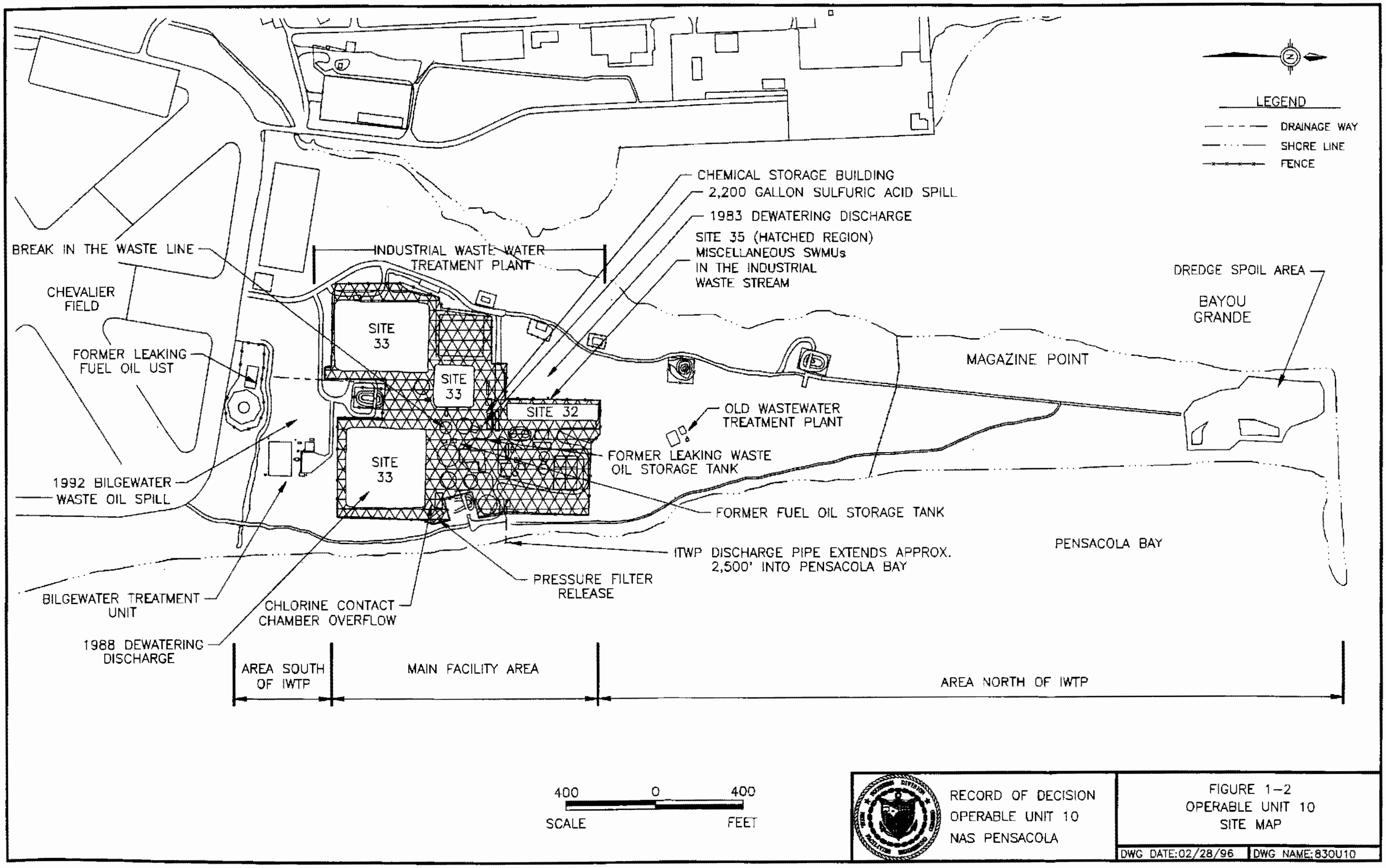


FIGURE 1–1
SITE LOCATION MAP


LEGEND
DRAINAGE WAY
SHORE LINE
FENCE
CHEMICAL STORAGE BUILDING
2,200 GALLON SULFURIC ACID SPILL
1983 DEWATERING DISCHARGE
SITE 35 (HATCHED REGION)
MISCELLANEOUS SWMUs
IN THE INDUSTRIAL
WASTE STREAM
BREAK IN THE WASTE LINE
INDUSTRIAL WASTE WATER
TREATMENT PLANT
CHEVALIER
FIELD
SITE 33
SITE 33
SITE 33
SITE 32
FORMER LEAKING
FUEL OIL UST
DREDGE SPOIL AREA
BAYOU
GRANDE
MAGAZINE POINT
OLD WASTEWATER
TREATMENT PLANT
FORMER LEAKING WASTE
OIL STORAGE TANK
1992 BILGEWATER
WASTE OIL SPILL
FORMER FUEL OIL STORAGE TANK
PENSACOLA BAY
ITWP DISCHARGE PIPE EXTENDS APPROX.
2,500' INTO PENSACOLA BAY
PRESSURE FILTER
RELEASE
BILGEWATER TREATMENT
UNIT
CHLORINE CONTACT
CHAMBER OVERFLOW
1988 DEWATERING
DISCHARGE
AREA SOUTH
OF IWTP
MAIN FACILITY AREA
AREA NORTH OF IWTP
400
0
400
SCALE
FEET
RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 1-2
OPERABLE UNIT 10
SITE MAP
DWG DATE:02/28/96
DWG NAME:830U10

The facility's main area is topographically higher than the surrounding areas and is dominated by fill and development. Large amounts of fill are mounded into berms 4 to 7 feet high around the closed stabilization and polishing ponds. An extensive plateau of fill 5 to 6 feet high is at the former surge pond and associated berms. Vegetation is limited to grasses within the fenced IWTP, and in several areas grass is absent, exposing a loose organic-poor sand. Marsh vegetation has colonized the closed stabilization and polishing ponds. The area south of the IWTP is a low-lying, heavily wooded swampy area. The area north of OU 10 is a wooded peninsula with thick underbrush bounded on the east by Pensacola Bay and on the west by Bayou Grande.

Depth to groundwater ranges from 0 to 4 feet beneath the land surface, depending on tidal influence and ground surface elevation. Most runoff does not flow from the site but infiltrates into the subsurface rapidly through the sandy surface soil; however, a channelized ditch drains water toward the south. Erosional channels in the steeply sloped berms and flanks of the three former ponds indicate surface runoff down the flanks of these structures. Standing surface water was observed in the Resource Conservation and Recovery Act (RCRA) clean closed cement-lined stabilization and polishing ponds at depths of approximately 6 to 8 inches. The asphalt cap of the closed ISDBs slopes southward, resulting in a southerly surface runoff from the asphalt area toward a sump intake to the wastewater treatment system near the chemical storage area.

Groundwater flow generally mimics the peninsular topography with flow to the northwest, north, northeast, east, and southeast and discharge to Pensacola Bay and Bayou Grande. Groundwater is not currently used as a potable water source at OU 10.

Access to the IWTP proper is limited by a fence. In addition, OU 10 is bounded by thick vegetation and trees to the north and south. To the east and west, Pensacola Bay and Bayou Grande limits site access.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 General Site History

NAS Pensacola was ranked using the Hazard Ranking System (HRS) in 1988 and was given an HRS score of 42.4, based on groundwater and surface water pathway scores. In December 1989, the base was placed on the United States Environmental Protection Agency's (USEPA) National Priorities List (NPL). Although all sites added to the NPL are generally called "Superfund sites," Department of Defense (DOD) sites like NAS Pensacola are cleaned up using Defense Environmental Restoration Account (DERA) funds.

The Federal Facilities Agreement (FFA), signed in October 1990, outlined the regulatory path to be followed at NAS Pensacola. NAS Pensacola must complete not only the regulatory obligations associated with its NPL listing, but it must also satisfy the ongoing requirements of an environmental permit issued in 1988. That permit addresses the treatment, storage, and disposal of hazardous materials and waste and also the investigation and remediation of any releases of hazardous waste and/or constituents from SWMUs. RCRA governs ongoing use of hazardous materials, and the rules of the operating permit. RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation and actions are coordinated through the FFA, streamlining the cleanup process.

2.2 Site-Specific History

Wastewater has been treated on Magazine Point since 1941 at various treatment facilities. In 1941, an Imhoff tank was installed north of the present IWTP. The tank treated only Magazine Point area sewage. The current facility was constructed in 1948 to process primarily domestic wastewater. The Imhoff tank north of the facility was abandoned subsequently. The facility was upgraded in 1971 to treat both industrial and domestic wastewater separately. Before 1971, the facility was receiving industrial waste from paint and plating operations at the Building 709 complex. Industrial waste was received via the sanitary sewer line and processed with domestic sewage.

In 1978, the domestic sludge generated at the IWTP was found to be hazardous by the Florida Department of Environmental Regulation (FDER; since renamed Florida Department of Environmental Protection [FDEP]), due to high chromium concentrations and had to be disposed of in the same manner as industrial sludge. After chromium concentrations decreased, FDER allowed the domestic sludge to be disposed of as a nonhazardous waste.

In 1981, the IWTP surge pond was designated by FDER as a hazardous waste surface impoundment and received an average of 880,000 gallons of waste per day. The wastewater contained high concentrations of organic solvents, phenols, chromium electroplating wastes (including cyanide and other heavy metals), and wastes from a chemical conversion coating process for aluminum. As a result of the hazardous waste designation, a RCRA detection groundwater monitoring program was implemented. Leakage from the surge pond was estimated to be as high as 5,800 gallons per day.

In 1984, the ISDBs were removed from service. RCRA detection monitoring identified groundwater contamination attributable to the surge pond. As a result, a RCRA assessment monitoring program was implemented to determine the extent of contamination.

In 1985, FDER issued a temporary RCRA operation permit (No. HT17-68087) to the U.S. Navy Public Works Center (PWC) for the surge pond. A new permit (No. H017-127026) was issued in September 1987.

In 1986, a RCRA Corrective Action Program was implemented at the IWTP to comply with conditions in the FDER Temporary Operating Permit No. HT17-68087. Based on results of the RCRA assessment monitoring program, a groundwater recovery system was designed and installed to capture contaminated groundwater.

In January 1987, a comprehensive groundwater monitoring evaluation was conducted by the USEPA. Groundwater samples were collected from seven shallow wells (0 to 15 feet) and one deep monitoring well. In February 1987, the groundwater recovery system was placed in operation.

In September 1987, FDER issued RCRA Permit No. H017-127026 to the U.S. Navy PWC to operate the surge pond. The permit stipulated the continued operation of the corrective action system (the recovery wells) and the implementation of two quarterly groundwater monitoring programs: (1) point-of-compliance monitoring at the surge pond and (2) corrective action monitoring to determine the effectiveness of ongoing groundwater remediation. Well sets and parameters for analysis were separately defined for each monitoring program. The first quarterly groundwater sampling for corrective action and point-of-compliance programs was initiated in November 1987.

In January 1988, FDER issued closure permits to the U.S. Navy PWC for the polishing pond, stabilization pond, and the ISDBs (No. HF17-134657). Liquids were removed from the impoundments and processed through the IWTP. Sludge was removed and transported to a hazardous waste disposal facility. Upon closure, the clay liner and/or subsurface soil of each impoundment were sampled and analyzed. The subsequent laboratory report indicated only low concentrations of phenol in liners or soil beneath the stabilization and polishing ponds; and hence, FDER granted clean closure status to these impoundments. Samples from the liner or soil beneath the ISDBs, however, indicated several contaminants.

A closure permit for the surge pond (No. HF17-148989) was issued in November to the U.S. Navy PWC. Upon closure, the clay liner and/or subsurface soil were sampled and analyzed. As with the ISDBs, several contaminants were identified. Consequently, both the surge pond and ISDBs were capped with low-permeability covers (clay and asphalt, respectively) as a condition of closure in 1989. A groundwater monitoring program was developed to ensure the effectiveness of the caps.

In September 1991, FDER issued permit No. HF17-170951, changing the monitoring requirement for each monitoring program from quarterly to semiannually.

In 1992, regulatory focus of environmental investigation at the IWTP shifted from RCRA to CERCLA. A Remedial Investigation/Feasibility Study (RI/FS) work plan for OU 10 (formerly called Group O) was submitted to meet CERCLA requirements. A Sampling and Analysis Plan (SAP) was submitted in October 1992 for the present study.

Between December 1992 and October 1995, EnSafe/Allen & Hoshall performed an RI at OU 10 on behalf of the Navy. The RI was designed to assess the nature and extent of contamination to support a remedy selection. Fieldwork for the RI included installing monitoring wells and sampling soil, sediment, surface water, and groundwater.

In 1994 and 1995, a time-critical removal action was performed on the Imhoff tank north of the IWTP. Approximately 148 tons of hazardous waste were removed from the tank. In addition, 619 tons of nonhazardous soil, gravel, and construction debris were removed and landfilled. Confirmatory samples collected at the extent of the excavation did not detect volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) or polychlorinated biphenyls (PCBs). Metals and pesticide concentrations detected were below preliminary remedial goals (PRGs).

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Throughout the site's history, the community has been kept abreast of activities in accordance with CERCLA sections 113(k)(2)(B)(i-v) and 117. In January 1989, a Technical Review Committee (TRC) was formed to review recommendation for and monitor progress of the investigation and remediation efforts at NAS Pensacola. The TRC was made up of representatives of the Navy, USEPA, FDER and the local community. In addition, a mailing list of interested community members and organizations was established and maintained by the NAS Pensacola Public Affairs Office. In July 1995, a Restoration Advisory Board (RAB) was established as a forum for communication between the community and decision-makers. The RAB absorbed the existing TRC and added more members from the community and local organizations. The RAB members work together to monitor progress of the investigation and to review remediation activities and recommendations at NAS Pensacola. RAB meetings are held regularly, advertised, and are open to the public.

Before the removal action at Site 32, an article and a public notice were published in the *Pensacola News Journal* on July 26, 1994, and August 31, 1994. Site-related documents were made available to the public in the administrative record at information repositories maintained at the NAS Pensacola Library, the West Florida Regional Library, and the John C. Pace Library of the University of West Florida.

After finalizing the RI and Focused FS reports, the preferred alternative for OU 10 was presented in the Proposed Remedial Action Plan, also called the Proposed Plan. Everyone on the NAS Pensacola mailing list was sent a copy of the Proposed Plan. The notice of availability of the Proposed Plan, RI, and FFS documents was published in the *Pensacola News Journal* on February 15, 1996. A public comment period was held from February 19 to April 4, 1996, to encourage public participation in the remedy-selection process. In addition, a public meeting was held on February 27, 1996, at the Pensacola Junior College, Building 3000, at the Warrington Campus for the Navy to present its preferred remedy for OU 10. The public meeting minutes have been transcribed, and a copy of the transcript is available to the public at the aforementioned repositories. Responses to comments received during the comment period are contained in Appendix B.

4.0 SCOPE AND ROLE OF THE OPERABLE UNIT

This selected remedy, with an excavation contingency remedy, is intended to reduce the risks to human health and environment associated with exposure to contaminated groundwater and soil. The purpose of this proposed action is to eliminate exposure for the unlikely future residential use and to reduce contaminant migration.

Using institutional controls, such as record notices, deeds, zoning, and land-use restrictions will limit the area to industrial use. A leachability study conducted during the Remedial Design/Remedial Action period will assess whether the contaminated soil is contributing unacceptable contaminant concentrations to site groundwater. If so, a contingency remedial action, which includes excavating the source areas and disposing of the soil offsite, will be implemented.

Remediating groundwater will be achieved by modifying the existing RCRA treatment system to capture the groundwater contamination and to reach the performance standards. This will prevent ingestion and inhalation of contaminated groundwater at or above maximum contaminant levels (MCLs) or Florida Groundwater Guidance Concentrations (FGGCs) whichever is lower. Although this water-bearing zone is affected, the site groundwater is not currently a potable water source.

This is the only ROD contemplated for OU 10. OU 10 is one of 37 sites at NAS Pensacola being investigated in accordance with CERCLA. Separate investigations and assessments are being conducted for these other sites. Therefore, this ROD applies only to OU 10.

