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FIVE-YEAR REVIEW OPERABLE UNITS 1, 2, 3 AND 4 NAS JACKSONVILLE FL (PUBLIC DOCUMENT)

9/1/2005

TETRA TECH

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62467-94-D-0888

Rev. 1
09/16/05

Five-Year Review

Operable Units 1, 2, 3, and 4

Naval Air Station Jacksonville
Jacksonville, Florida

Contract Task Order 0342

September 2005

Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

FIVE-YEAR REVIEW

OPERABLE UNITS 1, 2, 3, AND 4

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

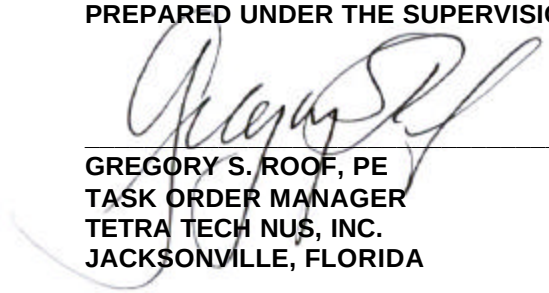
Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0342

SEPTEMBER 2005

PREPARED UNDER THE SUPERVISION OF:



GREGORY S. ROOF, PE
TASK ORDER MANAGER
TETRA TECH NUS, INC.
JACKSONVILLE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBRA M. HUMBERT
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

Five-Year Review Summary Form

SITE IDENTIFICATION			
Site Name *(from WasteLAN)*: Naval Air Station Jacksonville			**EPA ID *(from WasteLAN)*:** *FL6 170 024 412*
Region: 4	**State:** FL	**City/County:** Jacksonville/Duval	

SITE STATUS
NPL status: Final
Remediation status (under construction, operating, complete): Under Construction and Operating
Multiple OUs*? (highlight): Y N **Construction completion date:** To be determined
Has site been put into reuse? (highlight): Y N

REVIEW STATUS		
Lead agency: Department of the Navy, Southern Division Naval Facilities Engineering Command		
Author name:	**Author title:** Remedial Project Manager	
Author affiliation: Department of the Navy, Southern Division Naval Facilities Engineering Command		
Review period:** May 2001 to May 2005	**Date(s) of site inspection:**	
	Type of review (highlight): 1. Pre-SARA 2. Post-SARA 3. NPL-Removal Only 4. Regional Discretion 5. NPL State/Tribe-lead	**Review number (1, 2, etc.):** 2
Triggering action: Interim Remedial Action at Operable Unit 1		
Trigger action date *(from WasteLAN)*: *March 6, 1995*		
Due date *(five years after triggering action date)*: *March 6, 2005*		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Issues:

Issues discovered for NAS Jacksonville during the five-year review were as follows:

OU 1

1. Soil and Groundwater contamination on NW boundary of OU 1 is not delineated.
2. LNAPL recovery rates slower than expected.
3. LNAPL system not operating.
4. Lock missing on well MW-67.
5. Missed one LUC inspection.
6. No HASP or contingency plan exists for the LNAPL system.
7. Indoor Air Intrusion potential for residences in the groundwater contamination plume area.
8. According to the most recent USGS modeling effort, there is a potential for contaminated groundwater in the northern portion of the plume to migrate beyond the currently defined groundwater system.
9. The LNAPL system operation has been discontinued, and the RAO has not been achieved. A new remedy (e.g., natural attenuation) may need selected and the proper administrative actions performed.

OU 3

1. Monitoring well networks at Buildings 106 and 780 are insufficient.
2. The Response Action for PSC 48 and Building 780 is not expected to achieve cleanup levels; plume containment has not been confirmed or achieved.
3. Areas C and D not being monitored quarterly as stipulated in the ROD. Documentation of this was not found.
4. Monitoring well networks at Areas C and D do not encompass all of the groundwater contamination (e.g., the COC concentrations in the perimeter wells exceed GCTLs).
5. The COC list for Area C (from the ROD) does not include several other chlorinated VOCs that are exceeding groundwater standards. There appears to be no documentation of the change to add these to the monitoring program.
6. There are only LUCs in place for PSCs 14 and 15 at OU 3 for groundwater, though it was mentioned as part of the selected remedy for other areas of elevated groundwater contamination.
7. Low levels of contamination (less than 100 ppb) exist across most of OU 3 without a selected remedy.
8. Reported groundwater contamination exists just outside the existing boundary of OU 3.
9. The documentation for the future course of action for PSC 16 and regulatory approvals are incomplete to date.
10. The RAO for sediment does not appear to have been achieved.

Basewide (All OUs and sites)

1. Missed one LUC quarterly inspection for the year 2003.
2. Individual LUCIPs do not appear to have been prepared for all LUC sites at NAS Jacksonville.

Recommendation and Required Actions:

The following actions for NAS Jacksonville are recommended to be protective of human health and the environment:

OU 1

1. Do supplemental investigation along NW boundary to define and delineate shallow soil and groundwater issues. Make protectiveness determination.

2, 3. The LNAPL system was shutdown in February 2005. Therefore, these issues have been overcome by events.

4. Replace lock on well MW-67.

5. Inspect site quarterly or as required by LUCIPs.
6. The LNAPL system was shutdown in February 2005. Therefore, these issues have been overcome by events.
7. Evaluate this issue and take any required corrective actions.
8. Add monitoring wells located east of MW-89 to the monitoring program to verify that the groundwater contamination is contained within the monitoring network.
9. Prepare proper CERCLA documentation for alternate remedy.

OU 3

1. Monitoring well network issues should be addressed in the planned additional investigation resulting from the optimization study.
2. Complete the actions required from the optimization effort.
3. Prepare documentation and regulatory approvals.
4. Implement LUC including groundwater use restrictions for areas around OU 3 Areas C and D.
5. Prepare documentation and regulatory approvals for the new COCs in this program.
6. Draft and enact appropriate institutional controls for OU 3 to restrict access and exposure to various COCs in media as indicated by the ROD.
7. As part of LUCs for OU 3, restrict groundwater use from beneath OU 3 until RAOs are achieved.
8. Redraw existing boundary of OU 3 to include identified groundwater contamination.
9. Prepare documentation and regulatory approvals for the proposed future course of action.
10. Address this issue with Issue 9.

Basewide (All OUs and sites)

1. Inspect site quarterly as required by LUCIPs.
2. Prepare LUCIPs for each site covered under the station's LUC program per the MOA.

Protectiveness Statement(s):

OU 1

The remedial actions at OU 1 are currently protective of human health and the environment. However, a protectiveness determination for Issues 1, 7, 8 and 9 cannot be made at this time until further information is obtained. Further information for Issue 1 will be obtained through an indoor vapor air intrusion evaluation and any required testing. Further information for Issue 7 will be obtained via additional investigation on the northwestern side of the OU 1 landfill. It is expected that these actions will require approximately five years to complete, at which time a protectiveness determination will be made.

OU 2

The remedy at OU 2 is protective of human health and the environment. The institutional controls and RCRA groundwater monitoring at OU 2 provide an acceptable degree of protection of human health and the environment as long as they are conducted as required. The institutional controls help protect against exposure to groundwater and the stabilized soil and sediment.

OU 3

The following protectiveness statements apply to the various remedies for OU 3:

1. The remedial actions for PSC 14 and PSC 15 are protective of human health and the environment.

2. The remedial actions at PSC 48 and Building 780 are not protective because of the following issues:

    - The monitoring well networks at these sites are insufficient to define the extent of groundwater contamination.
    - The response actions for PSC 48 and Building 780 are not expected to achieve cleanup levels; plume containment has not been confirmed or achieved.

The following actions need to be taken:

- Implement groundwater restrictions and LUCs at the site to ensure short term protectiveness.
- Completely assess the horizontal and vertical extent of groundwater contamination at each site.
- Through the optimization effort, provide an applicable remedy for each site that will meet the CERCLA criteria.

3. The remedial actions at Area B at OU 3 are expected to be protective of human health and the environment, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

4. The remedial actions at Areas C and D at OU 3 are not protective because of the following issue: the monitoring well networks at these sites are insufficient to define the extent of groundwater contamination. The following action needs to be taken: implement groundwater restrictions and LUCs at the site to ensure short term protectiveness.

5. A protectiveness determination of the remedy for OU 3 Areas F and G cannot be made at this time until the remedial design is completed and implemented.

6. A protectiveness determination of the remedy for PSC 16 cannot be made at this time until further information is obtained by making a formal determination of the actions required for this site. Specifically, the RAO has yet to be achieved. Future actions should address this issue. It is expected that this will require approximately one year to complete, at which time a protectiveness determination will be made.

7. The remedies at OU 3 are not protective because there are multiple locations of groundwater contamination exceeding ARARs that have no remedy in place. The following actions should be taken to ensure protectiveness:

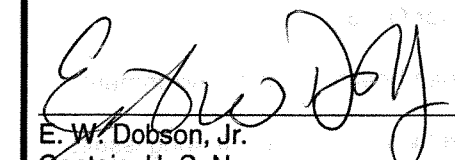
    - Determine the required extent of groundwater restrictions via literature search to find wells that were sampled for the various COCs within OU 3 and had results which were less than regulatory limits.
    - Implement groundwater use restrictions through a LUC to prevent exposure to groundwater at OU 3.

OU 4

The selected remedy for OU 4 is protective of human health and the environment for the site.

This five-year review shows that the Navy is meeting the requirements of the Records of Decision (RODs) for the OUs at NAS Jacksonville.

Signature of U.S. Department of the Navy and Date

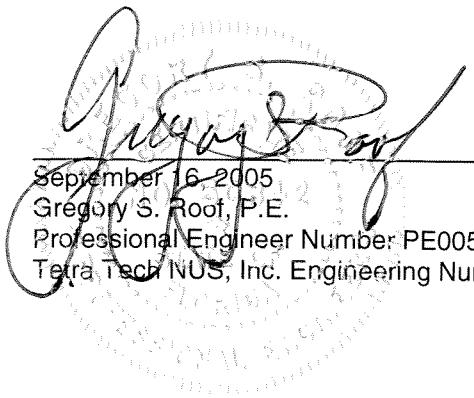


E. W. Dobson, Jr.
Captain, U. S. Navy
Commanding Officer
NAS Jacksonville

November 7, 2005
Date

NAVFAC
Naval Facilities Engineering Command

This document, the Five Year Review for Operable Units 1, 2, 3 and 4 at Naval Air Station Jacksonville, Jacksonville, Florida, has been prepared under the direction of a Florida-registered professional engineer. The work and professional opinions rendered in this report were developed in accordance with commonly accepted procedures consistent with applicable standards of practice and based on information by others. Should information come to light other than what was known at the time of this document preparation, the engineer reserves the right to modify his findings.



September 16, 2005
Gregory S. Roof, P.E.
Professional Engineer Number PE0050842
Tetra Tech NUS, Inc. Engineering Number 7988

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TABLES

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FIGURES

NUMBER **PAGE**

ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
Aerostar	Aerostar Environmental Services, Inc.
AGM	ARCADIS Geraghty & Miller, Inc.
Apex	Apex Environmental
ARARs	Applicable or Relevant and Appropriate Requirements
AS	Air Sparging
AS/SVE	Air Sparge with Soil Vapor Extraction
BEI	Bechtel Environmental, Inc.
bgs	Below Ground Surface
CCI	CH2M Hill Constructors, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIPP	Cured-in-place pipe
COCs	Contaminants of Concern
COEIs	Constituents of Ecological Interest
COIs	Constituents of Interest
COPCs	Contaminants of Potential Concern
CPT	Core Penetrometer Test
CTO	Contract Task Order
DCA	Dichloroethane
DCE	Dichloroethene
DPT	Direct Push Technology
DSDB	Domestic Waste Sludge Drying Bed
EECA	Engineering Evaluation and Cost Analysis
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFA	Federal Facilities Agreement
FFS	Focused Feasibility Study
FRI	Focused Remedial Investigation
FS	Feasibility Study
FWSW	Florida Surface Water Standards
ft	Feet (or Foot)
FWEC	Foster Wheeler Environmental Corporation
GAC	Granular Activated Carbon

ACRONYMS (Continued)

gal	Gallon(s)
GCTL	Groundwater Cleanup Target Level
GWPS	Groundwater Protection Standard
GWT	Groundwater Extraction Treatment
HASP	Health and Safety Plan
HLA	Harding Lawson & Associates
HRC®	Hydrogen Release Compound
IAS	Initial Assessment Study
IR	Installation Restoration
IRA	Interim Remedial Action
IROD	Interim Record of Decision
ISCO	In-situ Chemical Oxidation
ISDB	Industrial Waste Sludge Drying Bed
LNAPL	Light Non-aqueous Phase Liquid
LSA	LNAPL Source Area
LTMP	Long-term Monitoring Plan
LUCs	Land Use Controls
LUCIP	Land Use Control Implementation Plan
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
Mantech	Mantech Environmental Corporation
MCLs	Maximum Contaminant Levels
MCW	Multi-chamber Well
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MNA	Monitored Natural Attenuation
MOA	Memorandum of Agreement
msl	Mean Sea Level
NA	Natural Attenuation
NADEP	National Aviation Depot
NAS	Naval Air Station
NAT	Navy Aviation Trades
NAVFAC EFD SOUTH	Southern Division, Naval Facilities Engineering Command
Navy	United States Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