5.0 SITE CHARACTERISTICS

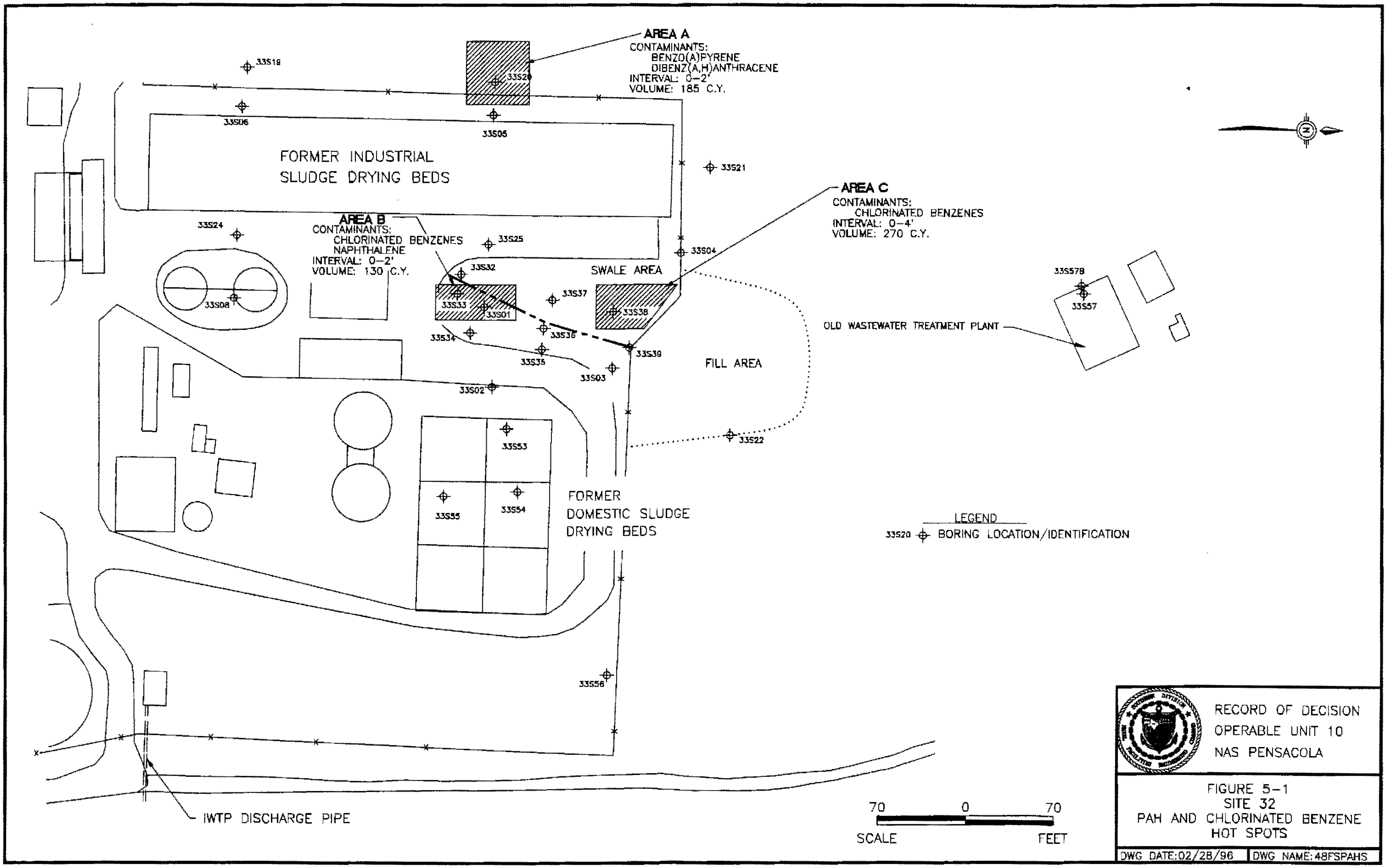
This section of the ROD presents an overview of the nature and extent of contamination at OU 10 with respect to known or suspected sources of contamination, types of contamination, and affected media. Known or potential routes of migration of contaminants also are discussed.

5.1 Nature and Extent of Soil Contamination

Site 32

Contamination by organic compounds in Site 32 soil consists primarily of dichlorobenzene isomers (predominantly 1,4-dichlorobenzene), polyaromatic hydrocarbons (PAHs), cyanide, and localized pesticide and PCB concentrations. Inorganic contamination consists of heavy metals including cadmium, chromium, and lead. Organic contaminants are concentrated primarily in the relict drainage swale area east/northeast of the former ISDBs. Secondary organic soil contamination occurs in a horizon above the water table at the southeast edge of the former ISDBs, in the domestic sludge drying beds, and near surface soil at the northwest slope from the ISDBs. Metal concentrations are elevated in the swale (especially in the northeast portion). The spatial distribution of these contaminants suggests the sources are related to past operation of the three sludge drying units, with most environmental contamination related to the former ISDBs and their historical surface overflow drainage into the adjoining swale and potential wetlands. The ubiquitous pesticide concentrations suggest residual effects from normal pest control applications.

The only PRG exceedances were for benzo(a)pyrene and dibenz(a,h)anthracene present in Area A, as Figure 5-1 shows. A volume of 185 cubic yards was estimated for Area A based on assumed dimensions of 50 feet by 50 feet by 2 feet deep. The actual volume may differ and will be refined during confirmation sampling.



AREA A
CONTAMINANTS:
BENZO(A)PYRENE
DIBENZ(A,H)ANTHRACENE
INTERVAL: 0-2'
VOLUME: 185 C.Y.
AREA B
CONTAMINANTS:
CHLORINATED BENZENES
NAPHTHALENE
INTERVAL: 0-2'
VOLUME: 130 C.Y.
AREA C
CONTAMINANTS:
CHLORINATED BENZENES
INTERVAL: 0-4'
VOLUME: 270 C.Y.
FORMER INDUSTRIAL SLUDGE DRYING BEDS
SWALE AREA
FILL AREA
OLD WASTEWATER TREATMENT PLANT
FORMER DOMESTIC SLUDGE DRYING BEDS
IWTP DISCHARGE PIPE
LEGEND
33S20 BORING LOCATION/IDENTIFICATION
70 0 70
SCALE FEET
RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 5-1
SITE 32
PAH AND CHLORINATED BENZENE HOT SPOTS
DWG DATE:02/28/96
DWG NAME:48FSPAHS

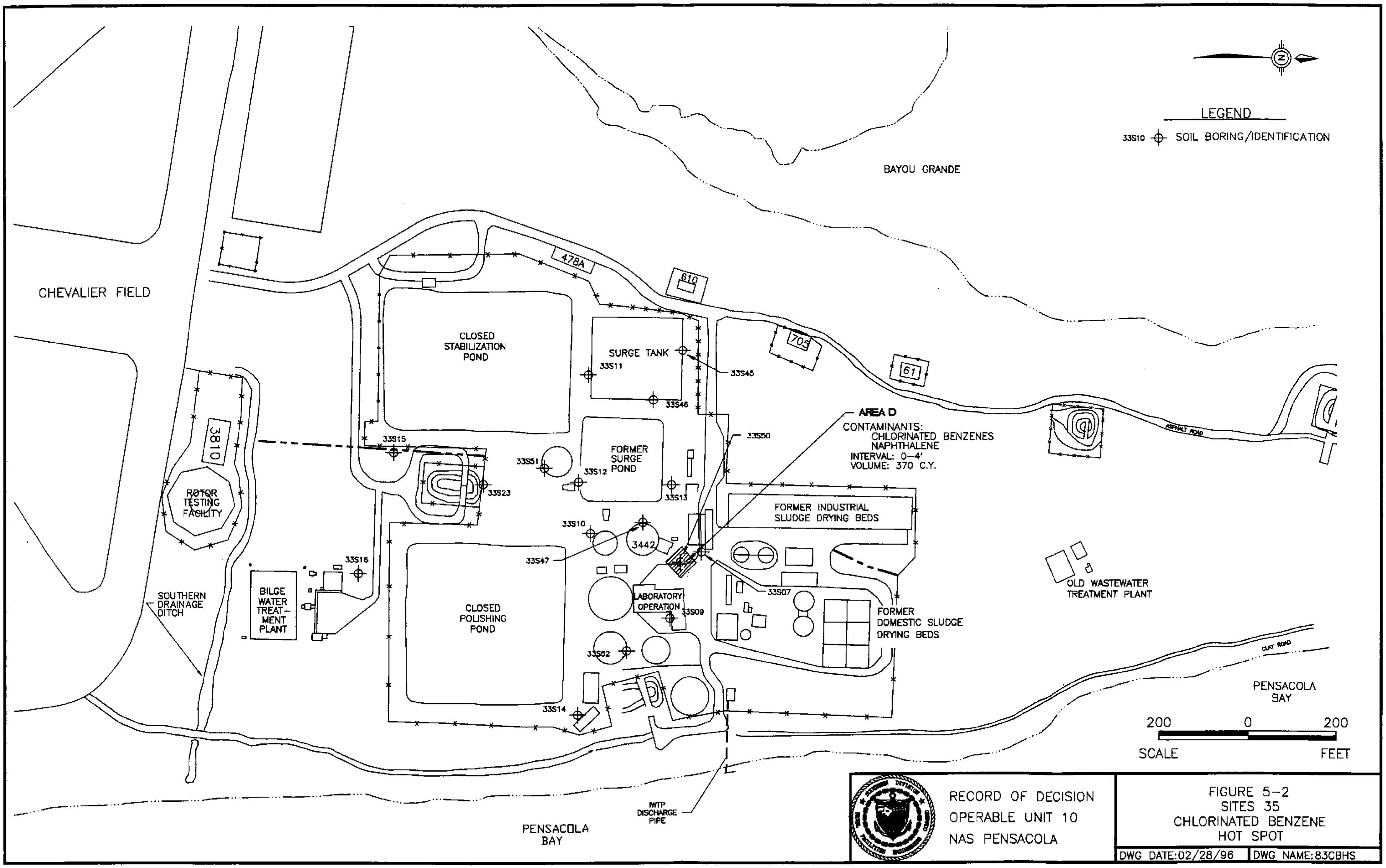
Areas B and C contained benzene and naphthalene exceeding their Florida leachability guidance concentrations. Estimated volumes were 120 and 270 cubic yards, respectively, based on outer sampling locations.

Sites 33 and 35

Two general types of organic contamination were detected in Sites 33 and 35 soil. The most pervasive contaminants are PAHs, pesticides, and PCBs. In general, concentrations are much lower in magnitude than those detected at Site 32, and low concentrations in outlying borings may approximate ambient conditions. The irregular and poorly delineated distribution of contaminants suggests that historically documented source areas (surge pond and stabilization pond) and several potential localized sources (i.e., miscellaneous spills, leaks, and/or line breaks) may have contributed to soil contamination. The spatial distribution of the contaminants indicates impacted soil at the southeastern corner of the former surge pond and around the surge tank. In addition, the spatial distribution indicates impacted soil caused by an undefined source near the chlorine contact chamber. Again, the ubiquitous presence of pesticides indicates widespread surface application for pest control.

Soil contamination of a second type appears restricted to the oily horizon at the water table around the area of the former waste oil underground storage tank (UST). Organic contamination includes dichlorobenzenes and other PAHs, 2-butanone, xylenes, and PCBs. Heavy metals also were detected. The contaminant source is thought to be leakage from the former waste oil tank. In conclusion, the boring coverage and analytical results indicate multiple sources of localized soil contamination.

As shown in Figure 5-2, Area D exceeded the Florida leachability standards for chlorinated benzenes and naphthalene. The extent of contamination was estimated to be 50 feet wide by 50 feet long by 4 feet deep for an estimated volume of 370 cubic yards. No other PRG exceedance for soil was noted at Sites 33 and 35.


LEGEND
33S10 SOIL BORING/IDENTIFICATION
BAYOU GRANDE
CHEVALIER FIELD
478A
610
705
61
CLOSED STABILIZATION POND
SURGE TANK
33S11
33S45
33S46
FORMER SURGE POND
33S12
33S13
33S51
33S15
33S23
3810
ROTOR TESTING FACILITY
AREA D
CONTAMINANTS:
CHLORINATED BENZENES
NAPHTHALENE
INTERVAL: 0-4'
VOLUME: 370 C.Y.
33S50
ASPHALT ROAD
FORMER INDUSTRIAL SLUDGE DRYING BEDS
33S10
3442
33S47
33S16
33S07
OLD WASTEWATER TREATMENT PLANT
SOUTHERN DRAINAGE DITCH
BILGE WATER TREATMENT PLANT
CLOSED POLISHING POND
LABORATORY OPERATION
33S09
FORMER DOMESTIC SLUDGE DRYING BEDS
33S52
CLAY ROAD
33S14
PENSACOLA BAY
200 0 200
SCALE FEET
IWTP DISCHARGE PIPE
PENSACOLA BAY
RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 5-2
SITES 35
CHLORINATED BENZENE
HOT SPOT
DWG DATE:02/28/96
DWG NAME:83CBHS

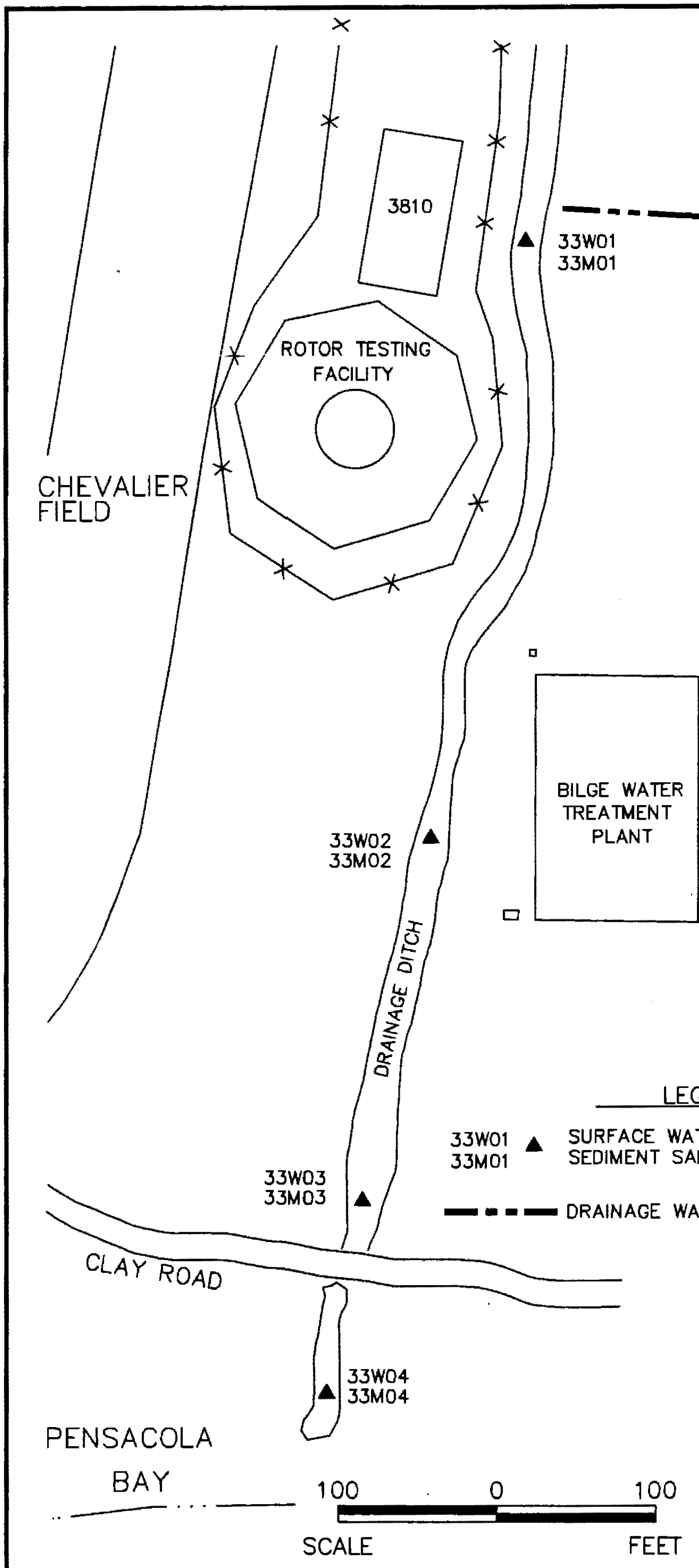
5.2 Nature and Extent of Sediment Contamination

Sediments were collected from the drainage ditch forming the southern boundary of the study area south of the bilge water facility. Sediment sampling locations are shown in Figure 5-3. Contaminants in the sediments include fluoranthene, pesticides, PCBs, cadmium, chromium, and lead. The overall distribution of contaminants indicates sources from direct surface drainage into the ditch from the former north end of Chevalier Field, drainage into the ditch from the southern part of the IWTP, and probable site pesticide application. The metals distribution increases toward the bay, probably representing hydrodynamic accumulation of finer-grained sediments containing adsorbed metals. Storms would put the ditch in direct contact with the bay. Wetlands will be investigated further during the Site 41 evaluation.

Sediment samples were not collected from within the north-south ditch draining the IWTP yard. This drainage ditch connects with the southern ditch between Stations 33M01 and 33M02 and would provide information about this pathway. Soil sample 33S15 was collected adjacent to, but not directly in, this north-south feeder ditch. This soil sample had some of the lowest detected concentrations at the IWTP.

5.3 Nature and Extent of Surface Water Contamination

Surface water samples were collected from the southern drainage ditch at the same locations as the sediment sampling stations (Figure 5-3). Contamination detected in these samples consisted of nonchlorinated aromatics, pesticides, cadmium, chromium, and lead. The nature and distribution of these contaminants suggest the sources are most likely related to the bilge water plant spill and normal pesticide application around the plant area. Cadmium (5.2 parts per billion; ppb) and lead (2.4 ppb) exceeded their surface water standards of 0.72 ppb and 1.5 ppb at location 33W01.



RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 5-3
SEDIMENT/SURFACE WATER
SAMPLING LOCATIONS
SOUTHERN DRAINAGE DITCH

DWG DATE: 02/28/96 | DWG NAME: 83SSWS

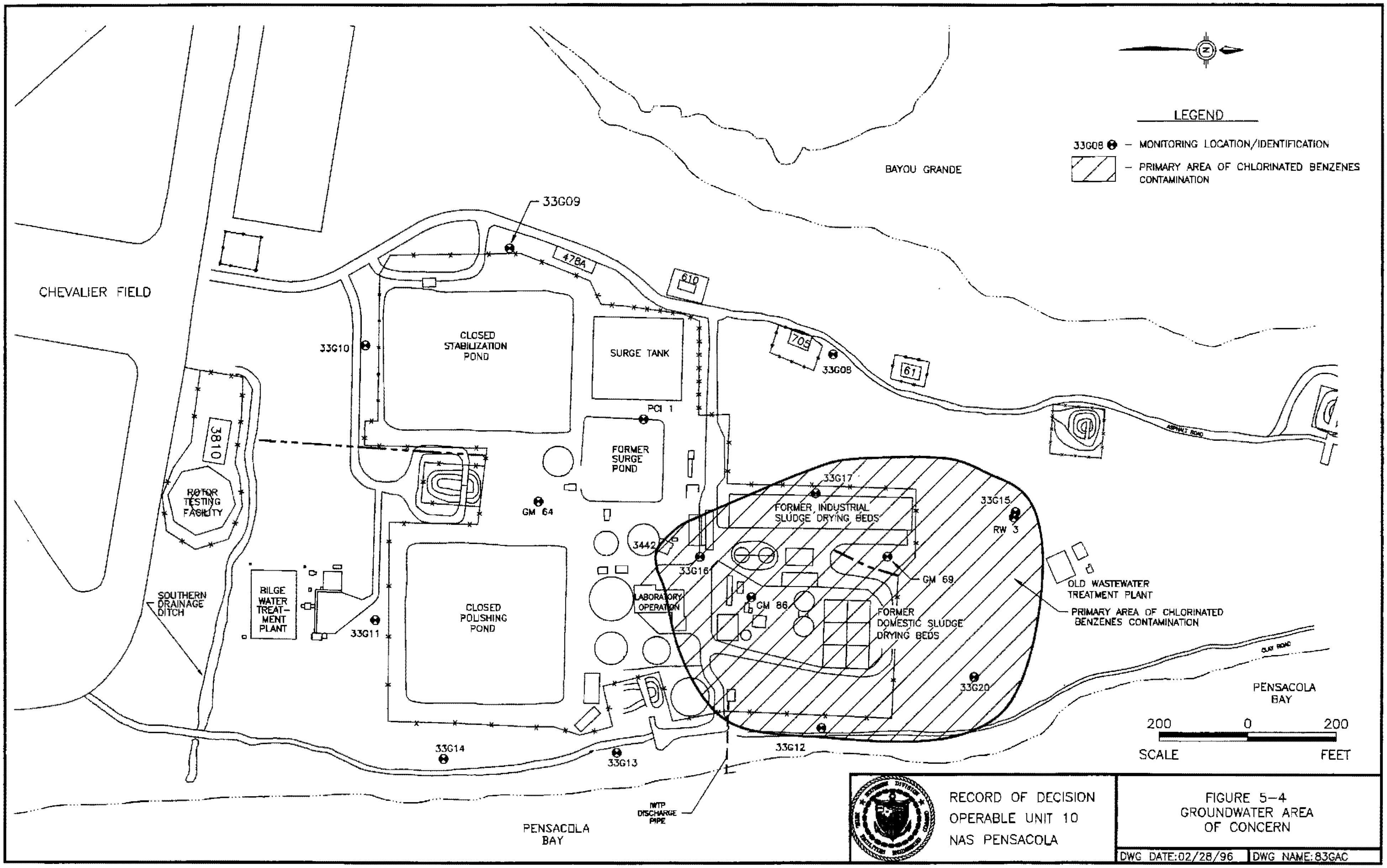
The bilge water plant spill is separate from the RI and will be investigated under the auspices of the FDEP UST program. The wetlands will be investigated further in the Site 41 evaluation.

5.4 Nature and Extent of Groundwater Contamination

Shallow Groundwater

Organic contamination present in shallow groundwater consists of volatiles (chlorobenzene and toluene), semivolatiles (dichlorobenzene isomers), and pesticides. The approximate extent of groundwater contamination is shown in Figure 5-4. The pesticide concentrations may result from high total suspended solids content in the groundwater samples. Inorganic contamination consists of heavy metals (cadmium, chromium, and lead) and major metals (iron and manganese) for which federal and state standards have been established. Chlorobenzene and 1,2- and 1,4-dichlorobenzene standards were not exceeded. However, the standards for cadmium (5 ppb) and lead (15 ppb) were exceeded in one CERCLA-sampled well (GM-71 and 13GS07) each, and the standards for iron and manganese were consistently exceeded. Metals concentrations were below all applicable standards in filtered aliquots.

Overall, the distribution of chlorinated aromatics in the shallow groundwater suggests the contaminant source is associated with the closed ISDBs, the drainage swale area, and the former waste oil UST. However, anomalous chlorinated aromatic concentrations near the eastern perimeter of the site suggest an additional source or, given the fairly high permeabilities at the shallow depth, may reflect a migratory effect of episodic contaminant loading. While this possibility has yet to be explored at this site, it could explain the historical problems in determining consistent trends in groundwater data and is a possibility given the nature of the facility's operation. This scenario also opens up possible contaminant introduction via some aspect of the treatment process (i.e., leaking underground pipes, etc.) although there are no supporting data. The distribution of metals in the shallow groundwater suggests the closed ISDBs, the swale area, the closed surge pond, and the former acid spill area as likely sources.


LEGEND
33G08 — MONITORING LOCATION/IDENTIFICATION
— PRIMARY AREA OF CHLORINATED BENZENES CONTAMINATION
BAYOU GRANDE
CHEVALIER FIELD
33G09
4784
610
705
33G08
61
33G10
CLOSED STABILIZATION POND
SURGE TANK
PCI 1
FORMER SURGE POND
3810
ROTOR TESTING FACILITY
GM 64
33G17
FORMER INDUSTRIAL SLUDGE DRYING BEDS
33G15
RW 3
3442
33G16
GM 69
GM 86
OLD WASTEWATER TREATMENT PLANT
PRIMARY AREA OF CHLORINATED BENZENES CONTAMINATION
SOUTHERN DRAINAGE DITCH
BILGE WATER TREAT-MENT PLANT
33G11
CLOSED POLISHING POND
LABORATORY OPERATION
FORMER DOMESTIC SLUDGE DRYING BEDS
33G20
PENSACOLA BAY
200 0 200
SCALE FEET
33G14
33G13
33G12
IWTP DISCHARGE PIPE
PENSACOLA BAY
RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 5-4
GROUNDWATER AREA OF CONCERN
DWG DATE:02/28/96
DWG NAME:83GAC

The pesticide concentrations in the groundwater are potentially attributable to diffuse leaching through surface soil containing residual application concentrations or may represent sediment carrydown in drilling. Turbidity in the groundwater samples may also elevate pesticide concentrations in groundwater. In addition, the laboratory may be attributing background noise to pesticide peaks or misidentified semivolatile compounds.

Intermediate Groundwater

Intermediate groundwater shows significant contaminant increases over those identified in shallow groundwater. Contaminants include chlorinated aliphatics, 2-butanone, chlorinated aromatics, major metals, and comparatively lower concentrations of nonchlorinated VOCs, phenols, pesticides, and heavy metals. Of the chlorinated aliphatics detected, standards for PCE were met or exceeded in four CERCLA-sampled wells. For TCE, standards were met or exceeded in three CERCLA-sampled wells, and for vinyl chloride, standards were exceeded in one well.

Of the chlorinated aromatics, the standards for chlorobenzene were exceeded in three CERCLA-sampled wells (33G12, 33G16, and 33G20); for 1,2-dichlorobenzene in three wells (33G12, 33G16, and 33G20), and for 1,4-dichlorobenzene in four CERCLA-sampled wells (33G12, 33G16, 33G20, and RW-3).

For the metals, the standards for cadmium, chromium, and beryllium were exceeded in one CERCLA-sampled well (GM-66). Of the major metals, the standards for iron and manganese were consistently exceeded, and the standard for sodium was exceeded in several wells. Again, metals concentrations were below applicable standards for filtered aliquots and may be representative of elevated suspended solids.

The overall distribution of contamination is consistent with the ISDBs, the swale area, the former waste oil UST, the surge pond, and the former acid spill as sources. Pesticide concentrations indicate either widespread leaching, downward migration through the shallow zone, or sediment carrydown in drilling.

The in-place recovery system at the site has little apparent influence on the shallow groundwater, but has had a pronounced effect on the intermediate depth. Evaluation of the data indicates flow in the intermediate depth in the southern part of the site is influenced by RW-7 and, in the northern part by RW-3. Flow in the central part of the site, however, remains to the east toward the bay, and may allow offsite contaminant migration.

Deep Groundwater

Heavy metals and major metals concentrations in the deep well sampled were similar to those of intermediate depth. The standard for sodium was exceeded, reflecting saltwater influence.

5.5 Fate and Transport

5.5.1 Sources of Contamination

Areas of soil contamination were identified at the former ISDBs, the swale area, and at the former waste oil UST. Semivolatiles, including chlorinated benzenes and PAHs, as well as PCBs and metals, were found in this area, with lesser phenol, pesticide, and cyanide concentrations. A second area of elevated contamination relative to surrounding areas can be found in a broad and ill-defined region including the former surge pond (boring 33S12), the present surge tank (33S11), and the former waste line breach area (33S10). The principal soil contaminants in this area include PAHs, pesticides, and PCBs. The potential for contaminant migration would be expected to be greatest in these areas.

Soil pesticide concentrations average less than 20 ppb and do not exceed 1,000 ppb at any location; therefore, based on soil-phase partitioning, it is expected little pesticide mass would be available for leaching. Soil semivolatile concentrations were nondetect to less than 500 ppb over 90% of the study area, based on sample data. However, semivolatile concentrations were detected in excess of 1 part per million (ppm) in the former ISDBs and swale area, at the former waste oil UST, and around the former surge pond, present surge tank, and historic waste line breach. In these limited areas, leaching of semivolatiles may threaten underlying water-bearing zones. Metal concentrations in soil were generally low except in the swale area, as well as in some isolated areas with lower (but significant) concentrations. The greatest threat to underlying water-bearing zones is in these areas.

5.5.2 Contaminant Migration

Leaching from Soil to Groundwater

Contamination identified in soil of the former ISDBs, swale area, former waste oil UST, former surge pond, surge tank, and waste line breach area may enter groundwater by three mechanisms: 1) contaminants may be leached from the soil by downward percolation of rainwater toward the water table or 2) into groundwater through direct continual contact with groundwater either from contaminant horizons identified at normal water table or 3) from seasonally submerged soil during periods of elevated water table. Soil at the IWTP in general is very permeable, resulting in quick infiltration and minimal contact time between percolating water and soil above the water table. Soil in the swale area, however, is fill material of sands and appreciable silts with discontinuous zones of clayey material. Permeability of this soil would be substantially lower than elsewhere at the study area, resulting in longer contact time with percolating water. Shallow monitoring wells around and downgradient of the former ISDBs and swale area exhibited relatively low to nondetect concentrations of metals and most organics, except chlorinated benzenes. The swale area including 33G01 is in the area of highest soil contamination. These high contaminant concentrations were recorded during an unusually wet season with percolation of rainwater through the contaminated soil. The resultant concentrations in shallow groundwater suggest the contaminated soil is releasing chlorinated benzenes at rates substantial enough to cause a detectable impact on groundwater, but other contaminants may be more tightly retained.

Soil contamination at the water table exists as black oily horizons around the site of the former waste oil UST and around the southern portion of the former ISDBs and as a darkened horizon around the surge tank and former surge pond. The contaminated soil may be continuously or seasonally in contact with shallow groundwater, allowing for maximum contact time for leaching. Low to nondetect concentrations in RCRA-sampled wells, downgradient of and adjacent to the former surge pond, and GM-8, downgradient and near the black oily horizon around the southern portion of the ISDBs, do not indicate any appreciable leaching of contaminants from their respective horizons at the water table. CERCLA well 33G02 shows chlorinated benzenes, suggesting groundwater and/or rainwater percolation may be leaching contaminants from the black oily horizon around the former waste oil UST.

The compound classes of PAH semivolatiles, pesticides, and PCBs are generally considered to have limited to very limited potential for migration due to their low solubility and high affinity for soil particles and organic carbon. Physical analyses on soil samples from the swale area and near the former surge pond indicate total organic carbon contents of 480 and 470 mg/kg dry weight, respectively. The potential for metals migration depends highly on pH, redox potential, and cation exchange capacity of the bearing soil. Cation exchange capacities measured on soil from the two contaminant sources in question are at 3.9 meq/100g in the swale area and 5.2 meq/100g near the former surge pond. The very low metal and PAH concentrations, extremely low pesticide concentrations, and nondetected concentrations of PCBs suggest soil across the site, and possibly the oily organic-rich material in the swale area, are retaining these compounds by sorption processes.

Surface Water Transport

The generally high soil permeabilities around the IWTP limit any substantial transfer of contamination via surface water flow. Although the site was investigated during an unusually wet winter, overland flow was not observed. The southern drainage ditch surface waters seem to collect by seepage or storm water culvert discharge from the surrounding industrially used land, including the IWTP, the bilge water treatment plant, the helicopter rotor-testing facility, and the former Chevalier Field. Although water was not flowing in these ditches, it is possible that accelerated seepage during heavy rains may produce some surface water movement. Contaminants transfer from soil to surface water by the same leaching processes discussed above under soil to groundwater pathways, mediated by groundwater quality characteristics.

Contaminant transport within the drainage ditch surface water has been investigated by the hydrologic study and southern drainage ditch sampling. The ditch surface waters were determined to be more a surface expression of groundwater than a conduit for surface water transport; any migration of water and contaminants within the ditch is probably related to groundwater flow velocities. The impact of OU 10 on area wetlands will be further evaluated during the Site 41, NAS Pensacola Wetlands investigation.

Groundwater Transport

Groundwater analytical results indicate contaminants are migrating with groundwater flow. Contaminant concentrations are evaluated around and hydraulically downgradient of the former ISDBs, downgradient of the surge tank, by the former waste oil UST, and at 33G15. Based on potentiometric measurements, groundwater contamination is migrating laterally east from the former ISDBs/swale area and the former waste oil UST, and north/northwest from the present surge tank. Two recovery wells at the heart of the former ISDBs and the swale area contamination apparently have not prevented or reversed the eastward migration of contaminated groundwater from the area. However, they are influencing flow in the southern and northern portions of the IWTP yard. Downward vertical hydraulic gradients between shallow and intermediate groundwater depths, equivalent in magnitude to lateral gradients, indicate a strong tendency for downward contaminant migration in conjunction with lateral movement. Elevated contaminant concentrations at intermediate depth may be a consequence of this downward flow component. Upward vertical hydraulic gradients between deep and intermediate groundwater depths, together with the presence of a 12- to 15-foot-thick, low- permeability clay layer between the two, may preclude any downward contaminant migration into the deep groundwater. Low-level contaminant concentrations, historically found in deep wells soon after installation and nondetect later, indicate these trace contaminants were introduced during deep well installation.

The groundwater contaminant migration rate is conservatively estimated to equal groundwater velocity. Based on groundwater velocities, the rate of contaminant movement from the former ISDBs and swale area toward well pair 33G05 and 33G12 (east of the ISDBs) is expected to average approximately 0.54 ft/day in shallow groundwater, and approximately 0.017 ft/day in intermediate groundwater. Groundwater contamination at well pair 33G03 and 33G08 (west of the ISDBs) is expected to flow north, away from the surge tank. Contaminated groundwater movement at 33G15 (north of the ISDBs) is likely influenced by nearby recovery well RW-3.

Analytical results of filtered and unfiltered sample aliquots indicate that metals in groundwater are strongly partitioned onto particulate matter. Therefore, movement of metals contamination depends on the ability of the particulate matter to move with groundwater. High hydrogen sulfide concentrations in groundwater may favor precipitation of metals from the dissolved phase, further associating metal constituents with particulates or as colloidal suspension.

Potential Receptors and Impacted Media

The primary medium impacted by site activity has been the surficial zone of the Surficial/Sand-and-Gravel Aquifer. Shallow and intermediate monitoring wells for this zone presently and historically have yielded impacted groundwater. Organic contaminant concentrations are lower than when the former surge pond and ISDBs operated. The greatest impacts have been observed around and downgradient of the former ISDBs and swale area, downgradient of the surge tank, and at 33G15. Several chlorinated aliphatic compounds and 1,4-dichlorobenzene exceed standards in area wells. Both impacted and unimpacted groundwater in this aquifer have been shown to be highly turbid and contain natural iron, manganese, and sodium concentrations exceeding standards. A large portion of the aquifer yields dark brown, highly organic pore water with an acrid hydrogen sulfide odor. Groundwater from the surficial zone is not used nor anticipated to be used as a potable water supply.

Pensacola Bay and Bayou Grande are potential impacted media of contaminated groundwater from the IWTP. These coastal waters have been classified by the FDEP as Class III waters, indicating their use for recreation and maintaining a well-balanced fish and wildlife population. Potential impacts on these water bodies will be addressed in upcoming RI/FSs for Bayou Grande (Site 40) and Pensacola Bay (Site 42).

The possible wetland immediately north and west of the former ISDBs and swale area may have been impacted by industrial sludge components released through poor handling practices. Presently, it is potentially subject to groundwater discharges during high rainfall. Soil samples collected west and north of the former ISDBs and swale area indicated some impact on soil from IWTP operations. Due to the ISDBs closure, past practices that directly contaminated the potential wetland no longer occur. The present threat appears to be transfer of contamination via groundwater during wet seasons, when the water table is above the soil surface. Overland runoff from the IWTP into the potential wetland rarely occurs due to the high surface soil permeability.

The potential wetland south of the IWTP and adjacent to the bilge water plant has possibly been impacted by contamination from these facilities. The southern IWTP yard north-south drainage ditch could transfer any contamination southward into the potential wetland, although RI results do not indicate any impact from the IWTP. Based on analytical results from the monitoring wells in the area, groundwater discharge beneath the southern yard of the IWTP does not appear to have impacted the potential wetland. Potential ecological impacts on these potential northern and southern wetlands will be addressed in an upcoming RI/FS for the NAS Pensacola wetlands (Site 41).

6.0 SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) has been conducted for OU 10, and the results are presented in Section 10 of the RI report. The BRA was based on contaminated environmental site media as identified in the RI. It was conducted to provide an assessment of the resulting impact to human health and environment if contaminated soil and groundwater at the site were not remediated. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or environment.

6.1 Chemicals of Potential Concern

Substances detected at OU 10 were screened against available information to develop a list or group of chemicals referred to as chemicals of potential concern (COPCs). The information consists of both federal and State of Florida cleanup criteria, soil and groundwater standards, and reference concentrations. COPCs are those chemicals selected after comparing to screening concentrations (risk-based and reference), intrinsic toxicological properties, persistence, fate and transport characteristics, and cross-media transfer potential. Any COPC that is carried through the risk assessment process and found to contribute to a pathway that exceeds a 10^{-6} risk or hazard index (HI) greater than 1 for any of the exposure scenarios evaluated in this risk assessment and has an incremental lifetime cancer risk (ILCR) greater than 10^{-6} or hazard quotient (HQ) greater than 0.1 is referred to as a chemical of concern (COC). Table 6-1 summarizes COPCs for these pathways. Surface water, sediment, and deep groundwater pathways did not produce any significant risk levels.

Essential elements may be screened out of a risk assessment if it is shown that concentrations detected are not associated with adverse health effects. Therefore, the following nutrients were eliminated: calcium, iron, magnesium, potassium, and sodium.

Table 6-1
Chemicals of Potential Concern

COPC	Soil	Groundwater: Shallow and Intermediate	Groundwater: Deep	Surface Water	Sediment
1,1-Dichloroethane	-	0.002 - 0.2		-	-
1,2-Dichlorobenzene	-	0.001 - 1.2		-	-
1,2-Dichloroethene (total)	-	0.003 - 0.012		-	-
1,3-Dichlorobenzene	-	0.001 - 0.7		-	-
1,4-Dichlorobenzene	-	0.001 - 0.7		-	-
2,4-Dichlorophenol	-	0.002 - 0.012		-	-
4,4'-DDD	-	-		0.000041 - 0.00011	-
Acenaphthene	0.001 - 0.026	-		-	-
Aluminum	193 - 17500	0.359 - 33.6	11.8	0.696 - 1.28	1100 - 4150
Arsenic	0.94 - 3.5	0.0031 - 0.0187	0.005	-	0.82 - 6.2
Benzene	-	0.003 - 0.003		-	-
Benzo(a)anthracene	7.5 - 7.5	-		-	-
Benzo(a)pyrene	6.2 - 6.2	-		-	-
Benzo(b)fluoranthene	0.028 - 7	-		-	-
Benzo(k)fluoranthene	0.028 - 7	-		-	-
Beryllium	-	-		-	-
Bis(2-chloroethyl)ether	0.83 - 0.83	-		-	-
Bis(2-ethylhexyl)phthalate	-	0.088 - 0.088		-	-
Cadmium	1.4 - 23	0.0202 - 0.0202		0.0052 - 0.0052	2.8 - 34.6
Carbon disulfide	-	0.003 - 0.007		-	-
Chlorobenzene	-	0.001 - 0.34		-	-
Chromium	1.8 - 910	0.0107 - 0.0757		-	9.3 - 1180
Copper	-	-		-	-
Dibenz(a,h)anthracene	1.4 - 1.4	-		-	-
Dieldrin	-	0.000003 - 0.000042		-	-
Heptachlor epoxide	-	-		0.0000013 - 0.0000013	-
Hexachloroethane	-	0.003 - 0.003			

Table 6-1
Chemicals of Potential Concern

COPC	Soil	Groundwater: Shallow and Intermediate	Groundwater: Deep	Surface Water	Sediment
Indeno(1,2,3-cd)pyrene	0.04 - 4.8	-		-	-
Lead	-	0.0021 - 0.0182		-	-
Manganese	1 - 537	0.0082 - 0.5		0.0113 - 0.28	-
Mercury	-	0.00021 - 0.0016		-	-
Naphthalene	-	0.026 - 0.038			
PCB Aroclor-1260	0.006 - 0.405	-		-	-
Tetrachloroethene	-	0.006 - 0.19		-	-
Thallium	-	-		-	-
Titanium	23 - 53	-		-	-
Trichloroethene	-	0.002 - 0.007		-	-
Vanadium	-	0.0159 - 0.076		-	-
Vinyl chloride	-	0.015 - 0.015		-	-
Yttrium	1.3 - 1.85	-		-	-
trans-Nonachlor	0.006 - 0.006	-		-	-

Notes:
The table presents the range of concentrations detected for all COPCs.
Essential nutrients (calcium, iron, magnesium, potassium, and sodium) were not considered COPCs in any medium.
All results are in parts per million (ppm).

Currently, site operations are being converted to domestic treatment only. However, there is no indication the domestic treatment operations will be discontinued in the future. Onsite groundwater is not being used at present; however, it is considered a viable source of groundwater for future consumption.

6.2 Exposure Assessment

Whether a chemical is actually a concern to human health depends upon the likelihood of exposure, i.e., whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- Source and mechanism of release;
- Transport medium (e.g., surface water, air) and mechanisms of migration through the medium;
- Presence or potential presence of a receptor at the exposure point; and
- Route of exposure (ingestion, inhalation, dermal absorption).

If all four elements are present, the pathway is considered complete.

An evaluation was undertaken of all potential exposure pathways that could connect chemical sources at OU 10 with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. Current pathways represent exposure pathways that could exist under current conditions while future pathways represent exposure pathways that could exist, in the future, if current exposure conditions change.

6.2.1 Current Exposure

Under current land use conditions at OU 10, access to areas of concern is restricted to authorized personnel only. At this time, the plant is being converted to domestic treatment only; however, there are no reported plans to decommission the facility. As a result, existing exposure scenarios will continue unaltered for the foreseeable future. Potential exposures under present land use are summarized below:

Potential Exposure Scenarios — Current Conditions

Media	**Exposure Pathway**	**Receptor**
Soil	Incidential Inhalation Dermal Contact	Onsite Worker Trespasser
Surface Water	Incidential Ingestion	Trespasser
Sediment	Incidential Ingestion Dermal Contact	Trespasser

6.2.2 Future Exposure

Complete exposure pathways could exist when based on an estimate of the reasonable maximum exposure (RME) expected to occur under future conditions. Although unlikely, it is assumed that OU 10 may be developed in the future as residential areas, which could also provide reasonable opportunities for recreational activities. If so, future residents could be exposed to soil via incidental ingestion and dermal contact routes of exposure associated with living in the area. Potential exposures for future land use are summarized below:

Potential Exposure Scenarios — Future Conditions

Media	**Pathway**	**Receptors**
Soil	Incidential Ingestion Dermal Contact	Site Resident

Potential Exposure Scenarios — Future Conditions

Media	Pathway	Receptors
Groundwater	Ingestion Inhalation	Site Resident
Surface Water	Incidential Ingestion	Site Resident (Recreational Use)
Sediment	Incidential Ingestion Dermal Contact	Site Resident (Recreational Use)

Exposure Point Concentration

Exposure point concentrations for each chemical of concern and exposure assumptions for each pathway were used to estimate chronic daily intakes (CDIs) for potentially complete pathways. CDIs were then used in conjunction with cancer potency factors and noncarcinogenic reference doses to evaluate risk.

The 95th percentile for reported concentrations of chemicals of concern in each-media evaluated were calculated as exposure point concentrations for the RME in each exposure scenarios. Exposures point concentrations are summarized in Table 6-2.

Table 6-2
Exposure Point Concentrations

Media and Chemical	Exposure Point Concentrations		
	Frequency of Detection	**RME**	**Background**
Soil (mg/kg)			
Aluminum	17/18	17500	3833
Arsenic	3/18	3.5	1.6
Cadmium	7/18	23	N/A
Chromium	17/18	910	6.2
Manganese	18/18	537	21.4
Titanium	9/9	53	N/A
Yttrium	4/9	1.85	N/A
PCB-1260	5/17	0.405	N/A
trans-Nonachlor	1/9	0.0062	N/A
Benzo(a)anthracene	1/18	7.5	N/A
Benzo(a)pyrene	1/18	6.2	N/A
benzo(b,k)fluoranthene	4/18	7	N/A
Dibenzo(a,h)anthracene	1/18	1.4	N/A
Indeno(1,2,3-cd)Pyrene	2/18	4.8	N/A
Bis(2-chloroethyl)ether	1/18	0.83	N/A
Shallow/Intermediate Groundwater (mg/L)			
1,1-Dichloroethane	10/27	0.065	N/A
1,2-dichlorobenzene	11/27	1.17	N/A
1,2-Dichloroethene (total)	4/27	0.00276	N/A
1,3-dichlorobenzene	7/27	0.274	N/A
1,4-dichlorobenzene	11/27	0.442	N/A
2,4-Dichlorophenol	2/27	0.00153	N/A
Acenaphthene	3/27	0.00187	N/A

Table 6-2
Exposure Point Concentrations

Media and Chemical	Exposure Point Concentrations		
	Frequency of Detection	RME	Background
Aluminum	27/27	8.66	3.82
Arsenic	13/27	0.0077	N/A
Benzene	1/27	0.0016	N/A
Bis(2-ethylhexyl)phthalate	1/27	0.00804	N/A
Cadmium	1/27	0.01094	0.0096
Carbon Disulfide	4/27	0.0023	N/A
Chlorobenzene	15/27	0.3208	N/A
Chromium	14/27	0.01905	0.0325
Dieldrin	4/27	0.000003	N/A
Hexachloroethane	1/27	0.001083	N/A
Lead	13/27	0.006352	N/A
Manganese	27/27	0.19341	0.022
Mercury	16/27	0.000624	N/A
Naphthalene	2/27	0.00781	N/A
Tetrachloroethene	3/27	0.00731	N/A
Trichloroethene	4/27	0.0017	N/A
Vanadium	8/27	0.02172	0.007
Vinyl chloride	1/27	0.00321	N/A
Deep Groundwater (mg/L)			
Aluminum	1/1	11.8	N/A
Arsenic	1/1	0.0048	N/A
Surface Water (mg/L)			
Aluminum	4/4	1.28	N/A
Cadmium	1/4	0.0052	N/A

Table 6-2
Exposure Point Concentrations

Media and Chemical	**Exposure Point Concentrations**		
	Frequency of Detection	**RME**	**Background**
Manganese	4/4	0.28	N/A
4,4'-DDD	2/4	0.00011	N/A
Heptachlor Epoxide	1/4	0.0000013	N/A
Sediment (mg/kg)			
Aluminum	4/4	4150	N/A
Arsenic	3/4	6.2	N/A
Cadmium	2/4	34.6	N/A
Chromium	4/4	1180	N/A

Notes:
RME — Reasonable Maximum Exposure
The number of samples for three non-TCL/TAL COPCs is nine rather than 18 due to the analyte list used by USEPA Region IV ESD during supplemental sampling for OU 10 surface soil.
All results are in parts per million (ppm).

Potential future exposure scenarios included all exposures examined under current conditions. Exposure assumptions were considered the same in evaluating future conditions as were used in evaluating current conditions. Assumptions are listed in Table 6-3 for current land use and Table 6-4 for future land use.

Table 6-3
Parameters Used to Estimate Potential Exposures for Current Land Use Receptors

Pathway Parameters	Trespassing Child Age 7-16	Onsite Worker	Units
Incidental Ingestion of Sediment/Soil			
Ingestion Rate	100[a]	50[b]	mg/day
Exposure Frequency	52[c]	250[b]	days/year
Exposure Duration	10[c]	25[b]	years
Body Weight	45[d]	70[b]	kg
AT-Noncancer	3,650[e]	9,125[e]	days
AT-Cancer	25,550[f]	25,550[f]	days
Dermal Contact with Sediment/Soil			
Skin Surface Area	3,950[g]	4,100[g]	cm^2
Adherence Factor	1[h]	1[h]	mg/cm^2
Absorption Factor	CSV	CSV	unitless
Exposure Frequency	52[c]	250[b]	days/year
Exposure Duration	10[c]	25[b]	years
Body Weight	45[d]	70[b]	kg
Averaging Time-Noncancer	3,650[e]	9,125[e]	days
Averaging Time-Cancer	25,550[f]	25,550[f]	days
Incidental Ingestion of Surface Water			
Ingestion Rate	0.05[a]	NA	liters/hour
Exposure Time	2.6[a]	NA	hours/day
Exposure Frequency	52[c]	NA	days/year
Exposure Duration	10[c]	NA	years
Body Weight	45[d]	NA	kg
Averaging Time-Noncancer	3,650[e]	NA	days
Averaging Time-Cancer	25,550[f]	NA	days

Notes:

a	=	USEPA (1989) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A).*
b	=	USEPA (1991) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual Supplemental Guidance, 'Standard Default Exposure Factors'*, Interim Final, OSWER Directive: 9285.6-03.
c	=	Assumes a trespass scenario of an adolescent age 7-16 with an exposure duration of 10 years and a exposure frequency of 52 days per year.
d	=	Adolescent body weight is the average value for the range of body weights for boys and girls ages 7-16 taken from USEPA (1990) *Exposure Factors Handbook*, USEPA/600/8-89/043.
e	=	Calculated as the product of ED (years) x 365 days/year.
f	=	Calculated as the product of 70 years (assumed lifetime) x 365 days per year.
g	=	Skin surface area (i.e., worker -head, forearms and hands) provided by USEPA Region 4. For trespassing children, skin surface area was computed as 25% of the age group mean total body surface per Dermal Guidance.
h	=	Specific guidance from USEPA Region 4 (February 11, 1992 New Interim Region 4 Guidance).
NA	=	Not applicable
CSV	=	Chemical-specific value

Table 6-4
Parameters Used to Estimate Potential Exposures for Future Land Use Receptors

Pathway Parameters	Resident Adult	Resident Child	Units
Incidental Ingestion of Soil			
Ingestion Rate	100[a]	200[a]	mg/day
Exposure Frequency	350[b]	350[b]	days/year
Exposure Duration	24[c]	6[a]	years
Exposure Duration$_{LWA}$	24[c]	6[a]	years
Body Weight	70[a]	15[a]	kg
AT-Noncancer	8,760[d]	2,190[d]	days
AT-Cancer	25,550[e]	25,550[e]	days
Dermal Contact with Soil			
Skin Surface Area	4,100[f]	2,000[f]	cm^2
Adherence Factor	1[g]	1[g]	mg/cm^2
Absorption Factor	CSV	CSV	unitless
Exposure Frequency	350[b]	350[b]	days/year
Exposure Duration	24[c]	6[a]	years
Exposure Duration$_{LWA}$	24[c]	6[a]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days
Drinking Water Ingestion			
Ingestion Rate	2[a]	1[a]	liters/day
Exposure Frequency	350[b]	350[b]	days/year
Exposure Duration	24[c]	6[a]	years
Exposure Duration$_{LWA}$	24[c]	6[a]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days

Table 6-4
Parameters Used to Estimate Potential Exposures for Future Land Use Receptors

Pathway Parameters	Resident Adult	Resident Child	Units
Inhalation of Volatilized Groundwater Constituents			
Ingestion Rate	2[a]	1[a]	m^3/day
Exposure Frequency	350[b]	350[b]	days/year
Exposure Duration	24[c]	6[c]	years
Exposure Duration$_{LWA}$	24[c]	6[c]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days
Incidental Ingestion of Sediment			
Ingestion Rate	17[h]	34[h]	mg/day
Exposure Frequency	104[i]	140[i]	days/year
Exposure Duration	24[c]	6[c]	years
Exposure Duration$_{LWA}$	24[c]	6[c]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days
Dermal Contact with Sediment			
Skin Surface Area	4,100[f]	2,000[f]	cm^2
Adherence Factor	1[g]	1[g]	mg/cm^2
Absorption Factor	CSV	CSV	unitless
Exposure Frequency	104[i]	140[i]	days/year
Exposure Duration	24[c]	6[c]	years
Exposure Duration$_{LWA}$	24[c]	6[c]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days

Table 6-4
Parameters Used to Estimate Potential Exposures for Future Land Use Receptors

Pathway Parameters	Resident Adult	Resident Child	Units
Incidential Ingestion of Surface Water			
Ingestion Rate	0.05[a]	0.05[a]	liters/hour
Exposure Time	2.6[a]	2.6[a]	hours/day
Exposure Frequency	104[i]	140[i]	days/year
Exposure Duration	24[c]	6[c]	years
Exposure Duration$_{LWA}$	24[c]	6[c]	years
Body Weight	70[a]	15[a]	kg
Averaging Time-Noncancer	8,760[d]	2,190[d]	days
Averaging Time-Cancer	25,550[e]	25,550[e]	days

Notes:

a = USEPA (1989) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A).*
b = Assumes a residential exposure frequency of 365 days per year with one two week vacation.
c = USEPA (1991), *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals),* OSWER Directive 9285.7-01B.
d = Calculated as the product of ED (years) x 365 days/year.
e = Calculated as the product of 70 years (assumed lifetime) x 365 days per year.
f = Skin surface area (i.e., adult resident - head, forearms and hands; child resident -head, arms, hands, and legs) provided by USEPA Region 4.
g = Specific guidance from USEPA Region 4 (February 11, 1992 New Interim Region 4 Guidance).
h = Values for sediment ingestion rate are based on a soil ingestion rates of 100 milligrams per day for adults and 200 milligrams per day for children and a recreational exposure time of 2.6 hours per day (over a 16 waking hour day.)
i = Recreational exposure frequency assumed to be 104 days per year for adults and 140 days per year for children.
NA = Not applicable.
CSV = Chemical specific value.

6.3 Toxicity Assessment

A cancer slope factor (CSF) and a reference dose (RfD) are applied to estimate potential risk of cancer from an exposure and the potential for non-carcinogenic effects to occur from exposure.

CSFs have been developed by USEPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminants of concern. CSFs which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by estimated intake of a potential carcinogen in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of risks calculated from the CSF. Use of this approach makes underestimation of actual cancer risk highly unlikely. CSF are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

This increased cancer risk is expressed by terms such as 1E-6. To state that a chemical exposure causes a 1E-6 added upper limit risk of cancer means that if 1,000,000 people are exposed, one additional incident of cancer is expected to occur. The calculations and assumptions yield an upper limit estimate which assures that no more than one case is expected and, in fact, there may be no additional cases of cancer. USEPA policy has established that an upper limit cancer risk falling below or within the range of 1E-6 to 1E-4 is acceptable.