ACRONYMS (Continued)

NFA	No Further Action
NFRAP	No Further Remedial Action Planned
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCP	Post-closure Permit
POC	Point-of-Compliance
PP	Polishing Pond
PPE	Personal Protective Equipment
ppb	Parts per Billion
ppt	Parts Per Thousand
PSC	Potential Source of Contamination
QAPP	Quality Assurance Project Plan
RA	Risk Assessment
RAC	Remedial Action Contractor
RAOs	Remedial Action Objectives
RBC	Risk-based Criteria
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SCTLs	Soil Cleanup Target Levels
SQAGs	Sediment Quality Assessment Guidelines
SSFP	Scoping Study Field Program
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
SWPPP	Storm Water Pollution Prevention Plan
TAL	Target Analyte List
TBC	To Be Considered
TCA	Trichloroethane
TCE	Trichloroethene

ACRONYMS (Continued)

TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TLCA	Trigger Levels for Contingent Action
TMWs	Temporary Monitoring Wells
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
TtNUS	Tetra Tech NUS, Inc.
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VC	Vinyl Chloride
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant
yd^3	Cubic Yards

1.0 INTRODUCTION

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of the reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

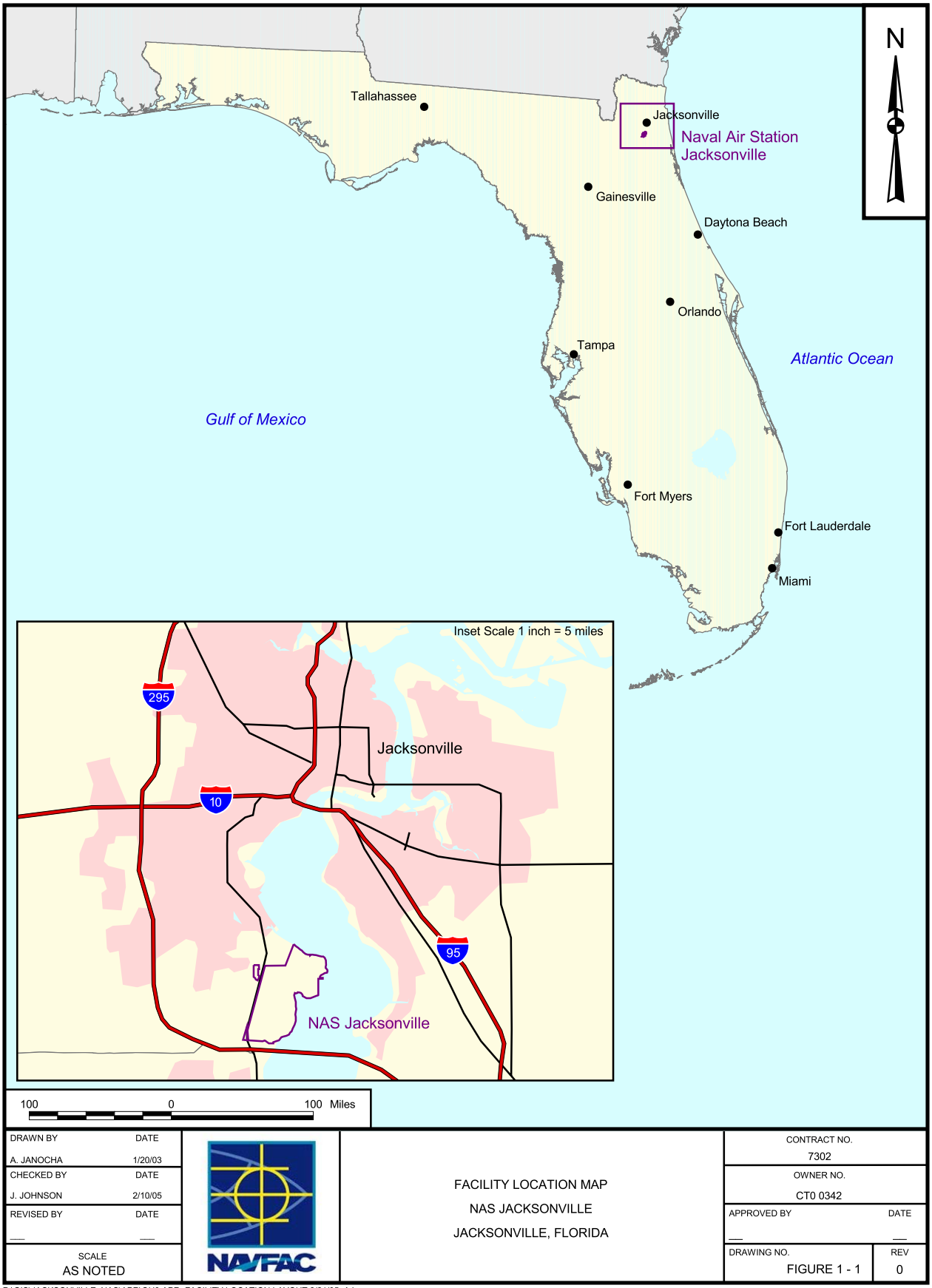
Southern Division, Naval Facilities Engineering Command (NAVFAC EFD SOUTH) is preparing this Five-Year Review report pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA § 121 states:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

NAVFAC EFD SOUTH interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) § 300.430(f)(4)(ii) states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

NAVFAC EFD SOUTH conducted the five-year review of the remedies implemented at Operable Units (OUs) 1 through 4 at Naval Air Station (NAS) Jacksonville in Jacksonville, Florida. Figure 1-1 shows the location of NAS Jacksonville in Florida, and Figure 1-2 shows the station and the OUs of concern. This review was conducted by the Remedial Project Manager for the entire site from May 2001 through March 2005. This report documents the results of the review.



DRAWN BY: A. JANOCHA	DATE: 1/20/03	FACILITY LOCATION MAP NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
CHECKED BY: J. JOHNSON	DATE: 2/10/05		OWNER NO.: CT0 0342
REVISED BY: —	DATE: —		APPROVED BY: — DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 1 - 1 REV: 0

P:\GIS\JACKSONVILLE_NAS\APR\OU3.APR FACILITY LOCATION LAYOUT 2/21/05 AJ

DRAWN BY: J. LAMEY	DATE: 7/28/04	OU LOCATION MAP NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
CHECKED BY: J. JOHNSON	DATE: 2/10/05		OWNER NO.: CTO 0342
REVISED BY: ___	DATE: ___		APPROVED BY: ___ DATE: ___
SCALE: AS NOTED			DRAWING NO.: FIGURE 1 - 2 REV: 0

P:\GIS\JACKSONVILLE_NAS\APR\OU3_TAGS.APR OU LOCATION MAP 2/22/05 CF

This is the second five-year review for NAS Jacksonville. The first five-year review addressed OU 1 and OU 2. This five-year review is intended to address OUs 1 through 4, which currently have signed Records of Decision (RODs) in place. The triggering action for this statutory review was the first start date for construction of the OU 1 Light Non-Aqueous Phase Liquid (LNAPL) System, which was March 6, 1995. This five-year review is being conducted because hazardous substances, pollutants, and contaminants from past storage, handling, and disposal practices remain at OUs 1 through 4 above levels that allow for unlimited use and unrestricted exposure.

This report consists of four sections as listed below:

- Section 1.0 discusses the purpose of the report, provides a summary of the history and site chronology of NAS Jacksonville, and evaluates the changes that have occurred in the Applicable or Relevant and Appropriate Requirements (ARARs).

- Sections 2.0 through 5.0 are the five-year reviews for OU 1 through OU 4, respectively at NAS Jacksonville. Each section includes the OU chronology; background, summary of the remedial actions performed; and the five-year review findings, assessment, deficiency list, recommendations, and protectiveness statements.

- Section 6.0 provides a general summary, conclusions, and protectiveness statement for the NAS Jacksonville facility. This section also identifies when the next five-year review is required and the other tasks that should be performed as part of that five-year review.

Tetra Tech NUS, Inc. (TtNUS) conducted the five-year review in conjunction with the NAS Jacksonville Partnering Team, which includes:

- Phillip McGinnis, NAVFAC EFD SOUTH
- Anthony Robinson, NAVFAC EFD SOUTH
- Harold McGill, NAVFAC EFD SOUTH
- Pete Dao, United States Environmental Protection Agency (USEPA) Region IV Remedial Project Manager
- Jim Cason, Florida Department of Environmental Protection (FDEP) Remedial Project Manager
- Bill Raspet, NAS Jacksonville
- Greg Roof, TtNUS Task Order Manager
- Mike Halil, CH2M Hill Constructors, Inc. (CCI)

This five-year review consisted of a review of relevant documents, interviews, and a site inspection. The completed report is available in the information repository at the Webb Wesconnett Branch Library located at 6887 103rd Street, Jacksonville, Florida 32210.

1.1 OVERVIEW OF NAS JACKSONVILLE

The official mission of NAS Jacksonville is to provide facilities, service, and support for the operation and maintenance of naval weapons and aircraft to operating forces of the United States Navy (Navy) as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission include operation of fuel storage facilities, performance of aircraft maintenance, maintenance and operation of engine repair facilities and test cells for aircraft engines, and support of weapon systems. The following sections provide a history and chronology, as well as a brief description of the physical and geological conditions at NAS Jacksonville.

1.1.1 History and Site Chronology

NAS Jacksonville was commissioned on October 15, 1940, to provide facilities for pilot training and a Navy Aviation Trades (NAT) School for ground crewmen. With the advent of World War II, the physical size of the NAS Jacksonville more than doubled, and military functions supported the war effort. During 1942, the Navy phased out pilot training, and the station became the headquarters for the Chief of Naval Operational Training, the final training phase before fleet assignment. The NAT School became the Naval Air Technical Training Center under the Chief of Naval Air Technical Training, NAS Memphis. The operational areas of the station still maintained coastal protection with seaplanes. The facility reached a peak of 42,000 naval personnel and 11,000 civilians by 1946.

At the conclusion of World War II, NAS Jacksonville was devoted entirely to aviation training. In 1945, Chief of Naval Operational Training was redesignated Chief Naval Air Advanced Training. In July 1946, the Seventh Naval District was transferred from Miami, Florida to the NAS Jacksonville facility as joint command with Chief Naval Air Advanced Training. On April 5, 1948, the Navy transferred the Chief Naval Air Training and all training facilities to NAS Corpus Christi, Texas.

By January 1949, NAS Jacksonville's mission was to support the operational carrier squadrons with fleet squadrons assigned to Commander, Naval Air Bases, Sixth District and patrol squadrons assigned to Combat Patrol Wing Eleven. On January 1, 1951, the Navy reactivated the Naval Air Technical Training Center and Marine Air Division activities in support of the Korean build-up of facilities. This joint operational and training status continues to this time.

The Navy initiated an environmental investigation of NAS Jacksonville in 1979. Currently, the cleanup program is being conducted under the Navy's Installation Restoration (IR) program. As a result of IR activities, 55 potential sources of contamination (PSCs) have been identified as needing additional investigation. The USEPA issued a Hazardous and Solid Waste Amendments of 1984 permit to the installation in June 1987, and a Resource Conservation and Recovery Act (RCRA) Facility Assessment was included in the USEPA-issued permit. The site was placed in the National Priorities List (NPL) in November 1989. Subsequently, a Federal Facilities Agreement (FFA) was signed that decreed that the cleanup of these PSCs would be conducted under the CERCLA, with RCRA as an ARAR. In addition to the IR/CERCLA program, the facility has other active regulatory programs. A Florida RCRA permit was issued to NAS Jacksonville by the FDEP. An Underground Storage Tank Program is currently investigating over 50 tank sites as provided for by Florida Administrative Code (FAC) Section 62-770.

1.1.2 Land Use

NAS Jacksonville occupies approximately 3,900 acres in southeastern Duval County, Florida and is located approximately nine miles south of downtown Jacksonville. The facility is located on the St. Johns River approximately 24 miles upstream from its confluence with the Atlantic Ocean. The main portion of NAS Jacksonville is bordered to the north by the Timaquana Country Club, to the east and northeast by the St. Johns River, to the south by a residential area, and to the west by Highway 17 (Roosevelt Boulevard), with Westside Regional Park, commercial developments, and other NAS Jacksonville operations beyond.

NAS Jacksonville is a multi-mission base hosting more than 100 tenant commands and employing more than 26,000 active duty and civilian personnel. The installation is home to the P-3C Orion long-range martitime surveillance aircraft, the SH-60F Seahawk helicopter, and the S-3B Viking jet aircraft. The Naval Aviation Depot (NADEP), located on NAS Jacksonville, is the largest industrial employer in northeast Florida and performs maintenance, repair, and overhaul of Navy aircraft.