RfDs have been developed by USEPA for indicating the potential for adverse health effects from exposure to COCs exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are likely to be without risk of an adverse affect. Estimated intakes of COCs from environmental media (e.g., amount of COCs ingested from contaminated groundwater) can be compared to the RfD. RfDs are derived from results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for use of animal data to predict effects on humans). If the estimated exposure to a chemical expressed as mg/kg/day is less than the RfD, exposure is not expected to cause any non-carcinogenic effects, even if exposure is continued for a lifetime. In other words, if the estimated dose divided by the RfD is less than 1.0, there is no concern for adverse non-carcinogenic effects.

Exposure Point Concentrations, and Toxicity Potency Factors used to calculate Human Health Risks are summarized in Table 6-5.

Table 6-5
Toxicological Database Information for Chemicals of Potential Concern

Chemical	Oral Reference Dose (mg/kg/day)	Inhalation Reference Dose (mg/kg/day)	TEF	Cancer Classification
1,1-Dichloroethane	0.1 b	0.143 c	NA	D
1,2-Dichlorobenzene	0.09 a	0.04 c	NA	ND
1,2-Dichloroethene (total)	0.009 b	ND	NA	ND
1,3-Dichlorobenzene	0.089 d	ND	NA	ND
1,4-Dichlorobenzene	ND	0.229 a	NA	Oral Reference Dose (mg/kg/day)
2,4-Dichlorophenol	0.003 a	ND	NA	D
4,4'-DDD	ND	ND	NA	Oral Reference Dose (mg/kg/day)
Acenaphthene	0.06 a	ND	NA	NA
Aluminum	1 d	ND	NA	ND
Arsenic	0.0003 a	ND	NA	A
Benzene	ND	0.00171 e	NA	A
Benzo(a)anthracene	ND	ND	0.1	B2
Benzo(a)pyrene	ND	ND	1	B2
Benzo(b)fluoranthene	ND	ND	0.1	Oral Reference Dose (mg/kg/day)
Benzo(k)fluoranthene	ND	ND	0.01	Oral Reference Dose (mg/kg/day)
Beryllium	0.005 a	ND	NA	Oral Reference Dose (mg/kg/day)
Bis(2-chloroethyl)ether	ND	ND	NA	Oral Reference Dose (mg/kg/day)
Bis(2-ethylhexyl)phthalate	0.02 a	ND	NA	Oral Reference Dose (mg/kg/day)
Cadmium (food)	0.001 a	ND	NA	D/B1
Cadmium (water)	0.0005 a	ND	NA	D/B1
Carbon disulfide	0.1 a	0.0029 b	NA	D

Table 6-5
Toxicological Database Information for Chemicals of Potential Concern

Chemical	Oral Reference Dose (mg/kg/day)	Inhalation Reference Dose (mg/kg/day)	TEF	Cancer Classification
Chlorobenzene	0.02 a	0.00571 c	NA	C
Chromium	0.005 a	ND	NA	Ainh
Copper	0.0371 b	ND	NA	D
Dibenz(a,h)anthracene	ND	ND	1	Oral Reference Dose (mg/kg/day)
Dieldrin	0.00005 a	ND	NA	Oral Reference Dose (mg/kg/day)
Heptachlor epoxide	0.000013 a	ND	NA	B2
Hexachloroethane	0.001 a	ND	NA	C
Indeno(1,2,3-cd)pyrene	ND	ND	0.1	B2
Lead	ND	ND	NA	B1
Magnesium	0.014	ND	NA	ND
Manganese	0.005 a	0.0000143 a	NA	D
Mercury	0.0003 b	0.0000857 b	NA	D
Naphthalene	ND	ND	NA	D
PCB Aroclor-1260	0.00007 a	ND	NA	B2
Tetrachloroethene	0.01 a	ND	NA	C
Thallium i	0.00008 a	ND	NA	ND
Titanium	ND	ND	NA	ND
Trichloroethene	0.006 e	ND	NA	B2
Vanadium	0.007 b	ND	NA	D
Vinyl chloride	ND	ND	NA	A
Yttrium	ND	ND	NA	ND
trans-Nonachlor	ND	ND	NA	ND

Notes:

a = Integrated Risk Information System (IRIS)
b = Health Effects Assessment Summary Tables (HEAST).
C = HEAST alternative method
D = Other USEPA documents including USEPA, Region III's "Risk-based Screening Concentrations Table, Third Quarter 1994, July 1994".
E = USEPA Environmental Criteria and Assessment Office — Cincinnati
F = Values for oral reference doses provided by Mr. Kevin Koporec with Region IV ECAO.
G = The oral and inhalation cancer potency factors of 7.3 and 6.1 [(mg/kg/day)-1], for Benzo(a)pyrene, respectively, were used for all other polynuclear aromatic hydrocarbons (PAHs). As reported in the Exposure Assessment Section of the risk assessment, toxicity equivalency factors (TEFs) were applied to carcinogenic PAHS to convert their concentrations to an equivalent concentration of Benzo(a)pyrene.

H = Withdrawn from IRIS or HEAST.
I = The oral reference doe for thallium carbonate was substituted for thallium.
ND = Not determined due to lack of information in available toxicological databases.
NA = Not applicable or available.
UF = Uncertainty factor used to derive reference dose, MF modifying factor used to derive reference dose.

6.4 Risk Characterization

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a life-time as a result of exposure to the carcinogen. Excess life-time cancer risk is calculated from the following equation:

RISK = CDI X CSF

where:

risk = a unit less probability (e.g., 2 X 10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
CSF = slope-factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are generally expressed in scientific notation (e.g., $1X10^{-6}$ or $1E^{-6}$). An excess lifetime cancer risk of 1 X 10^{-6} indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under specific exposure conditions at OU 10.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called an HQ. By adding the HQs for all COCs that affects the same target organ within a medium or across all media to which a given population may reasonably be exposed, the HI can be generated.

The HQ is calculated as follows:

Noncancer HQ = **CDI/RfD**

where:

CDI = Chronic Daily intake

RfD = Reference Dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

To evaluate estimated cancer risks, a risk level lower than $1x10^{-6}$ is considered a minimal or de minimis risk. The risk range of $1x10^{-6}$ to $1x10^{-4}$ is an acceptable risk range and would not be expected to require a response action. A risk level greater than $1x10^{-4}$ would be evaluated further, and a remedial action to decrease the estimated risk considered.

An HI of less than unity (1.0) indicates the exposures are not expected to cause adverse health effects. An HI greater than one (1.0) requires further evaluation. For example, although hazard quotients of the several chemicals present are added and exceed 1.0, further evaluation may show that their toxicities are not additive because each chemical affects different target organs. When total affects are evaluated on an effect and target organic basis, the hazard index of the separate chemicals may be at acceptable levels.

Carcinogenic risks and noncarcinogenic hazards were evaluated for potential exposures to media-specific chemicals of concern in surface soil, surface water, surface sediment, and groundwater. Receptor populations were potentially exposed workers, trespassers, and future residents that could, theoretically, use groundwater for a household water source. Risks and hazards for the identified COCs are summarized in Table 6-6.

Estimated potential exposure to chemicals of concern in surface water or sediments did not result in unacceptable carcinogenic risk or noncarcinogenic hazard. Current site workers and potential child trespassers did not have an individual pathway or combined single medium pathway with a hazard index in excess of 0.6 or an ILCR greater than 2E-6. The cross pathway hazard index and cancer risk for these two receptor types were also within the acceptable carcinogenic risk range. These projections indicate that neither group is at significant risk of deleterious health effects resulting form RME to all media. These receptor groups do not warrant further consideration.

Table 6-6
Risk and Hazard for Identified COCs and Pathways of Concerns

	Potential Future Land Use		
Chemical	**Resident Adult HI**	**Resident Child HI**	**Resident lwa ILCR**
Soil Ingestion Pathway			
Chromium (as VI)	0.2	2.3	ND
Aluminum	0.023	0.224	
Benzo(a)pyrene	ND	ND	3.50e-06
Dibenz(a,h)anthracene	ND	ND	8.00e-07
Soil Ingestion Pathway Hazard	0	3	
Soil Ingestion Pathway Risk			4.00e-06
Soil Dermal Contact Pathway			
Chromium	0.1	0.1	ND
Benzo(a)pyrene	ND	ND	1.40e-06
Dibenz(a,h)anthracene	ND	ND	3.10e-07
Soil Dermal Contact Hazard	0	0	
Soil Dermal Contact Risk			2.00e-06
Shallow/Intermediate Groundwater Ingestion Pathway			
1,2-Dichlorobenzene	0.4	0.8	ND
1,3-Dichlorobenzene	0.08	0.2	ND
1,4-Dichlorobenzene	0.1	0.1	1.60e-04

Table 6-6
Risk and Hazard for Identified COCs and Pathways of Concerns

	Potential Future Land Use		
Chemical	Resident Adult HI	Resident Child HI	Resident lwa ILCR
Aluminum	0.24	0.55	ND
Arsenic	0.7	1.7	2.00e-04
Bis(2-ethylhexyl)phthalate	0.01	0.03	1.67e-06
Cadmium (water)	0.6	1.4	ND
Chlorobenzene	0.4	1	ND
Chromium	0.1	0.24	ND
Manganese	1.06	2.47	ND
Mercury	0.06	0.13	ND
Tetrachloroethene	0.02	0.1	5.70e-06
Vinyl chloride	ND	ND	9.10e-05
Shallow/Intermediate Groundwater Ingestion Hazard	4	9	
Shallow/Intermediate Groundwater Ingestion Risk			5.00e-04
Shallow/Intermediate Groundwater Inhalation Pathway			
1,2-Dichlorobenzene	0.8	1.9	ND
1,3-Dichlorobenzene	0.08	0.2	ND
1,4-Dichlorobenzene	0.1	0.1	1.60e-04
Chlorobenzene	1.5	3.6	ND
Tetrachloroethene	0.02	0.05	2.21e-07
Vinyl chloride	ND	ND	1.40e-05
Shallow/Intermediate Inhalation Hazard	2	6	
Shallow/Intermediate Inhalation Risk			2.00e-04
Deep Groundwater Ingestion Pathway			
Aluminum	0.1	0.2	ND
Arsenic	0.4	1	1.25e-04
Deep Groundwater Ingestion Hazard	1	1	
Deep Groundwater Ingestion Risk			1.00e-04

6.5 Soil Performance Standards for Groundwater Protection

The potential for groundwater contamination due to site COCs was also assessed by comparing constituent concentrations in soil with guidance concentrations protective of groundwater (as identified in FDEP's *Soil Cleanup Goals*). These values were used because they are more conservative estimates for groundwater protection than USEPA values. As discussed above, these concentrations are TBC criteria for the site. Nineteen COCs were identified as exceeding guidance concentrations when soil concentrations were compared to leaching criterion:

Type A	*Type B*	*Type C*
Chlorobenzene	Xylene	Benzo(a)pyrene
1,2-Dichlorobenzene	Phenol	Phenanthrene
1,3-Dichlorobenzene	Acenaphthene	Pentachlorophenol
1,4-Dichlorobenzene	Dieldrin	Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate (BEHP)	Endosulfan	
Naphthalene	Acetone	
	DDE	
	DDT	
	Alpha-BHC	

Type A constituents were defined as those exceeding Florida guidance concentrations for leachability in soil and promulgated MCLs or Florida guidance concentrations in groundwater. Type A compounds in groundwater (except BEHP) are concentrated beneath and east (downgradient) of Sites 32 and 33; these compounds are targeted by the RCRA groundwater recovery system, as they were present in RCRA units at Sites 32 and 33. Soil containing these compounds (except for BEHP) is adjacent to or east of Sites 32 and 33. Because of this, it is not possible to distinguish between groundwater contamination attributable to soil contamination or the former RCRA units. For this reason, FDEP leachability-based guidance concentrations for Type A constituents have been retained as site COCs for development of PRGs. (BEHP, a common laboratory contaminant, is not expected to be present in site soil, and therefore has not been retained as a site COC.)

Type B compounds were present in both soil and groundwater. They exceeded Florida guidance concentrations for leachability in soil, but were below MCLs or Florida guidance concentrations in groundwater. Type B compounds are present in soil above FDEP guidance concentrations at various locations at OU 10, primarily single-boring detections; contaminant mass associated with these detections is expected to be low. The spatial distribution of Type B compounds in groundwater does not necessarily correlate with soil borings containing soil contamination above FDEP leachability-based guidance concentrations. However, groundwater contamination associated with these compounds is also concentrated primarily beneath Site 32 and is being addressed by the existing RCRA groundwater recovery system. Because groundwater monitoring is required as part of the RCRA groundwater recovery program, Type B constituents were not included in developing site-specific PRGs.

Type C compounds were present in soil at concentrations exceeding Florida guidance concentrations for leachability in soil, but not detected in groundwater. The spatial distribution of Type C compounds in soil above FDEP guidance concentrations is limited to primarily single-boring detections; contaminant mass associated with these detections is expected to be low. Because these compounds are not impacting groundwater, and ongoing groundwater monitoring is required under the RCRA groundwater recovery program, these compounds were not included in developing site-specific PRGs.

The State of Florida considers these TBC criteria applicable to OU 10.

6.6 Risk Uncertainty

The following areas of uncertainty were associated with the estimation of chemical uptake from exposure to groundwater:

Exposure scenarios based on USEPA Guidance use conservative assumptions, which means actual risk will not be greater than the estimate and may be lower. For this reason, estimated cancer risks based on USEPA Guidance such as are presented in this document may not represent actual risks to the population.

Exposures related to drinking and bathing are theoretical because groundwater in the area is not presently used for drinking water or for other household water needs.

Because of data set limitations, the 95th percentile may exceed the maximum concentration reported in some evaluations. This may occur when there are a large number of non-detects and the detection limits are unusually high due to interferences in the analyses. In these cases, consistent with USEPA Region IV guidance, the maximum reported values were used as exposure point concentrations to estimate human exposures. Although use of maximum values is generally recognized as an appropriate screening approach, it should be recognized that this procedure may over estimate actual exposure.

This is also the case for use of detection limits as non-detect values when a chemical has been reported as not detected in most of the samples collected and analyzed. Since some non-detects may be zero, assuming that a concentration equal to half the detection limit is present instead of zero may over-estimate actual chemical concentrations at the site. This is particularly true if interfering chemicals affect the analyses and the non-detect value is elevated.

Environmental sampling and analysis can contain significant errors and artifacts. At this site, data are believed to adequately and accurately represent existing conditions.

When long-term health effects are evaluated, it is assumed that chemical concentrations are constant for the exposure period being evaluated. This may not be accurate since reported chemical concentrations are changing due to various degradation processes (i.e. dilution by uncontaminated water, sorption, dispersion of contaminated groundwater, volatilization, biodegradation, chemical degradation, and photo degradation). Use of steady state conditions will likely over-estimate exposure.

Exposures to vapors and dust at the site, dermal contact with groundwater from household uses other than bathing (i.e. laundry, washing dishes), and other possible exposures to surface soil and surface water were not evaluated. Although these and other potential exposures could occur, magnitudes of these exposures are expected to be much lower than exposures evaluated, and would not quantitatively affect the total health impact from the site.

Since groundwater in the surrounding area is not presently used for drinking water or for other household water needs, exposures related to drinking and bathing are theoretical and relate to potential future exposures. This is unlikely since the domestic treatment plant is still operating and the area will remain industrial.

The following are uncertainties associated with estimation of risks:

In hazard and risk evaluations, risks or hazards presented by several chemicals reported for the same exposure have been added to provide a sum of estimated total risk or hazard for that particular exposure. This is a conservative assumption and is scientifically accurate only in those instances where health effects of individual chemicals are directed at the same effect and same target organ. Effects may be additive, synergistic, or antagonistic. Since a large number of chemicals have no similarity as to their non-carcinogenic action or target of their action, this approach may overestimate risk.

Risks calculated from slope factors are derived using a linearized multistage procedure; therefore, are likely to be conservative upper bound estimates. Actual risks may be much lower.

There is a degree of uncertainty regarding the RfD for manganese in the groundwater ingestion scenario. There is currently a debate whether it is appropriate to separate exposures from food and water as currently done by IRIS for some chemicals and whether it is appropriate to separate exposure from food and water as presently done for manganese (and some other inorganics) by IRIS. Due to the high degree of uncertainty associated with the present RfD of 0.005 mg/kg/day for manganese, the RfD determination is scheduled for USEPA review. The current USEPA RfD for manganese in water of 0.005 mg/kg/day was used to evaluate risks concerning manganese drinking water intake.

6.7 Human Health Risk Summary

Risk and/or hazard associated with exposure to all environmental media (and combinations) was within USEPA's generally acceptable ranges for both current site workers and potential current child trespassers. Chromium was identified as a COC in soil and groundwater in soil and combined shallow and intermediate groundwater. Chromium concentrations were assumed to represent hexavalent chromium which was not detected at OU 10 thus the chromium hazard quotients overestimate chromium hazard approximately 200 times.

For an unlikely hypothetical future site resident, exposure media were shown to pose risk in excess of 1E-6 or a hazard index greater than 1. These media included surface soil, shallow/intermediate groundwater, and deep groundwater.

Surface Soil RGOs

Table 6-7 provides remedial goal options (RGOs) for the combined surface soil pathway (ingestion and dermal contact). Chromium concentrations were assumed to represent hexavalent chromium which was not detected at OU 10, thus the chromium hazard quotients overestimate chromium hazard approximately 200 times. The RGOs for benzo(a)pyrene and dibenz(a,h)anthracene apply to the identified hot spot. Remediation of soil in the limited area would result in reduction of potential human health risk to below acceptable goals.