In addition to the many operational squadrons flying P-3, C-12, C-9 aircraft, and SH-60F helicopters, NAS Jacksonville is home to Patrol Squadron Thirty (VP-30), the Navy's largest aviation squadron and the only "Orion" Fleet Replacement Squadron that prepares and trains United States and foreign pilots, air crew, and maintenance personnel for further operational assignments.

Support facilities include an airfield for pilot training, a maintenance depot (employing more than 150 different trade skills capable of performing maintenance as basic as changing a tire to intricate micro-electronics or total engine disassembly), a Naval Hospital, a Fleet Industrial Supply Center, a Navy Family Service Center, and recreational facility.

1.1.3 Physiography and Topography

NAS Jacksonville is located in the Coastal Plain physiographic province. The Coastal Plain is composed of marine/coastal sediments in the vicinity of the facility. The sediments were deposited in terraces related to prehistoric fluctuations in sea level. The terrace deposits are in the form of ridges that tend to parallel the current coastline. The topography of the terrace deposits is characterized by very low relief with gentle slopes to the east-southeast. Seven terraces are present in northeastern Florida with NAS Jacksonville located within the Pamlico terrace [10-25 feet (ft) mean sea level (msl)].

The overall topography at NAS Jacksonville is generally flat with a gentle slope to the southeast according to the topographic map for Orange Park [United States Geological Survey (USGS), 1993].

1.1.4 Climate

The climate in northeast Florida approaches semi-tropical as it lies near the northern limit of the trade winds (the prevailing easterly winds that moderate summer and winter temperatures). The annual mean temperature is 68 to 70 degrees Fahrenheit with an average temperature in the summer of 82 to 83 degrees Fahrenheit and a winter average 56 to 57 degrees Fahrenheit. Summer highs reach the middle to upper 90 degrees Fahrenheit, sometimes exceeding 100 degrees Fahrenheit. The winter lows can reach the upper teens, although temperatures drop below freezing only a few nights each year.

The region experiences an average of 53 to 54 inches of rainfall per year, most of which accumulates during frequent summer thunderstorms. Extended dry periods may occur throughout the year; however, they are most common in spring and fall. The relative humidity averages 87 percent and the average annual sunshine is 62 percent of the maximum.

Wind speed in northeast Florida averages eight miles per hour with winds predominantly from the northeast in the winter and from the southwest in the summer. Winds of hurricane force can be expected once in five years with significant deviations from the average. Tropical storm activity mostly occurs from August through October, although the six-month period from June 1 through November 30 is officially considered the Atlantic hurricane season.

1.1.5 Soil

Soil at NAS Jacksonville developed in marine terrace sediment deposits and is regionally classified by the United States Department of Agriculture (USDA), Soil Conservation Service as the Pelham-Mascotte-Sapelo soil series assocation. Soils in this association are characterized as nearly level, poorly drained sands to a depth of 20 inches below ground surface (bgs), which are underlain by loamy sands (USDA, 1978).

1.1.6 Regional Geology

The geologic profile at NAS Jacksonville is comprised of unconsolidated surficial deposits of predominantly fine to very fine clastic sediments that range from clean medium- to fine-grained sands, to silty fine sands, to sandy and silty clay (Fairchild, 1972) overlying thick deposits of phosphatic sands and clays of the Hawthorn Group (Scott, 1988) and limestones and dolomites of the Floridan aquifer systems (Leve, 1966).

The Hawthorn Group is significant at NAS Jacksonville because it contains as much as 200 ft of low permeability, silty, sand-clay layers (Scott, 1988). This low permeability deposit acts as an aquiclude for the underlying Floridan aquifer system. The Floridan aquifer system is the major source of potable water in the Jacksonville area and throughout much of northeastern and central Florida.

1.1.7 Regional Hydrology

1.1.7.1 Surface Water

Two principal waterways are located near NAS Jacksonville, the St. Johns River and the Ortega River. The St. Johns River forms the eastern boundary of NAS Jacksonville. The river is rated by the FDEP as a Class III water body, which is designated for fish and wildlife propagation and body contact recreational use. The river at this point is influenced by tidal action and can be considered part of the St. Johns River estuary. Based on salinity measurements taken during the Scoping Study Field Program (SSFP), which ranged from 7.0 to 8.8 parts per thousand (ppt) as reported in the OU 3 Remedial Investigation/Feasibility Study (RI/FS), the water would be classified as marine. Salinity values greater than 2 ppt will support marine vegetation and aquatic life.

1.1.7.2 Groundwater

Three aquifer systems have been identified in the Jacksonville area including the surficial aquifer, intermediate aquifer consisting of permeable units within the Hawthorn formation, and the Floridan aquifer system.

The surficial deposits consist of sediments of Late Miocene to Recent age. The sediments are highly variable and include sands, shelly sands, coquina, silts, clay, and shell beds. While the surficial aquifer may be considered a single unit on a regional or base-wide scale, localized clay layers or discontinuous lenses may divide the aquifer into distinct permeable units in some areas [ABB Environmental Services, Inc. (ABB-ES), 1995a]. The contact between the surficial aquifer deposits and the underlying Hawthorn Group, containing the intermediate aquifer, is an unconformity generally identified by a coarse phosphatic sand and gravel bed (Leve, 1966). Average well yields in Jacksonville for the shallow groundwater aquifer were estimated by the City of Jacksonville Planning Department to be between 200 and 500 gallons per day (Toth, 1990). This groundwater is primarily used for lawn irrigation, domestic purposes, and the heat exchange unit in air conditioning and heating units.

The Hawthorn Group consists mainly of dark-gray and olive-green sandy to silty clay, clayey sand, clay and sandy limestone encountered at a depth of approximately 50 to 70 ft bgs. Black phosphatic sand, granules, and pebbles are common throughout the Hawthorn Group (Fairchild, 1972). The combination of numerous thick clay layers within the Hawthorn Group serves as a confining layer that separates the surficial aquifer from the underlying Floridan aquifer system. The most common carbonate components of the Hawthorn Group are dolomite and dolosilt. Clay minerals associated with the Hawthorn Group sediments are smectite, illite, palygorskite, and kaolinite.

A marine carbonate sequence makes up the Floridan aquifer system beneath NAS Jacksonville. The Floridan formation components are Eocene in age and consist of, in descending order, the Ocala Group, Avon Park Limestone, Lake City Limestone, and Oldsmar Limestone. The Floridan aquifer system is the principal source of fresh water in northeast Florida. The water bearing zones consists of soft, porous limestone and porous dolomite beds. The top of the Floridan aquifer in the vicinity of NAS Jacksonville occurs at a depth of about 400 ft bgs. Published transmissivities of the Floridan aquifer in eastern Duval County range from approximately 85,000 to 160,000 gallons per day per foot (Leve, 1966). Groundwater in the Floridan aquifer in the vicinity of NAS Jacksonville is moving eastward toward areas of heavy pumping (Fairchild, 1977). Floridan aquifer wells in the vicinity of NAS Jacksonville are under sufficient artesian pressure to flow at the surface.

1.2 ARAR AND SITE-SPECIFIC ACTION LEVEL CHANGES

The ARARs identified in each of the RODs were reviewed, as were new federal and state regulations that have been promulgated. This section describes the new or changed ARARs that address the risk posed to human health or the environment. Since the last five-year review was signed in 2001, there have been no ARAR changes that significantly affect this review.

1.3 NEXT REVIEW

The next five-year review for all OUs at NAS Jacksonville is required by March 6, 2010 (five years from the date of this review).

2.0 OPERABLE UNIT 1

Implementation of the remedial actions at OU 1 began approximately in 1983, and the last five-year review was performed in 2001. This five-year review provides a current status update for OU 1. This review is required by regulation because landfill wastes are still contained in on-site soil, sediment, and groundwater and do not allow for unlimited use and unrestricted exposure. Information pertaining to OU 1 is as follows:

- OU 1 contains a landfill (PSC 26) and a polychlorinated biphenyl (PCB) transformer storage area (PSC 27).

- Because PSC 26 and PSC 27 are located adjacent to each other and share the same potential fate and transport mechanism for contaminants, the sites are collectively known as OU 1. The area drains into a tributary to the St. Johns River estuary and adjoining wetlands and abuts a military housing area.

- The final remedy for the site included a cap for the landfill, continuation of the LNAPL recovery system, surface water monitoring, and monitored natural attenuation (MNA) for the groundwater with a contingency action for active remediation of groundwater and surface water. Construction of the final remedy for OU 1 was completed in August 1998.

- Surface water monitoring, the MNA program, and LNAPL recovery are ongoing.

2.1 SITE CHRONOLOGY

A list of important OU 1, PSC 26, and PSC 27 historical events and relevant dates in the site chronology is shown in Table 2-1. The identified events are illustrative, not comprehensive.

2.2 BACKGROUND

2.2.1 Physical Characteristics of OU 1

OU 1 includes a landfill, known as PSC 26, and a PCB transformer storage area, known as PSC 27. PSC 26 covers more than 30 acres while PSC 27 covers less than an acre of land. Because PSC 26 and PSC 27 are located adjacent to each other and share the same potential fate and transport mechanism for contaminants, the sites are collectively known as OU 1.

TABLE 2-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 1

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)		Date
Pre-discovery of contaminants		n/a
	United States Army disposed of non-hazardous debris such as vehicles at PSC 26.	Prior to 1940
	The Navy disposed of radium-226 and radium-228 paint waste and luminescent dials at PSC 26.	1940 to 1950
	PSC 26 served as a NAS Jacksonville disposal area for household, sanitary, and industrial waste.	1940 to 1979
Initial discovery of problem or contamination		n/a
	Radiation survey and soil/groundwater sampling discovered "hazard to human health"(1).	Feb-73
Pre-NPL responses		n/a
	Excavation activities resulted in 501 barrels of radiological contaminated material at PSC 26. (2)	Nov-73
	Oil was discovered seeping into a man-made ditch at PSC 26.	1978
	PSC 27 served as the PCB transformer storage area.	Prior to 1978
	Vandalism to transformers at PSC 27; the Navy removed the transformers.	1978
	PSC 26 closed as a disposal site.	1979
	LNAPL containing PCBs discovered and documented.	1979
	Trench system constructed and operated temporarily to recover LNAPL.	1983 to 1984
	Excavated ditch material (from LNAPL trenches) was blended with dry sandy fill and spread over the landfill. (2)	1983
NPL Listing		Nov-89
FFA signature		1990
Post-NPL responses		n/a
	Several investigations of the LNAPL contamination.	1990 to 1991
	Focused RI/FS on LNAPL source area.	Dec-93
Remedial design start (LNAPL only)		Early 1994
Remedial design complete (LNAPL only)		May-94
	Interim Record of Decision (IROD) signed for LNAPL removal.	Aug-94
	Interim remedial action initiated for LNAPL removal.	Feb-95
RI/FS complete for OU 1		Mar-96
Proposed Plan for Remedial Action (start of public comment period)		Jul-96
Remedial design start (excavation with landfill cap and cover only)		Late 1996

TABLE 2-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 1

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)		Date
Remedial design complete (excavation with landfill cap and cover only)		Jun-97
ROD signature for OU 1		Sep-97
Construction dates		n/a
	Excavation and disposal of contaminated surface soil and sediment from PSC 27 into PSC 26. (2)	Completed July 98
	Installation of cap and cover system at PSC 26.	Completed Aug 98
Construction completion date		Aug-98
Memorandum of Agreement (MOA) signed between USEPA, FDEP, and Navy to ensure land use control compliance.		Aug-98
Institutional controls for OU 1 developed through Land Use Control Program		Oct-98
Current remedial activities		n/a
	Inspection of the cap and cover since installation.	Ongoing
	LNAPL recovery.	Ongoing
	Groundwater and surface water monitoring including MNA.	Initiated Feb 1999
Previous five-year reviews		n/a
	First five-year review	Sep-01

Notes:
(1) ABB-ES, 1997 n/a = not applicable
(2) Removal actions

As indicated by Figure 2-1, Child Street bisects the northern most portion of OU 1. OU 1 is bordered by a forested area and golf course on the north, base housing to the east, a wooded area on the south, and a restricted weapons storage area on the west. The base hospital is located on Child Street to the east of OU 1. Within the forested area south of the main landfill are unnamed drainage features which are part of OU 1. These drainage features flow south into an unnamed tributary to the St. Johns River estuary and adjoining wetlands (hydrophytic forest habitat). Figure 2-2 shows the general topography of the area. According to ARCADIS Geraghty & Miller, Inc. (AGM) (AGM, 1999a), the 100-year flood stage for the station is 5 ft msl. Figure 2-2 appears to indicate that OU 1 is above the 10-foot msl contour interval, which would place it above that flood stage.