Shallow/Intermediate Groundwater RGOs

Table 6-8 provides RGOs for the combined shallow/intermediate groundwater pathways (ingestion/inhalation exposures). Arsenic, chromium, hexachloroethane, and mercury are below corresponding applicable or relevant and appropriate regulations (ARARs) which may influence remediation levels deemed necessary. Arsenic and cadmium, which account for greater than 30 percent of the hazard, may be associated with salt water intrusion. Manganese could also be associated with natural geology.

Deep Groundwater RGOs

The RGOs for deep groundwater pathway are provided in Table 6-9. Each COC is potentially related to saltwater intrusion and/or suspended sediment in samples. The arsenic concentration is below its corresponding ARAR.

6.8 Ecological Considerations

An ecological risk assessment was also performed to assess actual or potential effects of contamination at OU 10 to ecological receptors such as plants and animals. This assessment focused on both land at OU 10 and contamination in groundwater discharging to nearby surface water bodies. Potential impacts to wetlands near OU 10 and the southern drainage ditch will

Table 6-7
Remedial Goal Options for Surface Soil (0 to 1 foot depth interval)

	Carcinogenic Risk-Based RGOs Risk Goal			Hazard-Based RGOs Hazard Quotient Goal								
Chemical	**0.0001**	**1E-05**	**0.000001**	**10**	**1**	**0.1**	**Unadjusted EPC (mg/kg)**	**Reference Concentration (mg/kg)**	**Risk-based Screening Value (mg/kg)**	**Source**	**Soil HI-child**	**Soil Risk-Iwa**
Aluminum	NA	NA	NA	744898	74490	7449	17500	3833	3700	RBCr	0.2349315	0
Chromium VI	NA	NA	NA	3724	372	37	910	6.1	39	RBCr	2.4432877	0
Chromium III	NA	NA	NA	744898	74490	7449	910	6.1	7800	RBCr		
Benzo(a)pyrene	126	13	1.3	NA	NA	NA	6.2	NA	0.088	RBCr	0	4.91E-06
Dibenzo(a,h)anthracene	126	13	1.3	NA	NA	NA	1.4	NA	0.088	RBCr	0	1.109E-06

Notes:

NA Indicates an RGO was not applicable for this chemical under risk and/or hazard based conditions.
ND Indicates the chemical was not detected in reference (background) surface soil samples.
— No Risk-based RGOs were calculated for the combined soil pathway (ingestion and dermal) because the combined risk was computed to be < 1E-4.
RBCr Indicates the risk (1E-6) or hazard (HQ=0.1) based screening value as presented in USEPA Region III, "Risk-based Screening Concentration Tables, March 18, 1994.
— Noncarcinogenic hazard based RGOs were computed based on the future child site resident scenario with combined ingestion and dermal exposure (where applicable).
— Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).
— As discussed in Section 10-7 of this BRA, the RGO for trivalent chromium is approximately 200 times that of hexavalent chromium.

Table 6-8
Remedial Goal Options for Shallow/Intermediate Groundwater

	Carcinogenic Risk-based RGOs			Hazard-based RGOs Hazard Goal						
Chemical	**1E-4**	**1E-05**	**1E-06**	**10**	**1**	**0.1**	**EPC (mg/l)**	**Reference Concentration (mg/L)**	**ARAR (mg/L)**	**Source**
1,2-Dichlorobenzene	NA	NA	NA	4.35	0.435	0.043	1.17	NA	0.6	FPDWS
1,3-Dichlorobenzene	NA	NA	NA	6.96	0.696	0.070	0.274	NA	0.01	FSDWS-OL
1,4-Dichlorobenzene	0.14	0.01	0.0014	17.92	1.792	0.179	0.442	NA	0.075	FPDWS
Aluminum	NA	NA	NA	156.40	15.64	1.564	8.66	3.82	0.2	FSDWS-OL
Arsenic	3.8E-03	3.8E-04	3.8E-05	0.05	0.005	0.0005	0.0077	NA	0.05	FPDWS
Benzene	0.11	0.01	1.14E-03	0.24	0.024	0.002	0.0016	NA	0.001	FPDWS
Bis(2-ethylhexyl)phthalate	0.48	0.05	4.78E-03	3.11	0.311	0.031	0.008	NA	0.006	FPDWS
Cadmium	NA	NA	NA	0.08	0.008	0.0008	0.011	0.0096	0.005	FPDWS
Chlorobenzene	NA	NA	NA	0.70	0.07	0.007	0.321	NA	0.1	FPDWS
Chromium	NA	NA	NA	0.78	0.078	0.008	0.0191	0.0325	0.1	FPDWS
Hexachloroethane	0.24	0.02	2.44E-03	0.08	0.008	0.001	0.0011	NA	0.01	FDWS-C
Manganese	NA	NA	NA	0.78	0.078	0.008	0.193	0.022	0.05	FSDWS
Mercury	NA	NA	NA	0.05	0.005	0.0005	0.000624	NA	0.002	FPDWS
Tetrachloroethene	0.12	0.012	0.0012	0.78	0.078	0.008	0.0073	NA	0.003	FPDWS
Vinyl Chloride	3.1E-03	3.1E-04	3.1E-05	NA	NA	NA	0.00321	NA	0.001	FPDWS

Notes:

NA	—	Indicates an RGO was not applicable for this chemical under risk and/or hazard based conditions.
ND	—	Indicates the chemical was not detected in reference (background) wells.

Noncarcinogenic hazard based RGOs were computed based on the future child site resident scenario with combined ingestion and inhalation exposure (where applicable).

Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).

FPDWS	—	Means Florida Primary Drinking Water Standard, MCL mean federal Maximum Contaminant Level.
FSDWS-OL	—	Indicates Florida secondary drinking water standard.
FDWS-C	—	Indicates Florida guidance concentration based on carcinogenicity.
*		Indicates the inhalation pathway was not considered in establishing remedial goal options.

Table 6-9
Remedial Goal Objectives for Deep Groundwater

Chemical	Carcinogenic Risk-Based RGOs Risk Goal 0.0001	1E-5	1E-6	Noncarcinogenic Hazard Based RGOs (mg/L) Hazard Index Goal 10	1	0.1	Exposure Point Concentration (mg/L)	Reference Concentration (mg/L)	ARAR (mg/L)	Source
Aluminum*	NA	NA	NA	NA	NA	NA	11.8	ND	0.05-0.2	FSDWS/SMCL
Arsenic*	0.004	0.0004	0.00004	0.05	0.005	0.0005	0.0048	ND	0.05	FPDWS/SMCL

Notes:

NA Indicates an RGO was not applicable for this chemical under risk and/or hazard based conditions.
ND Indicates the chemical was not detected in reference (background) wells.
— Noncarcinogenic hazard based RGOs were computed based on the future child site resident scenario with combined ingestion and inhalation exposure (where applicable).
— Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).
FPDWS Means Florida Primary Drinking Water Standard, MCL mean federal Maximum Contaminant Level.
FSDWS Means Florida Secondary Drinking Water Standard, SMCL mean federal Secondary MCL.
* Indicates the inhalation pathway was not considered for deep groundwater COCs in establishing remedial goal options.

evaluated during the Site 41, NAS Pensacola Wetlands remedial investigation. Potential impacts to Pensacola Bay (Site 42) and Bayou Grande (Site 40) from groundwater contaminants will be assessed during remedial investigations at those sites. Risk from soil north of the IWTP is limited to metals in surface soil. Risk associated with levels present is most likely minimal. Because the IWTP is industrial and there is considerable human activity, wildlife habitat is absent and avian and terrestrial wildlife are not drawn to the site. Contact with soil would be limited to animals traveling across the area only. Therefore, contaminant levels present do not present an unacceptable risk to the environment.

An initial groundwater study was conducted to evaluate if ecological effects occur from contaminated groundwater discharging into surface water bodies. The only organic compound detected in shallow groundwater that may possibly impact ecological receptors in surface water was dieldrin. Metals that could potentially effect ecological receptors include: cadmium, chromium, lead, mercury, and zinc. Detrimental effects to surface water receptors, based on levels present, are considered unlikely. All contaminants will be studied further during the Pensacola Bay, Bayou Grande, and NAS Pensacola Wetlands investigations.

7.0 DESCRIPTION OF THE REMEDIAL ALTERNATIVES

The OU 10 Focused Feasibility Study (FFS) report presented the results of a detailed analysis conducted on four potential remedial action alternatives. These alternatives have been developed to address onsite soil that may act as a source of chemical migration into groundwater or may act as an exposure source at the site; groundwater contamination that may migrate offsite. This section of the ROD summarizes the four alternatives that are described in the FFS report, which include:

- No Action with continued groundwater treatment under the RCRA program
- Institutional Controls with groundwater treatment under the RCRA program modified to meet CERCLA requirements
- Capping
- Excavation

Four remedial action alternatives were developed to address contaminated groundwater and soil and various areas of concern (AOCs) within OU 10. The AOCs were identified by comparing media-specific contaminant concentrations detected at OU 10 to media-specific remediation goals developed in the FFS. The AOCs identified for OU 10 include:

- Contaminated soil above risk levels (ARARs)
- Contaminated soil above FDEP leachability guidance (TBCs)
- Contaminated groundwater above ARARs

Figure 7-1 shows the general location of the above-mentioned AOCs for soil and groundwater. Table 7-1 summarizes the remedial objectives for soil. A concise description of how each alternative will address contamination at OU 10 as well as estimated cost follows.

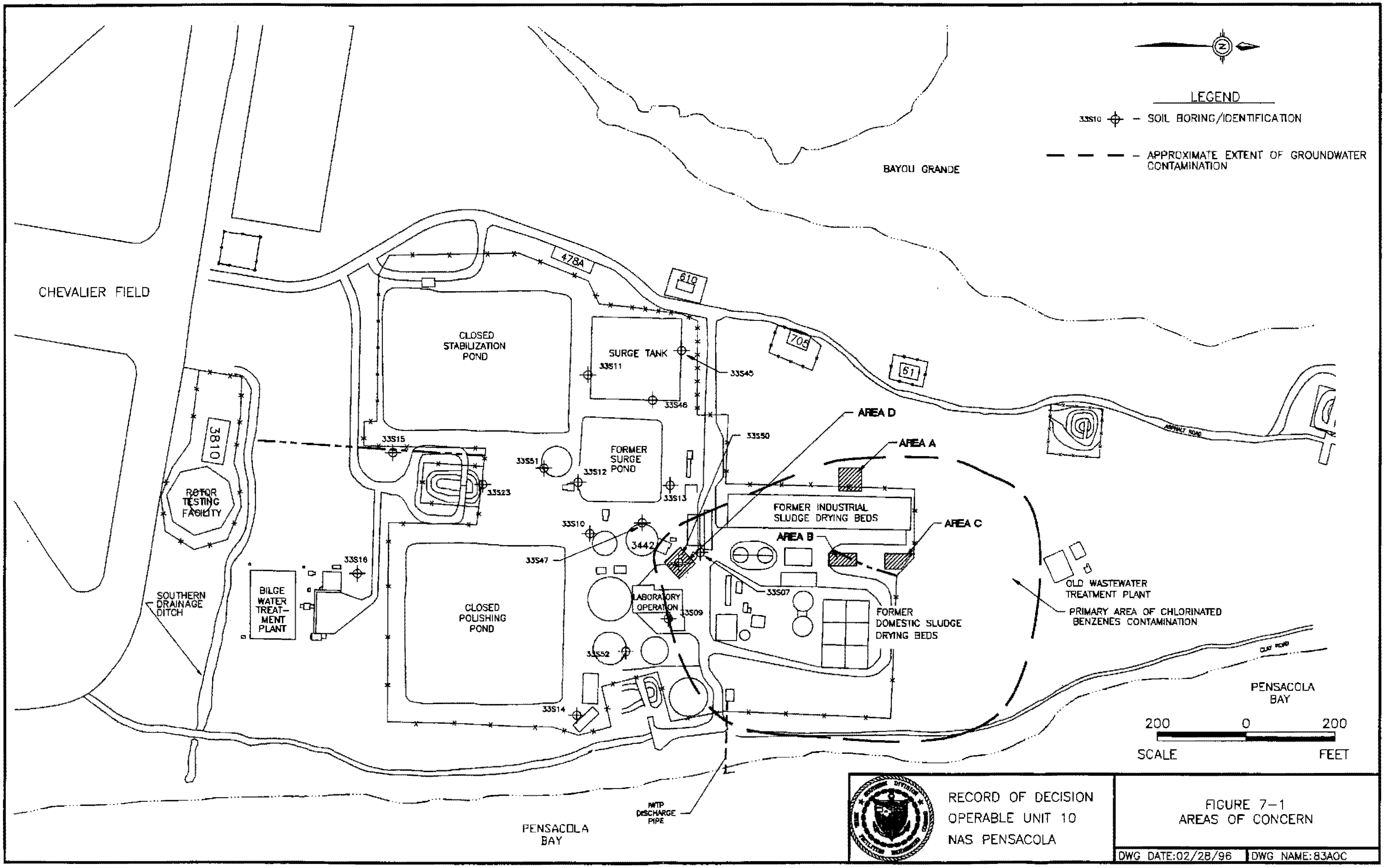

LEGEND
33S10 – SOIL BORING/IDENTIFICATION
– APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION
BAYOU GRANDE
CHEVALIER FIELD
CLOSED STABILIZATION POND
SURGE TANK
FORMER SURGE POND
ROTOR TESTING FACILITY
SOUTHERN DRAINAGE DITCH
BILGE WATER TREATMENT PLANT
CLOSED POLISHING POND
LABORATORY OPERATION
FORMER INDUSTRIAL SLUDGE DRYING BEDS
FORMER DOMESTIC SLUDGE DRYING BEDS
AREA A
AREA B
AREA C
AREA D
OLD WASTEWATER TREATMENT PLANT
PRIMARY AREA OF CHLORINATED BENZENES CONTAMINATION
WTP DISCHARGE PIPE
PENSACOLA BAY
200 0 200
SCALE FEET
RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 7-1
AREAS OF CONCERN
DWG DATE:02/28/96
DWG NAME:83AOC

Table 7-1
Soil Remedial Objectives

Objective	Location	Contaminated Media Estimated Volume (CY)	Rationale
Eliminate human health risk above $1x10^{-6}$ for residential land use.	West of closed ISDBs (Area A)	185	Benzo(a)pyrene and dibenz(a,h) anthracene above risk levels (ARAR).
Protect groundwater from leachable compounds.	Swale (Area B) Swale (Area C) North of operations building (Area D)	130 270 370	Chlorinated benzenes and naphthalene above performance standards

Note:
CY = Cubic yards

7.1 Alternative 1: No Action

Capital Cost: $0.00

Annual Operation and Maintenance (O&M) Costs: $0.00

Net Present Worth $0.00

The NCP requires consideration of a no-action alternative to serve as a baseline against which other alternatives are compared. In the no-action alternative, no further action will be taken to contain, remove, or treat soil contaminated above risk- or leachability-based performance standards.

Contaminated groundwater will be contained by the RCRA recovery system. Recovered groundwater will continue to be treated and disposed of at the wastewater treatment plant.

Potential health risks for the future resident will remain and no chemical-specific ARARs will be met. This alternative does not meet the effectiveness criterion as it does not reduce future child exposures to benzo(a)pyrene and dibenz(a,h)anthracene.

7.2 Alternative 2: Institutional Controls

Capital Cost:	$130,000.00
Annual Operation and Maintenance (O&M) Costs:	$0.00
Net Present Worth	$130,000.00

During the Remedial Design/Remedial Action period after the ROD is issued, a leachability study will be conducted to demonstrate whether contaminants found in soil above Florida levels are contributing significantly to groundwater contamination onsite. If the leachability study demonstrates that groundwater is being impacted by contaminants in soil, Alternative 4 would be the contingency remedy and the capital costs of the alternative would increase by $247,000.00 to a total of $377,000.00.

This alternative also would zone OU 10 for industrial use only on the Base Master Plan and prohibit Magazine Point from being used for residential use. This alternative eliminates risk to future potential child residents by not allowing the site to be residential. In addition, the Navy will meet RCRA requirements by modifying the existing recovery system to contain contaminated groundwater.

7.3 Alternative 3: Capping

Capital Cost:	$79,000.00
Annual Operation and Maintenance (O&M) Costs (for 30 years):	$6,000.00
Net Present Worth	$185,000.00

In the capping alternative, all four areas will be capped with asphalt. Caps will reduce risk of contact with contaminated soil and reduce quantity of leachate generated when rainwater filters through contaminated soil. The present cost of this alternative is estimated at $185,000, assuming 30 years of maintenance.

7.4 Alternative 4: Excavation with Offsite Disposal

Capital Cost:	$247,000.00
Annual Operation and Maintenance (O&M) Costs:	$0.00
Net Present Worth	$247,000.00

In the excavation and offsite disposal alternative, soil exceeding PRGs will be removed from OU 10 and disposed at an approved Subtitle D landfill to remove all current and future threats to human health and the environment posed by soil contamination. Soil would be sampled at the excavation extent to verify that soil remaining meets performance standards. The excavation will be refilled with clean soil.

Total costs presented above are $90,000, not including engineering services/report preparation or contingency costs. The cost estimate supplied by the Navy for engineering services/report preparation is $100,000. Dewatering may be required during removal activities. Short-term dewatering costs are expected to be $10,000 per week for equipment rental and operation.

8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides a comparative analysis of alternatives, examining potential advantages and disadvantages of each as per the nine criteria.

8.1 Threshold Criteria

All alternatives considered for selection must comply with the threshold criteria, overall protection of human health and the environment, and compliance with ARARs.

8.1.1 Overall Protection of Human Health and the Environment

This criterion evaluates, overall, the degree of protectiveness afforded to human health and the environment. It assesses the overall adequacy of each alternative.

Protection of Human Health

As discussed in Section 1, no human health risks greater than $1x10^{-6}$ are posed to current or future workers at the treatment plant. If OU 10 remains industrial, as proposed in Alternative 2 (institutional controls), no further actions will be required to protect human health.