2.2.2 Land and Resource Use at OU 1

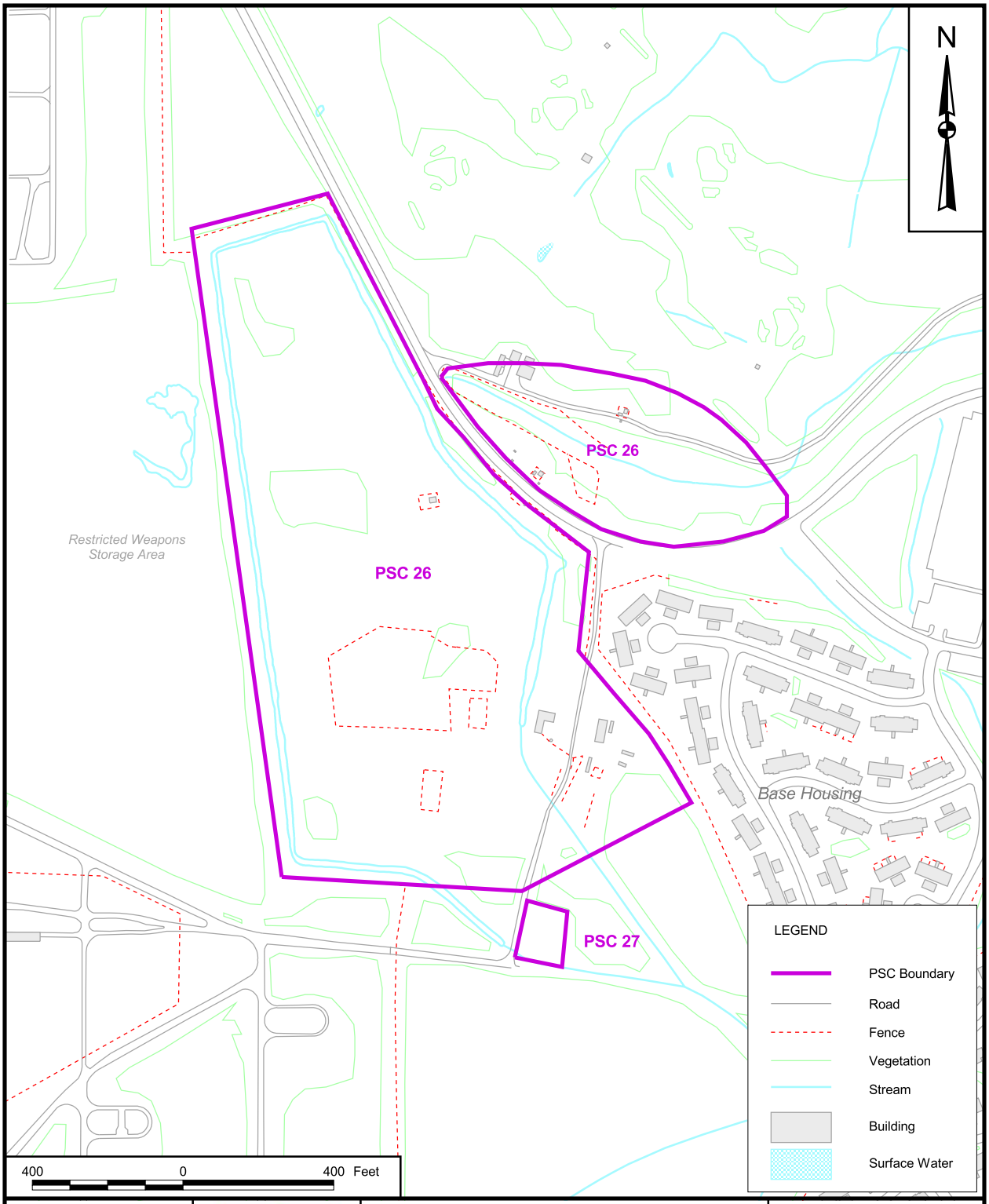
The land use at OU 1 is considered industrial. The landfill is currently fenced to prevent unauthorized access. The LNAPL area is an undeveloped grassy area between Child Street and the golf course. Under the LUC Program, the station has agreed to the following LUCs:

- Maintain the fence and signs around the landfill south of Child Street to prevent access.
- Restrict construction.
- Restrict groundwater access.
- Prevent residential use.

The objectives for the LUCs include preventing trespasser and residential use and to provide worker notification of potential hazards. The land use for the site has remained unchanged as of this writing.

2.3 HISTORY OF CONTAMINATION AT OU 1

PSC 26, the Old Main Registered Disposal Area, was also known as the Oil and Solvents Disposal Pits Area. Prior to 1940, the United States Army disposed of non-hazardous debris such as vehicles on this site. The Navy reportedly disposed of 1,000 gallons (gal) per week of volatile organic waste products over a 40-year period (ABB-ES, 1996a) in open pits. Other waste reportedly disposed of in the pits at the site included approximately 200 gal per week of cold carbon remover residue, 300 gal per week of vapor degreaser, and 600 gal per week of paint shop waste. These wastes contained the following organic compounds: methylene chloride, methylethyl ketone, ethyl acetate, trichloroethene (TCE), methyl isobutyl ketone, n-butyl acetate, xylenes, and heavy metal salts. Methylene chloride and methylethyl ketone were utilized during paint stripping operations. TCE and methylene chloride were used for degreasing. N-butyl acetate and xylenes were used as paint and lacquer solvents. These materials were burned in the pits, which were covered with soil when full of burned residues. Ambient air quality



DRAWN BY: A. JANOCHA — DATE: 9/17/04 CHECKED BY: M. DALE — DATE: 9/17/04 REVISED BY: — — DATE: — SCALE: AS NOTED	NAVFAC	SITE MAP OPERABLE UNIT 1 FIVE YEAR REVIEW NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO. 7302 OWNER NO. CTO 0342 APPROVED BY: — — DATE: — DRAWING NO. FIGURE 2 - 1 — REV 0

P:\GIS\JACKSONVILLE_NAS\APR\OU1.APR SITE LAYOUT 2/21/05 CF

DRAWN BY: A. JANOCHA	DATE: 9/17/04	TOPOGRAPHIC MAP OPERABLE UNIT 1 FIVE YEAR REVIEW NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
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SCALE: AS NOTED			DRAWING NO.: FIGURE 2 - 2 REV: 0

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considerations resulted in discontinuing the burning of waste. However, disposal of waste oils, spent solvents, and paint wastes continued until 1978. Low level radioactive wastes were reportedly disposed at PSC 26 during the period of 1940 to 1950. The radioactive waste consisted of radium-226 and radium-228 paint waste and luminescent dials.

During a 1992 interview, a former NAS Jacksonville employee indicated that approximately 200 drums containing hazardous materials were deposited in the southern portion of OU 1 during past land filling operations (ABB-ES, 1996a)

PSC 27, the Former PCB Transformer Storage Area, is adjacent to PSC 26, the Old Main Registered Disposal Area. PCB-containing electrical transformers were stored at this location until 1978. Vandalism to the transformers occurred in 1978 and reportedly resulted in the release of dielectric fluid containing PCBs. Not until 1979, when LNAPLs were discovered and investigated, was PCB contamination documented. The study discovered that leaking electrical transformers containing PCB-contaminated dielectric fluid at PSC 27 had contaminated soils and groundwater. PSC 27 is located on the southwestern ridge of OU 1. The Navy removed the transformers, and the PCB-contaminated soil was removed and disposed of off-site.

2.3.1 Initial Response for OU 1

CERCLA response began at NAS Jacksonville in 1982 with an Initial Assessment Study (IAS) conducted to collect and evaluate evidence that contaminants at PSCs might pose a health risk to humans and/or adversely affect the environment at locations both on and off of the station. The IAS evaluated a total of 38 PSCs. PSC 26 and PSC 27 were determined to require additional assessment activities and remedial action.

A remediation system was constructed and operated during the period between 1983 and 1984 to remove the LNAPL from PSC 26. The remediation system consisted of infiltration galleries, a perimeter drainage ditch system around PSC 26, two underflow weirs and a flow measuring weir, and either pumps or a boom system to collect free-phase hydrocarbons. The perimeter drainage ditches were plugged with earthen barriers near the downstream boundaries of OU 1 since the surface water failed to meet discharge requirements for the St. Johns River. Prior to the construction of the perimeter drainage ditch system, the three primary disposal pits were excavated to a depth of 8 ft, blended with sandy fill materials, and spread across the surface of OU 1. The entire land surface area of OU 1 was then graded to drain toward the perimeter drainage ditch system. The ditch system, while demonstrating some effectiveness in removing LNAPL, was discontinued in 1984 due to failure to meet National Pollutant Discharge Elimination System permits.

2.3.2 Basis for Taking Action at OU 1

The hazardous substances identified by the RI/FS (ABB-ES, 1996a) that were released at the site in each media were listed on two tables. Table ES-1 (Summary of Human Health Chemicals of Potential Concern) and Table ES-2 (Ecological Contaminants of Potential Concern) from the RI/FS are provided in Appendix A.

According to the RI/FS (ABB-ES, 1996a), potential health risks were evaluated under current and future land use conditions. All site-related cancer and noncancer risks for current land use are consistent with USEPA guidelines, which indicate exposure should not exceed the hazard index of 1. Site-related cancer and noncancer risks in surface soil, surface water north of Child Street, and sediment under future residential land use assumptions are consistent with acceptable risks as described by USEPA (USEPA, 1990). Cancer risks associated with chlorinated solvents and future use of groundwater as drinking water are sufficiently high to indicate the need to prevent drinking water use in the area of the plume. Cancer and noncancer risks associated with future residential use of areas not addressed by the presumptive remedy are slightly above the generally acceptable range. These risks are predominantly due to PCBs in soil in areas south of Child Street. There is at least one chemical in each medium which has associated cancer risk greater than 10^{-6}.

2.4 REMEDIAL ACTIONS

2.4.1 Remedy Selections at OU 1

A focused RI/FS was completed for the LNAPL area in 1993. An IROD addressing only the LNAPL was signed by the Navy in August 1994 (ABB-ES, 1994). In September 1994, the FDEP and USEPA had approved the IROD, and an Interim Remedial Action (IRA) for the LNAPL removal was initiated in early 1995 in the area of concern northeast of Child Street. The recovery system consists of three linear recovery trenches filled with high permeability, inert granular material. Collection sumps were installed at various points along the trenches, and pumps designed to recover product were installed. The system is designed to act both as a passive collection system as well as an active system that depresses groundwater to enhance flow of product to the collection sumps (ABB-ES, 1997a and TtNUS, 2001).

The remainder of the site contamination was addressed in another RI/FS for OU 1. The RI/FS identified contamination in various media. The two-fold purpose of remedial action at OU 1 was to contain and control the contamination at OU 1 and to reduce risks posed by contaminants of concern (COCs) to acceptable levels within 30 years. To meet these goals, ten remedial action objectives (RAOs) were identified for six mediums. Table 2-2 [a reproduction of Table 2-2 from the ROD for OU 1 (ABB-ES, 1997a)] lists the RAOs for OU 1.

TABLE 2-2
REMEDIAL ACTION OBJECTIVES FOR OPERABLE UNIT 1

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Landfill Soil and Debris	PCBs Inorganics Radionuclides	Reduce Exposure to contaminants in the landfill. Prevent contaminants on the surface of the landfill from washing off the site. Control leachate generation from the additional material placed on the landfill.
LNAPL in the vadose zone	Presence of LNAPL (containing PCBs and PAHs)	Remove LNAPL if greater than 0.1 inch from the water table.
Soil outside landfill	SVOCs PCBs Inorganics	Reduce human and ecological exposure to contaminants in the soil. Reduce the potential for humans or ecological receptors to ingest contaminants in the soil.
Groundwater	Low-level VOCs	Reduce the potential for humans to ingest or breathe contaminants found in the groundwater.
Surface water in unnamed tributary	None	Reduce the potential for humans and ecological receptors to come in contact with contaminants in the surface water that are the result of contamination in the sediment and groundwater.
Sediment in unnamed tributary	Pesticides PCBs Inorganics	Reduce human and ecological exposure to contaminants in the sediment. Reduce the potential for human and ecological receptors to ingest contaminants in the sediment.

Notes:
PAH = polynuclear aromatic hydrocarbon
SVOC = semivolatile organic compound
VOC = volatile organic compound

Five remedial alternatives were evaluated in the Feasibility Study (FS) for OU 1 to address the ten RAOs. Of the five alternatives evaluated, the selected remedial action for OU 1 was Alternative 3 as listed in the RI/FS and ROD for OU 1. The specific activities involved with Alternative 3 are further described in the following paragraphs. Figure 2-3 presents the general site layout proposed for the selected alternative.

Landfill Soil and Debris

The soil and debris within the landfill were capped and/or covered. The proposed cover was a partial cover/cap system with a geomembrane layer cap for a specific portion of the landfill. The proposed cover/cap system consisted of the following:

- A 30-mil geomembrane laid over the radionuclide-contaminated soil and debris and additional materials (see next two bullets) placed on the landfill (to prevent water from infiltrating through this material).

- An 18-inch layer of soil placed over the geomembrane and on the remainder of the landfill.

- A 6-inch layer of vegetative cover placed over the entire landfill to promote vegetation, absorb rainwater, and reduce surface runoff.

LNAPL

LNAPL collection and off-site disposal was continued as described in the IROD for LNAPL. This included the potential for upgrading of the LNAPL collection system to an active system if required to meet RAOs (ABB-ES, 1997a).

Soil and Sediment

Prior to capping of the landfill, contaminated soils and sediments exceeding the 1×10^{-4} risk action levels were to be excavated from the area outside the landfill and placed on the existing soil and debris within the landfill. Approximately 9,000 cubic yards (yd^3) (4,000 yd^3 from north of Child Street and 5,000 yd^3 from south of Child Street) of soil were to be excavated (see Figure 2-3).

In addition to excavating soil from outside the landfill, approximately 900 yd^3 of sediment from the unnamed tributary were also to be excavated as shown on Figure 2-4. Based on practical and technical implementation issues (i.e., impact to wetlands, forested areas, ecological receptors, and de-watering), only hot spots of contaminated sediments were to be selected for excavation. Excavation of those hot spots were expected to reduce the cumulative, residual risk to approach the low (i.e., more aggressive) end of the USEPA acceptable risk range.

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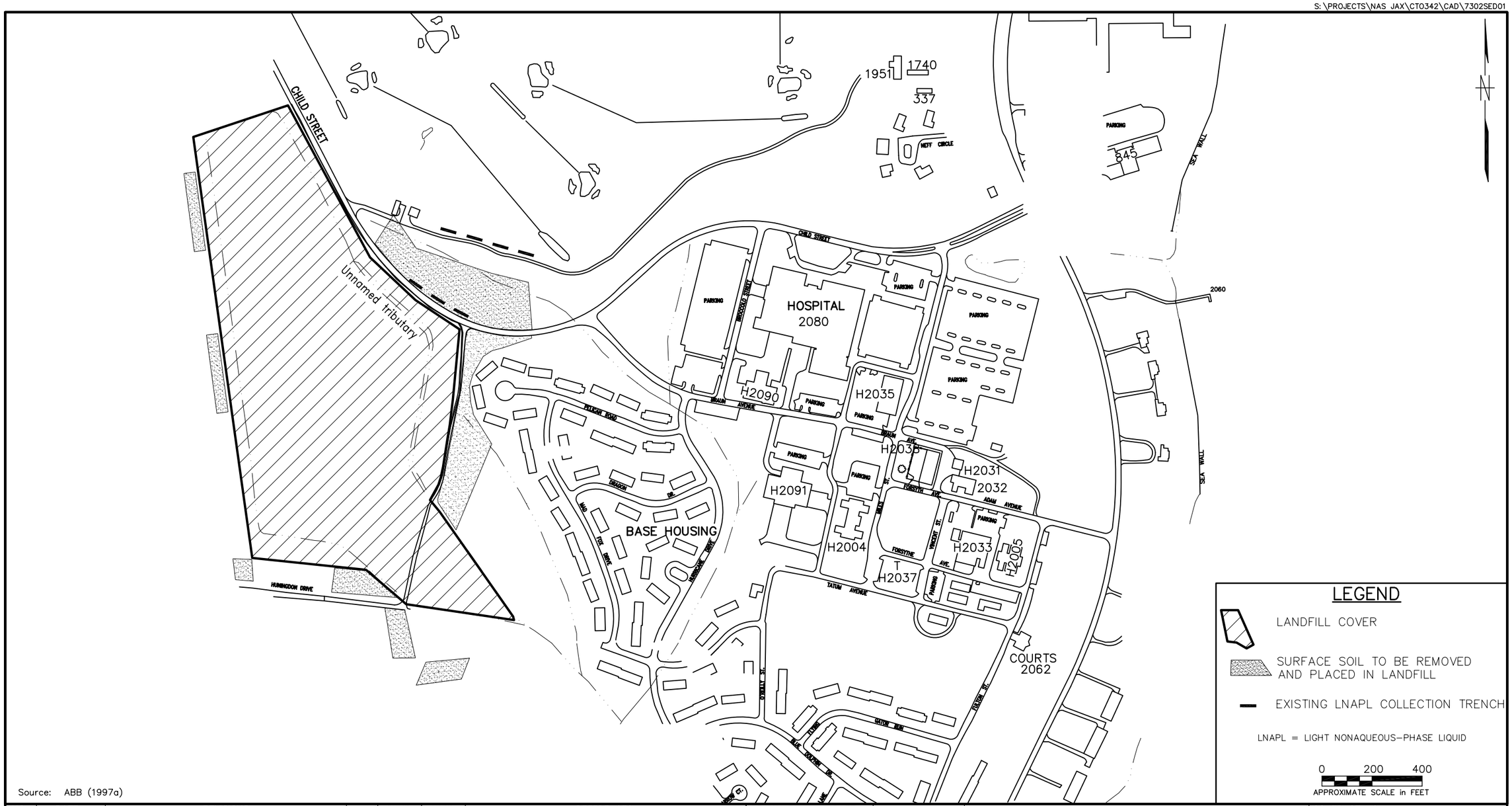

Source: ABB (1997a)

LEGEND

- LANDFILL COVER
- SURFACE SOIL TO BE REMOVED AND PLACED IN LANDFILL
- EXISTING LNAPL COLLECTION TRENCH

LNAPL = LIGHT NONAQUEOUS-PHASE LIQUID

0 200 400
APPROXIMATE SCALE in FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DATE: LLK 3/26/01
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SCALE: AS NOTED

NAVFAC

SITE LAYOUT FOR THE SELECTED ALTERNATIVE
(ALTERNATIVE 3)
OPERABLE UNIT 1
FIVE-YEAR REVIEW
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. 7302
OWNER NO. CTO 0342
APPROVED BY DATE
DRAWING NO. FIGURE 2-3
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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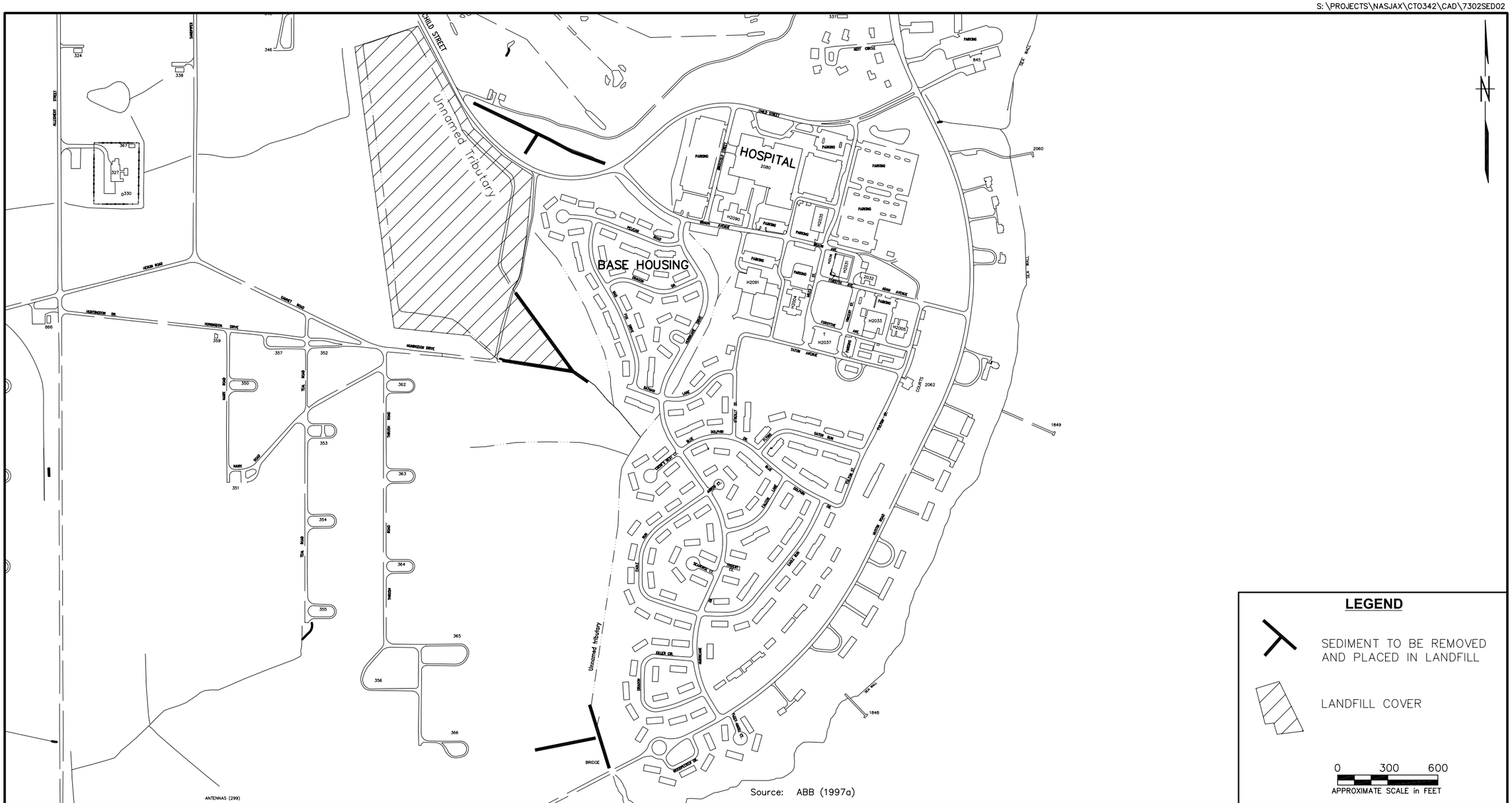

Source: ABB (1997a)

LEGEND

SEDIMENT TO BE REMOVED AND PLACED IN LANDFILL

LANDFILL COVER

0 300 600
APPROXIMATE SCALE in FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY LLK DATE 5/11/01
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED

SEDIMENT REMOVAL AREAS
OPERABLE UNIT 1
FIVE-YEAR REVIEW
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. 7302
OWNER NO. CTO 0342
APPROVED BY DATE
DRAWING NO. FIGURE 2-4
REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98

Once excavated, the media (i.e., soil from outside the landfill and sediment from the unnamed tributary) was to be capped under the partial cap and cover system (ABB-ES, 1996a). The intent of the "partial" cap was to prevent water migration through the area that contained radionuclides, inorganics, and PCBs. The cover was used to reduce human and ecological receptor exposure for the entire landfill.

Groundwater

The groundwater treatment component of the selected remedy consisted of monitored natural biodegradation/attenuation. Access restrictions were used to prevent consumption of the groundwater at OU 1 from the surficial aquifer in the affected area. The restrictions included constructing a fence around the landfill, posting signs along the fence, and obtaining a legal restriction on use of groundwater for consumption. The groundwater restrictions were to remain in effect until the groundwater contamination levels for COCs met or were less than maximum contaminant levels (MCLs) and concurrence was obtained from the FDEP and USEPA to remove the restrictions (ABB-ES, 1996a).

Groundwater and surface water monitoring was to be implemented upon completion of the soil/landfill remedial action to assess the restoration of the surficial aquifer, to evaluate the potential for breakthrough of contaminants into the unnamed tributary (i.e., the point of compliance), and to assess when groundwater access restrictions could be lifted. Groundwater and surface water monitoring locations are presented on Figure 2-5 and described in Table 2-3.

Contingent Actions

In addition to the primary action, the alternative selected in the ROD has two contingency actions: (1) a tributary collection system (i.e., collection of surface water) with on-site treatment and discharge and (2) enhanced bioremediation. A copy of the Contingency Plan Chart for OU 1 developed in the Long-term Monitoring Plan (LTMP) is included as Appendix A.

If monitoring data for two consecutive quarters indicated that concentrations of chemicals in surface water or groundwater from monitoring wells adjacent to the tributary were greater than the Florida surface water standards established in the ROD [i.e., trigger levels for contingent action (TLCA)], then one or more seepage meters were to be installed to collect water samples at the direct interface of groundwater discharge to surface water (see Table 2-4 for TLCA criteria). These samples were to be analyzed and if concentrations of COCs were still greater than Florida surface water standards, then the first contingent action, tributary water collection, would be implemented. The surface water pump and treat system was intended to operate until the contamination was reduced to less than the MCLs (ABB-ES, 1996a).