Alternative 1, no action, does not protect future child residents from incidental ingestion pathway carcinogenic risk (computed to be $6x10^{-6}$) or dermal pathway risk ($2x10^{-6}$). Concentrations detected are within the carcinogenic risk range considered acceptable by USEPA ($1x10^{-6}$ to $1x10^{-4}$); these values only slightly exceed the risk considered acceptable by FDEP ($1x10^{-6}$). **There are no indications that Magazine Point will be used for residential purposes in future use scenarios.** Alternative 1 does not protect future users of shallow groundwater. The groundwater plume is not being contained by the existing RCRA corrective action.

Protection of the Environment

The BRA concluded there were no risks to the environment (i.e., ecological) due to contamination at OU 10 associated with sediment, surface water, or groundwater. If

State of Florida TBCs are considered appropriate to OU 10 with respect to protection of groundwater, Alternatives 1 through 4 provide varying degrees of protection to the environment.

The no-action alternative does not address soil in excess of FDEP leachability-based guidance concentrations for chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene. As discussed in Section 1, these constituents are present in groundwater, possibly due to closed RCRA units at Sites 32 and 33. A RCRA groundwater containment/recovery system is operating onsite. It is unclear from current site data (and highly unlikely given the contamination age) whether current volumes of soil contaminated with leachable compounds will significantly impact the aquifer any worse than the current scenario. The no-action alternative does not address that portion of contaminated groundwater not contained by the RCRA corrective action. Alternative 2, institutional controls, seeks to quantify threats to the environment from Areas B, C, and D. If risks are deemed unacceptable, this alternative relies on Alternative 4 (excavation and disposal) as a contingency remedy. Also, institutional controls require contaminated groundwater to be contained and remediated.

Alternative 3 affords long-term protection of the environment by significantly reducing the quantity of rainfall infiltrating through contaminated soil; Alternative 4 removes soil from the site and secures it in an approved landfill.

8.1.2 Compliance with ARARs

As discussed in Section 1, no threats to human health above the $1x10^{-6}$ risk threshold are present under the current-use (industrial) scenario. If the site remains industrial, as in the institutional controls alternative (Alternative 2), no further action will be required at OU 10 to protect human health other than enforcing requirements of the existing RCRA corrective action. If compliance with future residential use scenario is required, only Alternatives 3 and 4 will comply with ARARs. Alternatives 1 and 2 slightly exceed the $1x10^{-6}$ threshold for future child residents for soil. Alternative 2 complies with groundwater ARARs by modifying the RCRA recovery system.

Compliance with action- and location-specific ARARs for Alternatives 3 and 4 is anticipated and easily attainable.

Alternatives 3 and 4 will comply with State of Florida chemical-specific TBCs. Alternative 3, capping, reduces leachate generation in Areas B, C, and D. Alternative 4 eliminates risks to human health and the environment identified by TBCs through excavating contaminated soil and disposing it offsite. Alternative 2, institutional controls, seeks to quantify threats to groundwater using a site-specific leachability study and by achieving contaminant specific ARARs for groundwater. If threats are deemed unacceptable, soil is excavated and disposed as per Alternative 4.

As per the NCP, onsite remedial actions selected in the ROD must attain those ARARs that are identified at the time of the ROD signature or provide grounds for invoking a waiver under 300.430(f)(1)(ii)(C) (or CERCLA 121[d][4]).

8.2 Primary Balancing Criteria

Five primary balancing criteria typically highlight major differences between alternatives, which include: long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost.

8.2.1 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion assesses the results of a remedial action in terms of risk remaining at a site, particularly in terms of the magnitude of remedial risk and adequacy and reliability of controls.

Magnitude of Residual Risk

As stated in the BRA, no risk is posed to current and future site workers at OU 10; no further action is required at OU 10 to protect human health under an industrial-use scenario.

Alternative 2 uses institutional controls to ensure future development on Magazine Point is limited to industrial use, thus eliminating all risk pathways to a future child resident.

If a residential use scenario is applied to the site, a residual risk slightly exceeding the $1x10^{-6}$ threshold is present for future child residents in the no-action alternative. This risk is well within the range deemed acceptable for carcinogenic risks by USEPA ($1x10^{-6}$ to $1x10^{-4}$); this risk slightly exceeds the $1x10^{-6}$ threshold preferred by FDEP. Alternative 2 also reduces risk pathways associated with contaminated groundwater by containing, removing, and treating it.

Risks to future child residents are minimized in Alternative 3 by the presence of asphalt caps; this risk is eliminated in Alternative 4 by excavating and removing soil contaminated above the $1x10^{-6}$ threshold from the site.

Adequacy and Reliability of Controls

Controls inherent to OU 10 include fencing, limited access, and security provided by military personnel and adherence with existing RCRA permit conditions. If Magazine Point remains a part of the NAS Pensacola installation, these controls will be adequate for minimizing trespasser risks in Alternative 2, and no further actions are required to protect human health under an industrial scenario. There are currently no plans to convert Magazine Point into a residential area. The leachability study will be adequate to determine if site soil poses unacceptable risks to groundwater. Implementation of the RCRA corrective action modification will reduce the unacceptable risk associated with groundwater.

Alternative 3 provides slightly more reliable controls than the no-action alternative if Magazine Point and the treatment plant become residential areas. Asphalt caps will minimize contact of future child residents with soil contaminated above the $1x10^{-6}$ threshold and soil potentially leaching to groundwater. However, caps will require annual maintenance to ensure that contact risks are reduced and infiltration is minimized.

Alternative 4 provides the most reliability from future residential risks, as soil is removed from the site. Some liability may be incurred through disposal at a landfill facility.

8.2.2 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 2 reduces toxicity, mobility, or volume of contaminants through treatment. Alternative 2 restricts future land use on Magazine Point to industrial applications and requires continued recovery and treatment of contaminated groundwater. Alternative 3 reduces leachability of constituents through containment. Alternative 4 removes constituents from the site.

8.2.3 Short-Term Effectiveness

No short-term effectiveness issues are associated with Alternatives 1 or 2, unless excavation and disposal are determined to be necessary by the leachability study. If excavation is required in Alternative 2, short-term effects will be identical to those posed by Alternative 4.

Both Alternatives 3 and 4 have short-term issues associated with implementation. In both alternatives, exposures to workers, treatment plant personnel, and Magazine Point environs can be controlled using engineering controls and correct personal protective equipment during grading or excavating. Duration of field activities is relatively short, expected to require up to 6 months.

8.2.4 Implementability

All four alternatives are implementable at OU 10. Each alternative is technically and administratively feasible; none of the four alternatives requires special services or materials.

8.2.5 Cost

Capital (direct and indirect), O&M, and net present worth costs for all four alternatives are presented in Table 8-1, below. Costs associated with continued implementation of the RCRA corrective action are not shown. Its cost is included in the operations and maintenance of the system through RCRA corrective action.

8.3 Modifying Criteria

These criteria will be evaluated in detail following comment on the FFS report and the proposed plan and will be addressed once a final decision is being made and the ROD is being prepared.

Preliminary comments from the State of Florida indicate that the state will consider TBC criteria applicable to remedial actions at OU 10.

Table 8-1
Cost Comparison for Alternatives

Alternative	Direct and Indirect Costs	Annual O&M Costs	Total Net Present Worth
Alternative 1	None	None	None
Alternative 2	$130,000[b]	None	$130,000[a,b]
Alternative 3	$102,000[b]	$6,000	$185,000[b]
Alternative 4	$247,000[b]	None	$247,000[b]

Notes:
Net present worth costs, where appropriate, were calculated using a 6 percent discount rate over a 30-year period.
a = If the leachability study determines that threats to groundwater are unacceptable, present worth costs may increase to $377,000 (including Alternative 4 costs).
b = This includes cost estimates of engineering services/report preparation ($50,000 for Alternatives 2 and 3, $100,000 for Alternative 4) that were supplied by the Navy.

9.0 THE SELECTED REMEDY

Considering CERCLA requirements, the detailed analysis of alternatives using the nine criteria, and public comments, the Navy with USEPA and FDEP concurrence, has determined that Alternative 2 with Alternative 4 as a contingency is the most appropriate remedy for OU 10.

The selected remedy shall include the following:

- Designate the area as industrial on the Base Master Plan.

- Collect soil samples for leachability analysis from designated areas. If the leachability analysis demonstrates soil contamination is adversely impacting groundwater implement Alternative 4, excavation with offsite disposal.

- Modify the RCRA groundwater treatment system to capture contamination and meet CERCLA performance standards.

It is estimated the present worth cost of the selected remedy will be approximately $130,000 for direct and indirect costs. If the leachability study determines that threats to groundwater are unacceptable, present worth cost increase may increase to $377,000 to include Alternative 4 costs.

Alternative 2 will reduce risk of exposure to contaminants in soil and groundwater and will also prevent further adverse contamination to the environment.

Performance Standards

The selected remedy will be in effect until the remediation goals developed in the FFS are met. Performance standards for groundwater COCs and soil COCs are listed in Tables 9-1, 9-2, and 9-3. Where applicable, groundwater performance standards are based on Federal MCLs or FGGCs whichever is lower. Although arsenic, chromium, hexachloroethane, and mercury contribute to risk, they were not detected above their respective MCLs. Therefore, those parameters are not considered in selection of a remedial action. In the absence of above-mentioned criteria, a risk-based action level (based on an ICR of 1.0E-6 and an HI of .1) was developed. Soil remediation goals are based on *Florida Soil Cleanup Goals* or based on risk-based action levels for an ICR of 1.0E-6 and an HI of 0.1.

For groundwater, semiannual monitoring results of the groundwater plume, as required under the RCRA permit, will determine when remedial action has met performance standards. If the leachability analysis determines that soil is having an adverse effect on groundwater, confirmation samples at the excavation extent will ensure that it is complete.

Table 9-1
Chemical-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
Federal Requirements			
RCRA Maximum Concentration Limits 40 CFR 264 Subpart F	Applicable	Maximum Concentration Limits have been established for 14 toxic compounds under RCRA groundwater protection standards. A compliance monitoring program is included for RCRA facilities.	Applicable to OU 10 with current groundwater monitoring program; also applicable where identified hazardous wastes are treated, stored, or disposed onsite.
Safe Drinking Water Act MCLs 40 CFR 141.11 - 141.16	Applicable	MCLs have been set for toxic compounds as enforceable standards for public drinking water systems. SMCLs are unenforceable goals regulating aesthetic quality of drinking water.	The Sand and Gravel Aquifer is a potential source of drinking water. Some contaminants in the plume below OU 10 are above MCLs and SMCLs.
Safe Drinking Water Act MCLGs 40 CFR 141.50-141.51	Relevant and Appropriate	MCLGs are unenforceable goals under the SDWA.	The Sand and Gravel Aquifer is a potential source of drinking water. Some contaminants is plume below OU 10 are above MCLGs.
Clean Water Act Federal Water Quality Criteria 51 Federal Register 43665	Relevant and Appropriate	Effluent limitations must meet BAT. Water Quality Criteria for ambient water quality are provided for toxic chemicals.	Discharges to Pensacola Bay or Bayou Grande associated with groundwater remediation or other activities would have AWQCs as potential goal.
Clean Air Act National Emission Standards for Hazardous Air Pollutants 40 CFR 61	Not Applicable	Establishes emissions standards, monitoring and testing requirements, and reporting requirements for 8 pollutants in air emission.	No NESHAPs have been identified for OU 10.
Clean Air Act National Ambient Air Quality Standards 40 CFR Part 50	Applicable	Establishes emissions standards to protect public health and publish welfare. These standards are national limitations on ambient air intended to protect health and welfare.	Escambia County is an attainment area for ozone for which VOCs are a precursor.
State Requirements			
Florida Air Pollution Rules Title 62 Chapter 62-2	Applicable	Establishes emission standards, emission rates, baseline areas, and source classifications for protection of health and welfare. Identifies new source requirements, test and analysis methods.	Remedial actions may include technologies that have air emissions.
Florida Rules on Permits Title 62 Chapter 62-4	Relevant and Appropriate	Establishes requirements and procedures for all permitting required by FDER, and identifies anti-degradation requirements.	Requirements may be applicable to site depending upon remedial action and discharge options selected.

Table 9-1
Chemical-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
State Requirements			
Florida Ambient Air Quality Standard Title 62 Chapter 62-2	Applicable	Establishes ambient air quality standards and ambient test methods.	Remedial actions may include technologies which have air emissions.
Florida Water Quality Standards Title 62 Chapter 62-3	Applicable	Establishes minimum water quality criteria for groundwater.	Remedial objectives require remediation of Sand and Gravel Aquifer.
Florida Surface Water Standards Title 62 Chapter 62-301 and 62-302	Applicable	Establishes water quality standards for all state waters.	Remedial objectives require protection of surficial water. Remedial actions may impact surficial water bodies.
Florida Drinking Water Standards Title 62 Chapter 62-550	Applicable	Establishes MCLs for drinking water. Establishes secondary requirements for drinking water.	Remedial objectives require restoration of Sand and Gravel Aquifer to drinking water standards.
Florida Guidance Document on Petroleum Contaminated Soils	To Be Considered	Establishes cleanup levels for soil contaminated by petroleum spills/leaks.	Guidance provides clean up levels for metals in Florida soil.
Florida Soil Cleanup Goals	To Be Considered	Establishes cleanup levels for surface soil (upper 2 feet) and leachability levels for subsurface soil	Guidance provides clean up levels for Florida soil.

Table 9-2
Location-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
Federal Requirements			
RCRA Location Requirements 40 CFR 264.18(c)	Relevant and Appropriate	Sets forth minimum requirements for design, construction, and operation of a facility where treatment, storage, or disposal of hazardous waste will be located within a 100-year floodplain.	Treatment, disposal, and storage of hazardous materials may take place during site remediation. Some wastes are located within the 100-year floodplain.
National Historic Preservation Act of 1966 16 U.S.C. 470 et seq. 36 CFR Part 800	Not ARAR	Requires action not affect or cause harm to registered Historic Places or Historic Landmarks.	No registered Historic Places or Historic Landmarks are onsite or nearby.
Endangered Species Act 16 U.S.C. 1531 et seq. 50 CFR Part 402	Applicable	Action must avoid jeopardizing the continued existence of listed endangered or threatened species or modification of their habitat.	Endangered species are present on Magazine Point.
Coastal Zone Management Act 16 U.S.C. 1451 et seq. 15 CFR Part 930	Applicable	Activities affecting land or water uses in a coastal zone required to certify noninterference with coastal zone management.	OU 10 is located on Magazine Point, a peninsula in Pensacola Bay adjacent to navigable channels.
Fish and Wildlife Coordination Act 16 U.S.C. 661 et seq.	Applicable	Requires actions to protect fish and wildlife from actions modifying streams or areas affecting streams.	Onsite remediation activities may include modifications to Pensacola Bay of Bayou Grande adjacent to the site.
Clean Water Act Section 404 Pertaining to Wetlands 33 U.S.C. 1251 et seq.	Not Applicable	Prohibits discharge of dredged or fill material into navigable waters without a permit.	Remedial activities will not include discharge of dredge or fill material to Pensacola Bay or Bayou Grande.
Executive Order 11990 Wetlands Protection Policy	Applicable	Sets forth policy for wetlands protection.	There are several wetlands on Magazine Point that fit the definition under the Executive Order.
Executive Order 11988 Floodplain Management Policy	To Be Considered	Sets forth policy for floodplains protection.	The entire site is located in a 100 year floodplain; however, Executive Order sets forth policy and is not enforceable.
Clean Air Act National Ambient Air Quality Standards 40 CFR Part 50	Applicable	Establishes emissions standards to protect public health and public welfare. These standards are national limitations on ambient air intended to protect health and welfare.	Escambia County is an attainment area for ozone for which VOCs are a precursor.

Table 9-2
Location-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
State Requirements			
Florida Air Pollution Rules Title 62 Chapter 62-2	Applicable	Establishes emission standards, emission rates, baseline areas, and source classifications for protection of health and welfare. Identifies new source requirements, test and analysis methods.	Remedial actions may include technologies that have air emissions.
Florida Rules on Permits Title 62 Chapter 62-4	Relevant and Appropriate	Establishes requirements and procedures for all permitting required by the FDER, and defines antidegradation requirements.	Requirements may be applicable to site depending upon remedial actions and discharge options selected.
Florida Ambient Air Quality Standards Title 62 Chapter 62-2	Applicable	Establishes ambient air quality standards and ambient test methods.	Remedial actions may include technologies which have air emissions.
Florida Industrial Wastewater Facilities Regulations Title 62 Chapter 62-660	Applicable	Establishes effluent limitations and minimum treatment requirements for industrial facilities; establishes water quality criteria.	Remedial actions may require treated effluent to be discharged as per state and federal regulations.
Florida Water Quality Standards Title 62 Chapter 62-3	Applicable	Establishes minimum water quality criteria for groundwater.	Remedial objectives require remediation of Sand and Gravel Aquifer.
Florida Surface Water Standards Title 62 Chapter 62-301 and 62-302	Applicable	Establishes water quality standards for all waters of the state.	Remedial objectives require protection of surficial water. Remedial actions may impact surficial water bodies.
Florida Beach and Shore Preservation Act Chapter 161	Applicable	Establishes guidelines for work which may impact upon beaches and shorelines of the state.	Remediation actions may impact beaches or shorelines on Magazine Point.