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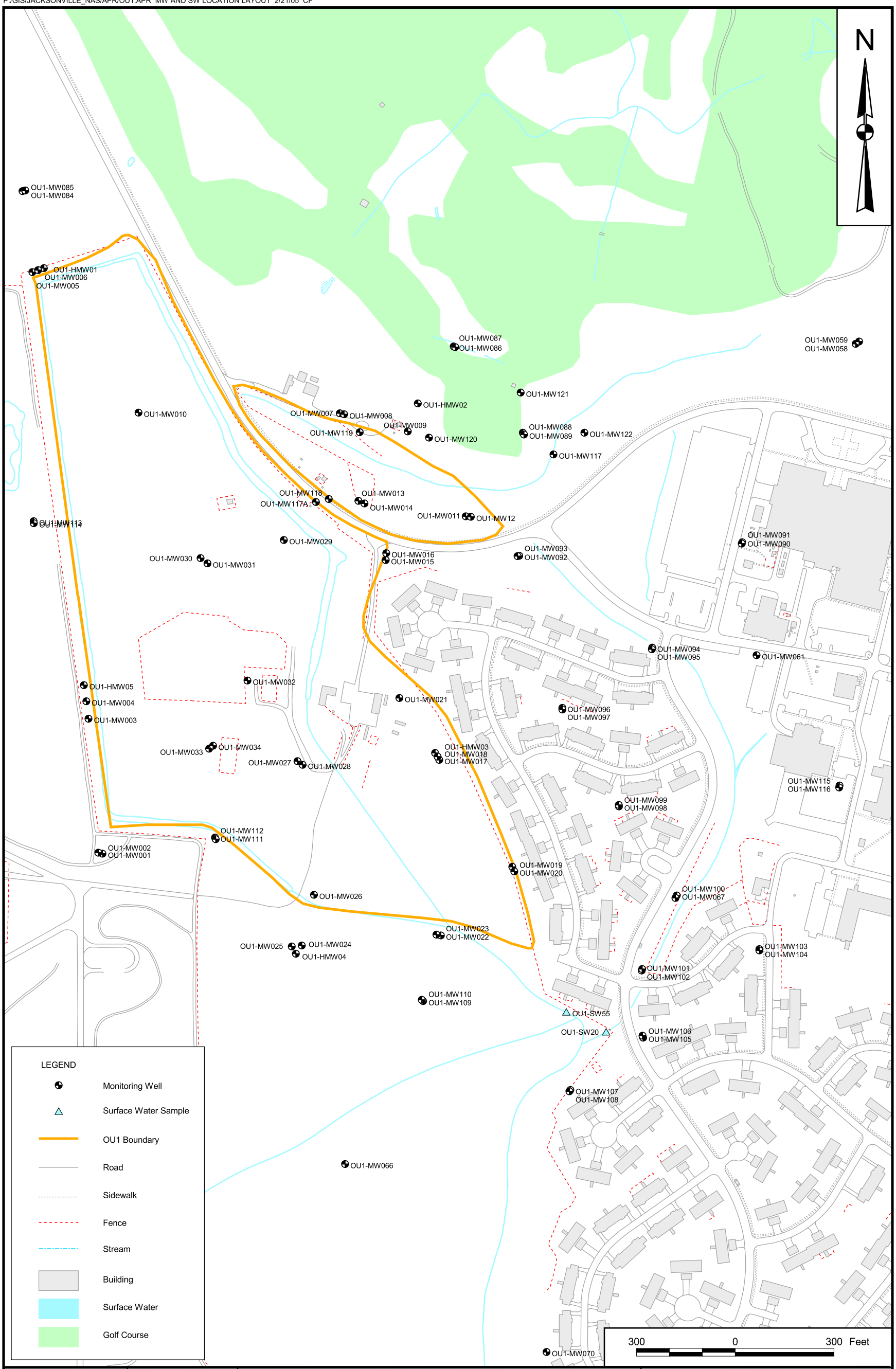

DRAWN BY: A. JANOCHA	DATE: 9/17/04	MONITORING WELLS AND SURFACE WATER SAMPLES OPERABLE UNIT 1 FIVE YEAR REVIEW NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
CHECKED BY: M. DALE	DATE: 9/17/04		OWNER NO.: CTO 0342
REVISED BY: —	DATE: —		APPROVED BY: — DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 2 - 5 REV: 0

TABLE 2-3
MONITORING PROGRAM AT OPERABLE UNIT 1

FIVE YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE FLORIDA

Monitoring Location	Depth (relative)	Screened Interval (ft below surface)	Purpose of Sampling
Groundwater Monitoring			
MW-12	Deep	30 to 35	Monitor groundwater downgradient of LNAPL area.
MW-18	Deep	26.5 to 31.5	Monitor groundwater downgradient of landfill.
MW-19	Deep	19 to 24	Monitor groundwater downgradient of landfill.
MW-22	Deep	25 to 30	Monitor southern edge of dissolved plume.
MW-67	Shallow	3.5 to 13.5	Monitor vicinity of groundwater discharge to surface water.
MW-84	Deep	35 to 40	Monitor groundwater upgradient from the landfill (serves as background).
MW-85	Shallow	3 to 13	Monitor groundwater upgradient from the landfill (serves as background).
MW-89	Shallow	3 to 13	Monitor concentrations of compounds in vicinity of LNAPL area.
MW-93	Shallow	3 to 13	Monitor groundwater between the stream and the housing area.
MW-95	Shallow	3 to 13	Monitor groundwater between the stream and the housing area.
MW-97	Deep	22.5 to 27.5	Monitor extent of dissolved plume in housing area.
MW-98	Deep	20.5 to 25.5	Monitor extent of dissolved plume in housing area.
MW-100	Deep	16.5 to 21.5	Monitor vicinity of groundwater discharge to surface water.
MW-101	Shallow	3 to 13	Monitor vicinity of groundwater discharge to surface water.
MW-102	Deep	16.5 to 21.5	Monitor vicinity of groundwater discharge to surface water.
Surface Water Monitoring			
SW-20	Surface water	--	Monitoring point for surface water
SW-55	Surface water	--	Monitoring point for surface water

Source: ROD (ABB-ES, 1997a)

If, after a review of data accumulated during the first five years of natural attenuation (NA), predicted concentrations of COCs in groundwater would not achieve MCLs in 30 years, the second contingent action, enhanced bioremediation was to be implemented.

2.4.2 Remedy Implementation at OU 1

The remedial action selected for implementation at OU 1 is consistent with CERCLA and the NCP. The selected remedy satisfies the statutory preference for treatment to the extent practicable, which permanently and significantly reduces the mobility, toxicity, and/or volume of hazardous substances as a principle element.

The current LNAPL recovery system was installed in April 1995 in general accordance with the IROD for OU 1 [Foster Wheeler Environmental Corporation (FWEC), 1995a]. The recovery system as designed was installed across the groundwater-soil interface and removes the light phase layer from the top of the water table. The system consisted of three recovery trenches with lengths of 20 ft, 195 ft, and 240 ft, each 18 ft deep. The South Trench is 195 ft long and is located directly north of Child Street. The 20 ft trench is located beneath Child Street, which is connected to the South Trench. The North Trench is 240 ft long and is located north of the other two trenches, near the golf course. The installation of the trenches was completed as designed except for the drainpipes that were installed at the bottom of the trenches. During installation of the trenches the drainpipe that was installed in the South Trench broke after the first 40 ft of trenching. Similarly, the North Trench drainpipe line broke 10 ft to 12 ft into trenching operations. These trenches were completed without the drainpipe. The drainpipe was installed as designed in the small trench. A drawdown modeling report (FWEC, 1995b) was performed to provide an analysis of the impact to active pumping operations as a result of not having the entire horizontal drainpipe installed. The drawdown modeling report indicated that the absence of the horizontal drainpipe would have minimal affect on active pumping operations.

The remedial design, which included the closure and post-closure plans for the OU, was initiated in late 1996 and was completed by ABB-ES for the Navy in June 1997. The remedial design included the specifications necessary to conduct the remedial actions listed in the ROD [Bechtel Environmental Inc. (BEI), 1999a].

Remedial activities began in 1998. BEI completed the excavation of contaminated surface soil from PSC 27 and contaminated surface soil and sediment from outside PSC 26 (including sediment from the unnamed tributary) in July 1998. The disposal of the excavated soil and sediment into PSC 26 was completed in July 1998. The installation of the cap and cover system at PSC 26 was completed in August 1998 (BEI, 1999a).

TABLE 2-4
TRIGGER LEVELS FOR CONTINGENT ACTION

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Parameter (Contaminant of Concern in Groundwater or Surface Water)	Concentration Triggering Contingent Action[1]
VOCs (µg/L)	
1,1-Dichloroethene (DCE)	3.2
1,2-Dichloroethane (DCA)	--
1,2-DCE (cis)	--
1,2-DCE (trans)	--
Benzene	71.28
TCE	80.7
Vinyl chloride (VC)	--
SVOCs (µg/L)	
bis(2-ethylhexyl) phthalate	--
Naphthalene	--

Notes: µg/L = micrograms per liter

[1] Concentrations triggering contingent action are the Florida surface water standards for Class III freshwaters. Where an entry is marked "--", no standard is available for that compound.
Trigger levels for contingent action are for the two surface water sample locations and shallow monitoring wells MW-67, MW-93, MW-95, and MW-101.

Source: ROD (ABB-ES, 1997a). However, the concentrations triggering Contingent Action values for 1,1-DCE and benzene were changed in accordance with the last five-year review.

The monitoring and maintenance of the landfill cap was initiated after the completion of the cap and cover system in August 1998. Starting in the year 2000, landfill inspections have been conducted semi-annually.

The long-term monitoring program, which includes groundwater monitoring, MNA, and surface water sampling, was initiated in February 1999 and continues at the time of this review.

The institutional controls for OU 1 were developed through the LUC program in October 1998. An MOA between the USEPA, FDEP, and the Department of the Navy was signed on August 31, 1998. The purpose of the MOA was to ensure compliance with LUCs to protect human health and the environment from exposure to contaminated media at NAS Jacksonville. Therefore, land and groundwater use restrictions at OU 1 were identified and enforced under the guidelines of the MOA (USEPA, 1998).

2.4.3 System Operation/Operation and Maintenance at OU 1

The Navy has operated the LNAPL recovery system since July 1995. As stated in the IROD, the LNAPL recovery system was expected to operate for two years and recover approximately 5,000 to 10,000 gal of LNAPL (ABB-ES, 1994). A member of the NAS Jacksonville Facilities Environmental Department provided copies of the recovery records to date. The data from those records were then transcribed to a spreadsheet and the total recovered LNAPL over the nine plus years of operation was calculated at approximately 781 gal. The spreadsheets with the calculated total for the North and South Trenches are attached as Appendix B.

The Navy's original 1994 present worth cost estimate for implementation and operation of the LNAPL recovery system was approximately $621,000. The actual cost of implementation of the system and Operation and Maintenance (O&M) to date is approximately $1,000,000. The system was evaluated via an NAVFAC EFD SOUTH sponsored optimization program. The results of the optimization effort, which were approved by the NAS Jacksonville Partnering team in January 2005, were to discontinue operation of the LNAPL system. The system has since ceased operation.

The Navy maintains contracts to perform the long-term monitoring and maintenance for OU 1. The work is to be conducted as directed by the ROD, the OU 1 Monitoring Plan for Selected Remedy, and the Maintenance and Monitoring Plan for OU 1. The completed activities for the long-term monitoring include the following:

- The first year (1999) of groundwater monitoring (quarterly), surface water sampling and analysis (quarterly), and quarterly reporting of results.

- The second (2000) and third (2001) years of semi-annual monitoring of groundwater, surface water sampling, and reporting.

- Annual monitoring of groundwater, surface water sampling, and reporting from 2003 to present.

- Semi-annual inspection and maintenance of the landfill cover. The first year (1999) of inspections was accomplished by BEI and TtNUS performed the inspections from 2000 through 2003.

- A Basic Order Agreement contractor, Aerostar Environmental Services, Inc. (Aerostar), is currently responsible for the inspections and maintenance of the landfill and groundwater and surface water sampling for the MNA program.

As stated in the ROD for OU 1 (ABB-ES, 1997a), the Navy's original 1996 cost estimate for implementation of remedial action and closure of OU 1 and 30 years of long-term monitoring program (risk-reduction) was approximately $4.2 million. The actual costs of remedial actions to date for OU 1 are in excess of $6 million.

2.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

2.5.1 Protectiveness Statements from the Last Review

The following list of protectiveness statements is duplicated from the first five-year review:

1. The remedy at OU 1 remains protective of human health and the environment. The implementation of the LTMP and institutional controls (LUCs) provide a degree of protection of human health and the environment.

2. The remedial actions for the source control alternative are being implemented as designed with the exception of the trench construction. This deviation from the design was presented to and approved by the NAS Jacksonville Partnering Team. Although the system is currently partially inoperable, the other portion of the LNAPL recovery system provides a reduction in source contaminants. In addition, the groundwater monitoring downgradient of the LNAPL area maintains that the remedy is still protective.

3. The LTMP has been implemented as designed. The continued monitoring in connection with the contingency actions are protective of human health and the environment. The contingency actions are described on Page 2-13.

4. Based on the completed activities and the activities that are underway or planned, the intent and goals of the ROD for OU 1 have or will be met.

2.5.2 Status of Recommendations and Follow-up Actions from Last Review

Table 2-5 provides a list of recommendations, recommended follow-up actions from the first five-year review, the parties responsible for the follow-up, milestone dates, actions taken, outcomes, and dates of action.

2.5.2.1 Actions Taken and Outcome for Issues 1, 3, and 4 from Table 2-5

TtNUS addressed Issues 1, 3, and 4 from Table 2-5 in their report (TtNUS, 2003a). An excerpt from the executive summary of that report follows to indicate the actions taken to address Issues 1 and 4: "The project objectives, as envisioned by the Partnering Team, were to evaluate the effectiveness of the LNAPL recovery system (in operation since June 1995), estimate the extent of LNAPL remaining in the subsurface in the LSA, and to investigate the magnitude and extent of groundwater contamination in the MW-89 area."

To achieve these objectives, TtNUS installed 10 temporary monitoring wells (TMWs) and 4 permanent shallow monitoring wells in the LNAPL source area (LSA) for the purpose of measuring product thickness and developed a profile of associated dissolved phase contaminants in the LSA. Soil samples were collected from immediately above the water table to assess correlation between solid and aqueous COCs. To address the MW-89 issue, TtNUS installed three shallow TMWs and one permanent shallow monitoring well and collected groundwater samples from these wells and from three existing wells in the area, including MW-89, to estimate the lateral extent of the plume in this area.

During the investigation, three permanent wells in the LSA and the two surface waters from the LTMP were sampled for PCBs to satisfy the recommendation of Issue 3.

The results of the effort, as reported in the final report for this effort were as follows:

- Measurable LNAPL was only observed at a thickness of 0.02 ft in one well in the LSA.

- Free product is still being recovered in modest amounts from both recovery sumps in the northern LNAPL area and from one of the three sumps in the southern LNAPL area.

- Dissolved VOCs in the LSA are predominantly petroleum hydrocarbons; chlorobenzene is the most prominent COC in the southern LNAPL area and total xylenes in the northern LNAPL area; benzene and isopropylbenzene are present in both areas.

- Based on validated laboratory analytical data, PCBs are present at concentrations exceeding residential soil cleanup target levels (SCTLs) in some subsurface soils in the LSA, but are not present in associated groundwater samples.

TABLE 2-5
ACTIONS TAKEN SINCE LAST FIVE-YEAR REVIEW

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
1. System Operations-LNAPL Recovery (inability to determine if RAO is achieved)	Perform phased assessment of extent of LNAPL, including the analysis of PCBs. End result is to determine whether the RAOs have been achieved, require modification, and the fate of the recovery system.	Navy	6-Mar-2005	See Section 5.2.1	November 2002
2. System Operations - LNAPL Recovery (North Trench control panel failure)	Repair/replace North Trench control panel.	Navy	31-Dec-2002	See Section 5.2.3	Not completed
3. System Operations - LNAPL Recovery (PCB concentrations in investigation derived waste versus no dissolved phase monitoring for PCBs)	Perform a round of PCB analyses to determine if they have become a COC for groundwater or surface water.	Navy	31-Dec-2002	See Section 5.2.1	November 2002
4. System Operations - LTMP (spike of COCs in MW-89)	Investigate the reason why COCs have increased in MW-89.	Navy	6-Mar-2005	See Section 5.2.1	November 2002
5. System Operations - LTMP (benzene omitted from surface water COC list)	Add monitoring for benzene in surface water and establish a TLCA for benzene.	Navy	31-Dec-2001	See Section 5.2.5	June 2001
6. Missed one LUC Inspection	Inspect OUs quarterly as agreed upon with MOA between FDEP and USEPA.	Navy	31-Dec-2001	Not Achieved – one LUC inspection missed during the period of this review.	June 2001
7. --	Add monitoring for TCE daughter products in surface water for information for the five-year modeling assessment. Establish TLCAs for COCs as deemed appropriate by the partnering team.	Navy/ Partnering Team	20-Jun-2001	See Section 5.2.5	June 2001
8. --	Remove TLCA for 1,2-DCA since there is not a surface water standard for this constituent.	Navy	31-Dec-2001	See Section 5.2.5	June 2001

2.5.2.2 Results for Issues 1, 3, and 4

With respect to Issue 1 identified in the last review, the horizontal extent of the free-phase LNAPL beneath OU 1 was determined to be negligible. Of the six temporary well points installed around the South Trench, no measurable free product was detected. However, approximately 0.03 ft of LNAPL was measured in one of the sumps attached to the South Trench. Near the North Trench, measurable free product was detected in one well point at a thickness of 0.02 ft, and two sumps in the North Trench contained measurable free product. This data would appear to indicate that there is little free-phase LNAPL present on site for the system to remediate. The investigation (TtNUS, 2003a) did point out that total petroleum hydrocarbon (TPH) concentrations exist in the soils exceeding the leachability SCTL. The data summarized on Figure 2-4 from the report shows various VOC, PCB, and TPH concentrations that exceed leachability SCTLs. However, only one point (JAX-26-TW1) has a TPH concentration that exceeds the 20,000 micrograms per kilogram (µg/kg) TPH level for soil that ABB-ES established during the assessment phase as a potential indicator of free-phase LNAPL in the groundwater. Based on this limited investigation, it appears that LNAPL quantity estimated by ABB-ES may have been greater than actual quantities. However, there does appear to be a quantity of soil contamination that remains with the COCs sorbed to the soil matrix.

NAVFAC EFD SOUTH has completed an optimization effort to evaluate the LNAPL system effectiveness and to determine if changes to the current corrective action technologies are necessary or otherwise may be beneficial in achieving site closure. The optimization effort completed for the LNAPL system at OU 1 resulted in discontinued operation of the LNAPL system installed in 1995. The combination of the limited assessment performed by TtNUS and this optimization effort achieved the intended effect for Issue 1.

Issue 3, which required a round of PCB analyses to determine if PCBs are a COC for groundwater or surface water, was completed with results indicating no regulatory exceedances. Therefore, the intended effect was achieved and no changes to the final corrective action were required for this issue.

Issue 4 involved investigating the reason why COCs have increased in MW-89. Sampling performed during the limited assessment (TtNUS, 2003a) helped in better defining the current extent of the contamination associated with MW-89. Additionally, the USGS modeled the OU 1 groundwater and believes the spike was caused by the excavation activities associated with the trench installation. The combination of the limited assessment performed by TtNUS and the modeling by the USGS achieve the intended effect for Issue 1.

2.5.2.3 Actions taken and outcome for Issue 2 from Table 2-5

The previous five-year review noted that the control panel was not operational as of February 2000. TtNUS personnel were unable to reach the technician currently assigned to operate the LNAPL system. However, Bill Raspet reported that the repairs were not made. Due to the limited amount of LNAPL, cost of operation and effectiveness of the system, the NAS Jacksonville Partnering Team reached consensus during the January 2005 meeting that the LNAPL system would be shut down.

2.5.2.4 Results for Issue 2

Bill Raspet of NAS Jacksonville reports that the repairs were not completed.

2.5.2.5 Actions taken and outcome for Issues 5, 7 and 8 from Table 2-5

Benzene has been monitored at the surface water points during the events covered by this five-year review, which goes back to the June 2001 semi-annual sampling event. A TLCA of 71.28 µg/L was adopted by the NAS Jacksonville Partnering Team for benzene that was already listed in FAC 62-302.

TCE and its daughter products, which were already being monitored in groundwater, were added to the monitoring program for surface waters during the June 2001 semi-annual sampling event. The current TLCAs from the ROD and as adopted/changed by the NAS Jacksonville Partnering Team are shown on Table 2-6. The NAS Jacksonville Partnering Team also approved removal of the erroneous TLCA of 1580 µg/L that was established in the ROD for 1,2-DCA.

2.5.2.6 Results for Issue 5, 7, and 8

The intent to monitor several COCs (i.e., benzene and TCE and daughter products) that were already in groundwater and might reach the point of compliance (i.e., surface water) has been met. The other intent to correct or modify the TLCAs as deemed appropriate by the NAS Jacksonville Partnering Team has also been met.

2.5.2.7 Actions taken and outcome for Issue 6

Issue 6 was documentation that formal quarterly LUC inspections were missed during the years preceding the last five-year review. This issue is administrative in nature and did not affect the protectiveness of the remedy. Although not formally performed and documented, the station reports indicate that multiple drive-by inspections were conducted on a monthly basis. Therefore, the site was likely observed multiple times during the inspection period that was missed. Therefore, the actions taken appear to have achieved the intended effect for Issue 6.

TABLE 2-6
REVISED TRIGGER LEVELS FOR CONTINGENT ACTION

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Parameter (COCs in Groundwater or Surface Water)	Concentration Triggering Contingent Action[1]
Volatile Organic Compounds (µg/l)	
1,1-DCE	3.2
1,2-DCA	--
1,2-DCE (cis)	--
1,2-DCE (trans)	--
Benzene	71.28
TCE	80.7
VC	--

Notes:
(1) Concentrations triggering contingent action are the Florida surface water standards for Class III freshwaters. Where an entry is marked "--", no standard is available for that compound.

Trigger levels for contingent action are for the two surface water sample locations and shallow monitoring wells MW-67, MW-93, MW-95, and MW-101.

2.6 FIVE-YEAR REVIEW PROCESS

2.6.1 Administrative Components

The NAS Jacksonville Five-Year Review team consisted of Harold McGill, Phillip McGinnis, and Anthony Robinson (NAVFAC EFD SOUTH); Bill Raspet (NAS Jacksonville); Peter Dao (USEPA); James Cason (FDEP); Hal Davis (USGS); Greg Roof (TtNUS); and Mike Halil (CCI). These organizational representatives have participated in the five-year review. No other potentially interested parties were identified or otherwise notified at the beginning of the review process.

This five-year review consisted of a review of the previous five-year review; evaluation of the issues raised in the previous review, actions taken, and results; site inspections; personnel interviews; and a technical assessment of each site and the remedial actions underway.

This five-year review was funded by NAVFAC EFD SOUTH in February 2004 and will be completed by March 2005. More detailed interview and inspection dates are included in the following sections.

2.6.2 Community Involvement

No public notice identifying that this review was beginning was published. However, at the conclusion of the review, a fact sheet is planned for production and disbursement to the Restoration Advisory Board and others.

2.6.3 Document Review

This five-year review consisted of a review of relevant documents including O&M records for the LNAPL system, landfill inspection reports, and monitoring data. Applicable groundwater and surface water cleanup standards, as listed in the 1997 ROD, were reviewed. The Reference List included as the last section of this document is a detailed list of documents reviewed during this review.

2.6.4 Data Review

2.6.4.1 Review of COC Data for Groundwater

Review of records and monitoring reports indicate that long-term monitoring through a fifth year has occurred in accordance with the LTMP for OU 1. A review of the reports covered by this five-year review indicates that two semi-annual monitoring events were conducted in 2001; one annual monitoring event was conducted in 2002 and one in 2003. As part of the monitoring program, groundwater from specific well locations (see Table 2-3) were analyzed for the COCs as indicated in the ROD and later modified by the NAS Jacksonville Partnering Team. Additionally, NA parameters were monitored for each of the semi-annual sampling events and annually thereafter. The results of the groundwater chemical analysis from the November 2003 Monitoring Event are shown on Figure 2-6.

The OU 1 ROD-specified groundwater concentration criteria for nine groundwater COCs including the following: 1,1-DCE (7 µg/L); 1,2-DCA (3 µg/L); cis-1,2-DCE (70 µg/L); trans-1,2-DCE (100 µg/L); benzene (1 µg/L); TCE (3 µg/L); VC (1 µg/L); bis-(2-ethylhexyl)phthalate (6 µg/L); and naphthalene (6.8 µg/L). The groundwater COC criteria are equal to the Florida MCLs for the individual parameters with the exception of naphthalene for which the criteria was equal to the Florida Groundwater Guidance Concentration. However, bis-(2-ethylhexyl)phthalate and naphthalene were eliminated after the first year of monitoring as approved by the FDEP and USEPA due to lack of detection of either constituent during the 1999 year. Table 2-7 is provided to show the concentrations reported for the remaining seven COCs at each well location for the four events covered by this review.

This review indicates the following wells have exceeded the MCLs and whether the trend for the four events is decreasing or increasing:

- 1,1-DCE was observed to exceed its MCL in wells MW-18 and MW-89. The concentration in both wells attained the highest level during the November 2001 event. The level in MW-18 has been less than the MCL for the past two years. While the level of this COC has steadily decreased in MW-89, it remains in excess of the MCL.
- 1,2-DCA was observed to exceed the MCL only once in well MW-89 during the period under review.
- Benzene was observed to exceed the MCL in wells MW-12 and MW-89 during each of the four events covered by the period of this review. The level reported for MW-12 has shown a steady decrease while the concentrations for MW-89 have shown an increase.
- Cis-1,2-DCE was observed to exceed the MCL in four wells (MW-19, MW-67, MW-89, and MW-100) for the period under review. Generally, the concentrations spiked in November 2001 and have otherwise remained consistent or decreased.
- While trans-1,2-DCE was not observed to exceed the MCL in any of the wells for the period of this review, the concentrations observed for well MW-19 did mimic those of its isomer (cis-1,2-DCE) in relative intensity from sampling event to sampling event.
- TCE was observed to exceed the MCL in seven of the LTMP wells as follows: MW-18, MW-19, MW-22, MW-67, MW-89, MW-97, and MW-100. The levels in the following five wells (MW-18, MW-19, MW-22, MW-67, and MW-97) appear to have become approximately static for the last two events and remain in excess of the MCL. The concentrations for wells MW-89 and MW-100 spiked in November 2001, but have steadily decreased since that time for both wells.
- VC was observed to exceed the MCL in seven of the LTMP wells as follows: MW-12, MW-18, MW-19, MW-67, MW-89, MW-100, and MW-102. The levels in six of the seven remain approximately static and exceed the MCL while the level of VC reported for MW-102 has increased over the last three events.