Table 9-3
Action-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
Federal Requirements			
RCRA Identification of Hazardous Waste 40 CFR 261	Applicable	Criteria for identifying those solid wastes subject to regulation as hazardous waste under RCRA.	Suspected hazardous wastes at OU 10 should be identified as RCRA hazardous waste or nonhazardous waste prior to remedial activities.
RCRA Identification of Hazardous Waste 40 CFR 261.33(d)	Applicable	Defines a material as hazardous waste if it is a residue or contaminated soil, water or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in the section.	Soil and groundwater contamination at OU 10 are a result of contact with wastewater containing F006 wastes. Spent solvents may also have been present in industrial wastewater, triggering F001-F005 classifications.
RCRA Facility Standards	Applicable	Establishes minimum standards for the acceptable management of RCRA hazardous wastes. Includes preparedness and prevention measures, general facility standards, and contingency and emergency procedures.	Treatment, storage, and/or disposal of RCRA hazardous wastes may occur at OU 10 during remediation.
RCRA Manifest System, Recordkeeping, and Reporting 40 CFR 264 Subpart E	Applicable	Establishes the rules and recordkeeping requirements for offsite transportation of RCRA hazardous materials for treatment and/or disposal.	Offsite transportation of RCRA hazardous wastes for treatment and/or disposal may be included in the site remediation.
RCRA Groundwater Monitoring Requirements 40 CFR 264 Subpart F	Applicable	Establishes minimum requirements for groundwater monitoring and protection standards for RCRA facilities.	Onsite treatment, storage, and/or disposal of RCRA wastes may be included in the remediation of OU 10.
RCRA Closure and Post-closure Requirements 40 CFR 264 Subpart G	Applicable	Establishes minimum requirements for closure and post-closure care of a RCRA facility engaging in treatment, storage, and/or disposal of hazardous wastes. Closure requirements include in-place wastes and remediated areas.	At the conclusion of a remedial action involving the treatment, storage, disposal, removal of hazardous wastes, closure procedures and post-closure care would be required.
RCRA Landfill Requirements 40 CFR 264 Subpart M	Applicable	Establishes minimum requirements for the design and construction, operation and maintenance, monitoring and inspection, closure and post-closure care for a hazardous waste landfill.	Remedial actions may include RCRA hazardous waste to be landfilled onsite.

Table 9-3
Action-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
Federal Requirements			
RCRA Treatment Requirements 40 CFR 264 Subparts O and X	Applicable	Establishes minimum requirements for the permit approval, operation, and standards for incineration and other treatment for hazardous wastes.	Remediation may include incineration and/or treatment of hazardous wastes.
RCRA Land Disposal Restrictions 40 CFR 268	Applicable	Certain classes of waste are restricted from land disposal without acceptable treatment.	Removal of soil from OU 10 for land disposal may trigger the regulation after its effective date for CERCLA wastes on 5/8/93.
Clean Air Act National Ambient Air Quality Standards 40 CFR Part 50	Applicable	Establishes emissions standards to protect public health and public welfare. These standards are national limitations on ambient air intended to protect health and welfare.	Escambia County is an attainment area for ozone for which VOCs are a precursor.
Clean Water Act Discharge Limitations NPDES Permit 40 CFR 122, 125, 129, 136 Pretreatment Standards 40 CFR 403.5	Applicable	Prohibits unpermitted discharge of any pollutant or combination of pollutants to waters of the U.S. from any point source. Standards and limitations are established for these discharges and discharges to POTWs.	Remedial actions may include the discharge of treated groundwater, runoff, or other flows to a surface water or publicly owned treatment facility.
Clean Water Act Wetlands Regulations Part 404 40 CFR 230	Relevant and Appropriate	Controls the discharge of dredged or fill materials into waters of the U.S. such that the physical and biological integrity is maintained.	Remedial actions may occur along Pensacola Bay or Bayou Grande.
Executive Order 11990 Wetlands Protection Policy	To Be Considered	Establishes guidelines for identification and protection of wetlands.	Several wetlands are present on Magazine Point.
Executive Order 11988 Floodplain Management Policy	To Be Considered	Establishes guidelines for activities conducted within a 100-year floodplain.	OU 10 is located within a 100-year floodplain.
Department of Transportation Rules for the Transport of Hazardous Substances 49 CFR Parts 107 and 171-179	Applicable	Regulates the labelling, packaging, placarding, and transportation of solid and hazardous wastes offsite.	Remedial actions may include offsite transport and disposal of solid and hazardous wastes.

Table 9-3
Action-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
Federal Requirements			
Occupational Safety and Health Standards 29 CFR 1910.120 for Hazardous Waste Operations and Emergency Responses, Part 1926 for General Safety and Health Standards, and Reporting Requirements	Applicable	Sets limits on exposure to workers on hazardous site or emergency responses, sets forth minimum health and safety requirements such as personal protection and training, and reporting requirements.	All activities taking place at OU 10 including remediation, construction, and monitoring are subject to OSHA health and safety regulations.
State Requirements			
Florida Air Pollution Rules Title 62 Chapter 62-2	Applicable	Establishes emission standards, emission rates, baseline areas, and source classifications for protection of health and welfare. Identifies new source requirements, test and analysis methods.	Remedial actions may include technologies that have air emissions.
Florida Rules on Permits Title 62 Chapter 62-4	Applicable	Establishes requirements and procedures for all permitting required by FDER, and defines antidegradation requirements.	Requirements may be applicable to site depending upon remedial actions and discharge options selected.
Florida Ambient Air Quality Standards Title 62 Chapter 62-2	Applicable	Establishes ambient air quality standards and ambient test methods.	Remedial actions may include technologies which have air emissions.
Florida Stormwater Discharge Regulations Title 62 Chapter 62-25	Applicable	Establishes design and performance standards and permit requirements for stormwater discharge facilities.	Remedial actions may impact stormwater discharge patterns at OU 10.
Florida Water Quality Standards Title 62 Chapter 62-3	Applicable	Establishes minimum water quality criteria for groundwater.	Remedial objectives require remediation of the Sand and Gravel Aquifer.
Florida Surface Water Standards Title 62 Chapter 62-301 and 62-302	Applicable	Establishes water quality standards for all waters of the state.	Remedial objectives require protection of surficial water. Remedial actions may impact surficial water bodies.
Florida Drinking Water Standards Title 62 Chapter 62-550	Applicable	Establishes MCLs for drinking water. Establishes secondary requirements.	Remedial objectives require restoration of surficial aquifer to drinking water status.
Florida Resource Recovery and Management Regulations Title 62 Chapter 62-7	Applicable	Establishes guidelines for resource recovery programs as well as hazardous waste site disposal and monitoring criteria.	If hazardous wastes or other wastes are disposed of onsite, these regulations would become applicable.

Table 9-3
Action-Specific ARARs

Requirements	Status	Requirement Synopsis	Application to the RI/FS
State Requirements			
Florida Hazardous Waste Rules Title 62 Chapter 62-730	Applicable	Establishes standards for generators and transporters of hazardous wastes, and owners and operators of hazardous waste facilities. Outlines permitting requirements.	Applicable if remedial actions generate and/or transport hazardous wastes.
Florida Hazardous Substance Release Notification Rules Title 62 Chapter 62-150	Applicable	Establishes notification requirements in the event of a hazardous substance release.	May be applicable if a hazardous substance is released during remedial activities.
Florida Rules on Hazardous Waste Warning Signs	Applicable	Establishes standard warning messages and specifications for signs used at hazardous waste sites.	Remediation systems may require signage for public notification.
Florida Beach and Shore Preservation Act Chapter 161	Applicable	Establishes guidelines for work which may impact upon state beaches or shorelines.	Remediation actions may impact beaches or shorelines on Magazine Point.
Well Permits	To Be Considered	Establishes local criteria for design and installation of monitoring wells.	Installation of monitoring wells will be a necessary part of site remediation given any alternative.

10.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, 42 U.S.C. § 9621, the Navy must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy at OU 10 meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy provides protection of human health and the environment by eliminating, reducing, and controlling risk through institutional controls. Contaminated groundwater will be treated by modifying the RCRA groundwater treatment system. Soil and groundwater treatment, if required, are delineated through performance standards described in Section 9 of the ROD. Institutional controls will prevent exposure to contaminants.

However, if soil contamination is adversely impacting groundwater, Alternative 4 will be implemented and soil performance standards will be met through removal. There are no unacceptable short-term risk or cross-media impacts caused by implementation of the remedy.

10.2 Attainment of the ARARs

Remedial actions performed under CERCLA, Section 121, 42 U.S.C. § 9621 must comply with all ARARs. All alternatives considered for OU 10 were evaluated based on the degree to which they complied with these requirements. The selected remedy with contingent remedial action was found to meet or exceed identified ARARs.

10.3 Cost Effectiveness

The Navy believes the selected remedy, Alternative 2, will eliminate risks to human health at an estimated cost of $130,000. If soil is found to be adversely affecting groundwater, soil excavation costs will be $247,000. However, Alternative 2 may and is expected to achieve a comparable effectiveness at a substantially lower cost (although over a longer period of time). Alternative 2 provides an overall effectiveness proportionate to its costs, such that it represents a reasonable value achieved for the investment.

10.4 Use of Permanent Solutions to the Maximum Extent Practicable

The Navy, with USEPA and Florida concurrence, have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for final remediation at OU 10 at NAS Pensacola. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy with USEPA and Florida concurrence, have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and consideration of state and community acceptance. The selected remedy will satisfy the statutory preference for treatment if the contingency remedial action is implemented. The selected remedy provides for long-term effectiveness and permanence, is easily implemented, reduces toxicity, mobility or volume, and is cost effective.

10.5 Preference for Treatment as a Principal Element

The selected remedy with contingency uses treatment technologies to the extent practicable. The statutory preference for remedies that employ treatment as a principal element is satisfied.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant changes in the selected remedy, Alternative 2, from the preferred remedy described in the proposed plan.

Appendix A

Glossary

This glossary defines terms used in this record of decision describing CERCLA activities. The definitions apply specifically to this record of decision and may have other meanings when used in different circumstances.

ADMINISTRATIVE RECORD: A file which contains all information used by the lead agency to make its decision in selecting a response action under CERCLA. This file is to be available for public review and a copy is to be established at or near the site, usually at one of the information repositories. Also a duplicate is filed in a central location, such as a regional or state office.

AQUIFER: An underground formation of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs. Most aquifers used in the United States are within a thousand feet of the earth's surface.

BASELINE RISK ASSESSMENT: A study conducted as a supplement to a remedial investigation to determine the nature and extent of contamination at a Superfund site and the risks posed to public health and/or the environment.

CARCINOGEN: A substance that can cause cancer.

CLEANUP: Actions taken to deal with a release or threatened release of hazardous substances that could affect public health and/or the environment. The noun "cleanup" is often used broadly to describe various response actions or phases of remedial responses such as Remedial Investigation/Feasibility Study.

COMMENT PERIOD: A time during which the public can review and comment on various documents and actions taken, either by the Department of Defense installation or the USEPA. For example, a comment period is provided when USEPA proposes to add sites to the National Priorities List.

COMMUNITY RELATIONS: USEPA's, and subsequently Naval Air Station Pensacola's, program to inform and involve the public in the Superfund process and respond to community concerns.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The act created a special tax that goes into a trust fund, commonly known as "Superfund," to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Under the program the USEPA can either:

- Pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work.
- Take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government for the cost of the cleanup.

DEFENSE ENVIRONMENTAL RESTORATION ACCOUNT (DERA): An account established by Congress to fund DOD hazardous waste site cleanups, building demolition, and hazardous waste minimization. The account was established under the Superfund Amendments and Reauthorization Act.

DRINKING WATER STANDARDS: Standards for quality of drinking water that are set by both the USEPA and the FDEP.

EXPLANATION OF DIFFERENCES: After adoption of final remedial action plan, if any remedial or enforcement action is taken, or if any settlement or consent decree is entered into, and if the settlement or decree differs significantly from the final plan, the lead agency is required to publish an explanation of any significant differences and why they were made.

FEASIBILITY STUDY: See Remedial Investigation/Feasibility Study.

GROUNDWATER: Water beneath the earth's surface that fills pores between materials such as sand, soil or gravel. In aquifers, groundwater occurs in sufficient quantities that it can be used for drinking water, irrigation, and other purposes.

HAZARD RANKING SYSTEM (HRS): A scoring system used to evaluate potential relative risks to public health and the environment from releases or threatened releases of hazardous substances. USEPA and states use the HRS to calculate a site score, from 0 to 100, based on the actual or potential release of hazardous substances from a site through air, surface water, or groundwater to affect people. This score is the primary factor used to decide if a hazardous site should be placed on the NPL.

HAZARDOUS SUBSTANCES: Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

INFORMATION REPOSITORY: A file containing information, technical reports, and reference documents regarding a Superfund site. Information repositories for Naval Air Station Pensacola are located at the West Florida Regional Library, 200 W. Gregory Street, Pensacola, Florida; The John C. Pace Library, University of West Florida; and the NAS Pensacola Library, Building 633, Naval Air Station, Pensacola, Florida.

MAXIMUM CONTAMINANT LEVEL: National standards for acceptable concentrations of contaminants in drinking water. These standards are legally enforceable standards set by the USEPA under the Safe Drinking Water Act.

MONITORING WELLS: Wells drilled at specific locations on or off a hazardous waste site where groundwater can be sampled at selected depths and studied to assess the groundwater flow direction and the types and amounts of contaminants present, etc.

NATIONAL PRIORITIES LIST (NPL): The USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from the trust fund. The list is based primarily on the score a site receives on the Hazard Ranking System. USEPA is required to update the NPL at least once a year.

PARTS PER BILLION (ppb)/PARTS PER MILLION (ppm): Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene in a million ounces of water is 1 ppm; 1 ounce of trichloroethylene in a billion ounces of water is 1 ppb. If one drop of trichloroethylene is mixed in a competition-size swimming pool, the water will contain about 1 ppb of trichloroethylene.

PRELIMINARY REMEDIATION GOALS: Screening concentrations that are provided by the USEPA and the FDEP and are used in the assessment of the site for comparative purposes prior to remedial goals being set during the baseline risk assessment.

PROPOSED PLAN: A public participation requirement of SARA in which the lead agency summarizes for the public the preferred cleanup strategy, and the rationale for the preference, reviews the alternatives presented in the detailed analysis of the remedial investigation/feasibility study, and presents any waivers to clean up standards of Section 121(d)(4) that may be proposed. This may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public review and comment on all alternatives under agency consideration.

RECORD OF DECISION (ROD): A public document that explains which cleanup alternative(s) will be used at NPL sites. The Record of Decision is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments and community concerns.

REMEDIAL ACTION (RA): The actual construction or implementation phase that follows the remedial design and the selected cleanup alternative at a site on the NPL.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS): Investigation and analytical studies usually performed at the same time in an interactive process, and together referred to as the "RI/FS." They are intended to: (1) gather the data necessary to determine the type and extent of contamination at a Superfund site; (2) establish criteria for cleaning up the site; (3) identify and screen cleanup alternatives for remedial action; and (4) analyze in detail the technology, and costs of the alternatives.

REMEDIAL RESPONSE: A long-term action that stops or substantially reduces a release or threatened release of hazardous substances that is serious, but dose not pose an immediate threat to public health and/or the environment.

REMOVAL ACTION: An immediate action performed quickly to address a release or threatened release of hazardous substances.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA): A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new, uncontrolled hazardous waste sites.

RESPONSE ACTION: As defined by Section 101(25) of CERCLA, means remove, removal, remedy, or remedial action, including enforcement activities related thereto.

RESPONSIVENESS SUMMARY: A summary of oral and written public comments received by the lead agency during a comment period on key documents, and the response to these comments prepared by the lead agency. The responsiveness summary is a key part of the ROD, highlighting community concerns for USEPA decision-makers.

SECONDARY DRINKING WATER STANDARDS: Secondary drinking water regulations are set by the USEPA and the FDEP. These guidelines are not designed to protect public health, instead they are intended to protect "public welfare" by providing guidelines regarding the taste, odor, color, and other aesthetic aspects of drinking water which do no present a health risk.

SUPERFUND: The trust fund established by CERCLA which can be drawn upon to plan and conduct clean ups of past hazardous waste disposal sites, and current releases or threats of releases of nonpetroleum products. Superfund is often divided into removal, remedial, and enforcement components.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA): The public law enacted on October 17, 1986, to reauthorize the funding provisions, and to amend the authorities and requirements of CERCLA and associated laws. Section 120 of SARA requires that all federal facilities "be subject to and comply with, this act in the same manner and to the same extent as any non-governmental entity."

SURFACE WATER: Bodies of water that are above ground, such as rivers, lakes, and streams.

VOLATILE ORGANIC COMPOUND: An organic (carbon-containing) compound that evaporates (volatizes) readily at room temperature.

Appendix B

Responsiveness Summary

RESPONSIVENESS SUMMARY

Overview

At the time of the public comment period, the U.S. Navy had selected a preferred remedy to address soil and groundwater contamination at OU 10 on NAS Pensacola. This preferred remedy was selected in coordination with the USEPA and the FDEP. The NAS Pensacola Restoration Advisory Board, a group of community volunteers, reviewed the technical details of the selected remedy and no fundamental objections to its selection have been raised.

The sections below describe the background of community involvement on the project and comments received during the public comment period.

Background of Community Involvement

Throughout the site's history, the community has been kept abreast of site activities through press releases to the local newspaper and television stations that reported on site activities. Site related documents were made available to the public in the administrative record at information repositories maintained at the NAS Pensacola Library, the West Florida Regional Library, and the John C. Pace Library of the University of West Florida.

On February 15, 1996, newspaper announcements were placed to announce the date and location of the public meeting to present the proposed plan (PP), the public comment period (February 19 through April 4, 1996) and included a short synapses of the PP. The add ran in the *Pensacola News Journal*. In conjunction with these newspaper announcements, addresses on the Installation Restoration Program mailing list were sent a proposed plan. A public meeting was held at the Pensacola Junior College Warrington Campus on February 27, 1996.

Summary of Comments Received During the Public Comment Period

This section will be completed after the close of the public comment period on April 4, 1996.