P:\GIS\JACKSONVILLE_NAS\APR\OU1.APR REVISED GW TAG LAYOUT 2/21/05 CF

N

OU1-MW85
No Volatile Organics Detected

OU1-MW84
No Volatile Organics Detected

OU1-MW12
Volatile Organics (ug/L)

BENZENE	**6.3**
CIS-1,2-DICHLOROETHENE	3.7
TRICHLOROETHENE	1.3
VINYL CHLORIDE	**3.3**

OU1-MW89
Volatile Organics (ug/L)

1,1-DICHLOROETHENE	**59**
BENZENE	**81**
CIS-1,2-DICHLOROETHENE	**300**
TRICHLOROETHENE	**1200**
VINYL CHLORIDE	**480**

OU1-MW93
No Volatile Organics Detected

OU1-MW95
No Volatile Organics Detected

OU1-MW97
Volatile Organics (ug/L)

CIS-1,2-DICHLOROETHENE	40
TRANS-1,2-DICHLOROETHENE	8.2
TRICHLOROETHENE	**14**
VINYL CHLORIDE	0.96 J

OU1-MW98
Volatile Organics (ug/L)

CIS-1,2-DICHLOROETHENE	1.2

OU1-MW18
Volatile Organics (ug/L)

1,1-DICHLOROETHENE	5.3
BENZENE	0.51 J
TRANS-1,2-DICHLOROETHENE	6.6
TRICHLOROETHENE	**61**
VINYL CHLORIDE	**14**

OU1-MW67
Volatile Organics (ug/L)

1,1-DICHLOROETHENE	0.49 J
TRANS-1,2-DICHLOROETHENE	5.3
TRICHLOROETHENE	**4.6**
VINYL CHLORIDE	**12**

OU1-MW19
Volatile Organics (ug/L)

1,1-DICHLOROETHENE	2.6
BENZENE	0.43 J
CIS-1,2-DICHLOROETHENE	**180**
TRANS-1,2-DICHLOROETHENE	32
TRICHLOROETHENE	**180**
VINYL CHLORIDE	**16**

OU1-MW22
Volatile Organics (ug/L)

CIS-1,2-DICHLOROETHENE	12
TRANS-1,2-DICHLOROETHENE	3.1
TRICHLOROETHENE	**7.2**
VINYL CHLORIDE	0.74 J

OU1-MW101
No Volatile Organics Detected

OU1-MW102
Volatile Organics (ug/L)

CIS-1,2-DICHLOROETHENE	11
VINYL CHLORIDE	**33**

OU1-MW100
Volatile Organics (ug/L)

CIS-1,2-DICHLOROETHENE	**120**
TRANS-1,2-DICHLOROETHENE	9.4
TRICHLOROETHENE	**3.3**
VINYL CHLORIDE	**2.8**

Shallow Zone Monitoring Well
Screen interval: 3 to 13.5 ft bls

Intermediate Zone Monitoring Well
Screen interval: 16.3 to 35 ft bls

Deep Zone Monitoring Well
Screen interval: 35 to 40 ft bls

OU1 Boundary

Road

Sidewalk

Fence

Stream

Building

Surface Water

Golf Course

Notes:

Bold values exceed GCTLs

J signifies estimated concentration

Volatile Organics (ug/L)	GCTL
1,1-DICHLOROETHENE	7
1,2-DICHLOROETHANE	3
BENZENE	1
CIS-1,2-DICHLOROETHENE	70
TRANS-1,2-DICHLOROETHENE	100
TRICHLOROETHENE	3
VINYL CHLORIDE	1

300 0 300 Feet

DRAWN BY: A. JANOCHA	DATE: 2/24/04
CHECKED BY: M. DALE	DATE: 9/17/04
REVISED BY: —	DATE: —
SCALE: AS NOTED	

NAVFAC

GROUNDWATER VOC DATA (NOV. 2003)
OPERABLE UNIT 1
FIVE YEAR REVIEW
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	7302
OWNER NO.	CTO 0342
APPROVED BY: —	DATE: —
DRAWING NO.	FIGURE 2 - 6
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TABLE 2-7
SUMMARY OF GROUNDWATER ANALYTICAL DATA

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
1,1-DCE	OU1-MW12	INT	7	<1	<1	<5.0	<1
	OU1-MW18	INT	7	**9**	**11**	3.6 J	5.3
	OU1-MW19	INT	7	3	4	2.4 J	2.6
	OU1-MW22	INT	7	<1	<1	<5.0	<1
	OU1-MW67	Shallow	7	<1	<1	<5.0	0.49 J
	OU1-MW84	INT	7	<1	<1	<5.0	<1
	OU1-MW85	Shallow	7	<1	<1	<5.0	<1
	OU1-MW89	Shallow	7	**21**	**86**	**70**	**59**
	OU1-MW93	Shallow	7	<1	<1	<5.0	<1
	OU1-MW95	Shallow	7	<1	<1	<5.0	<1
	OU1-MW97	INT	7	<1	<1	<5.0	<1
	OU1-MW98	INT	7	<1	<1	<5.0	<1
	OU1-MW100	INT	7	<1	<1	<1	<1
	OU1-MW101	Shallow	7	<1	<1	<5.0	<1
	OU1-MW102	INT	7	<1	<1	<5.0	<1

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
1,2-DCA	OU1-MW12	INT	3	<1	0.7 J	<5.0	<1
	OU1-MW18	INT	3	<1	<1	<5.0	<1
	OU1-MW19	INT	3	<1	1	<5.0	<1
	OU1-MW22	INT	3	<1	<1	<5.0	<1
	OU1-MW67	Shallow	3	<1	<1	<5.0	<1
	OU1-MW84	INT	3	<1	<1	<5.0	<1
	OU1-MW85	Shallow	3	<1	<1	<5.0	<1
	OU1-MW89	Shallow	3	**8**	<10	<5.0	<10
	OU1-MW93	Shallow	3	<1	<1	<5.0	<1
	OU1-MW95	Shallow	3	<1	<1	<5.0	<1
	OU1-MW97	INT	3	<1	<1	<5.0	<1
	OU1-MW98	INT	3	<1	<1	<5.0	<1
	OU1-MW100	INT	3	<1	<1	<1	<1
	OU1-MW101	Shallow	3	<1	<1	<5.0	<1
	OU1-MW102	INT	3	<1	<1	<5.0	<1

See notes at end of table.

TABLE 2-7
SUMMARY OF GROUNDWATER ANALYTICAL DATA

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
BENZENE	OU1-MW12	INT	1	**9**	**9**	**6.7**	**6.3**
	OU1-MW18	INT	1	<1	<1	<5.0	0.51 J
	OU1-MW19	INT	1	<1	0.6 J	<5.0	0.43 J
	OU1-MW22	INT	1	<1	<1	<5.0	<1
	OU1-MW67	Shallow	1	<1	<1	<5.0	<1
	OU1-MW84	INT	1	<1	<1	<5.0	<1
	OU1-MW85	Shallow	1	<1	<1	<5.0	<1
	OU1-MW89	Shallow	1	**12**	**39**	**41**	**81**
	OU1-MW93	Shallow	1	<1	<1	<5.0	<1
	OU1-MW95	Shallow	1	<1	<1	<5.0	<1
	OU1-MW97	INT	1	<1	<1	<5.0	<1
	OU1-MW98	INT	1	<1	<1	<5.0	<1
	OU1-MW100	INT	1	<1	<1	<1	<1
	OU1-MW101	Shallow	1	<1	<1	<5.0	<1
	OU1-MW102	INT	1	<1	<1	<5.0	<1

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
CIS-1,2-DCE	OU1-MW12	INT	70	5	6	5.3	3.7
	OU1-MW18	INT	70	61	68	38	<1
	OU1-MW19	INT	70	**160**	**280**	**160**	**180**
	OU1-MW22	INT	70	4	4	4.5 J	12
	OU1-MW67	Shallow	70	26	**92**	57	<1
	OU1-MW84	INT	70	<1	<1	<5.0	<1
	OU1-MW85	Shallow	70	<1	<1	<5.0	<1
	OU1-MW89	Shallow	70	**98**	**410**	**330**	**300**
	OU1-MW93	Shallow	70	<1	<1	<5.0	<1
	OU1-MW95	Shallow	70	<1	<1	<5.0	<1
	OU1-MW97	INT	70	33	0.6 J	25	40
	OU1-MW98	INT	70	2	2	<5.0	1.2
	OU1-MW100	INT	70	**85**	61	67	**120**
	OU1-MW101	Shallow	70	<1	<1	<5.0	<1
	OU1-MW102	INT	70	4	5	5.2	11

See notes at end of table.

TABLE 2-7
SUMMARY OF GROUNDWATER ANALYTICAL DATA

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
TRANS-1,2-DCE	OU1-MW12	INT	100	<1	0.6 J	<5.0	<1
	OU1-MW18	INT	100	6	5	4.5 J	6.6
	OU1-MW19	INT	100	28	98	26	32
	OU1-MW22	INT	100	<1	0.5 J	<5.0	3.1
	OU1-MW67	Shallow	100	3	7	7.0	5.3
	OU1-MW84	INT	100	<1	<1	<5.0	<1
	OU1-MW85	Shallow	100	<1	<1	<5.0	<1
	OU1-MW89	Shallow	100	3	<10	3.8 J	<10
	OU1-MW93	Shallow	100	<1	<1	<5.0	<1
	OU1-MW95	Shallow	100	<1	<1	<5.0	<1
	OU1-MW97	INT	100	8	<1	4.9 J	8.2
	OU1-MW98	INT	100	<1	<1	<5.0	<1
	OU1-MW100	INT	100	8	9	8	9.4
	OU1-MW101	Shallow	100	<1	<1	<5.0	<1
	OU1-MW102	INT	100	<1	0.6 J	<5.0	<1

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
TCE	OU1-MW12	INT	3	3	3	1.9 J	1.3
	OU1-MW18	INT	3	**55**	**74**	**42**	**61**
	OU1-MW19	INT	3	**710**	**310**	**180**	**180**
	OU1-MW22	INT	3	**11**	**8**	**4.4 J**	**7.2**
	OU1-MW67	Shallow	3	<3	2	**5.0 J**	**4.6**
	OU1-MW84	INT	3	<1	<1	<5.0	<1
	OU1-MW85	Shallow	3	<1	<1	<5.0	<1
	OU1-MW89	Shallow	3	**900 J**	**1800**	**1400**	**1200**
	OU1-MW93	Shallow	3	<1	<1	<5.0	<1
	OU1-MW95	Shallow	3	<1	<1	<5.0	<1
	OU1-MW97	INT	3	**19**	<1	**11**	**14**
	OU1-MW98	INT	3	<1	<1	<5.0	<1
	OU1-MW100	INT	3	**6**	**11**	**7**	**3.3**
	OU1-MW101	Shallow	3	<1	<1	<5.0	<1
	OU1-MW102	INT	3	<1	<1	<5.0	<1

See notes at end of table.

TABLE 2-7
SUMMARY OF GROUNDWATER ANALYTICAL DATA

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Contaminant	Well Identification	Interval of Surficial Aquifer	MCL	Concentrations in µg/L			
				6/2001	11/2001	11/2002	11/2003
VC	OU1-MW12	INT	1	**5**	**6**	**6.1**	**3.3**
	OU1-MW18	INT	1	**13**	**22**	**10**	**14**
	OU1-MW19	INT	1	**11**	**14**	**14**	**16**
	OU1-MW22	INT	1	<1	<1	<2.0	0.74 J
	OU1-MW67	Shallow	1	**7**	**9**	**7.8**	**12**
	OU1-MW84	INT	1	<1	<1	<2.0	<1
	OU1-MW85	Shallow	1	<1	<1	<2.0	<1
	OU1-MW89	Shallow	1	**68**	**500**	**330**	**480**
	OU1-MW93	Shallow	1	<1	<1	<2.0	<1
	OU1-MW95	Shallow	1	<1	<1	<2.0	<1
	OU1-MW97	INT	1	0.7 J	<1	<2.0	0.96 J
	OU1-MW98	INT	1	<1	<1	<2.0	<1
	OU1-MW100	INT	1	**4**	0.8 J	1	**2.8**
	OU1-MW101	Shallow	1	<1	<1	<2.0	<1
	OU1-MW102	INT	1	**9**	**7**	**16**	**33**

Notes:
< = less than
J = estimated concentration
Bolded value = concentration exceeds the groundwater cleanup target level (GCTL)
INT = intermediate zone of the aquifer
Shallow = shallow zone of the aquifer

The point of compliance for the groundwater monitoring at OU 1 is assigned to a pair of surface water stations; therefore, any contamination indicated by downgradient wells is expected to follow a vertical gradient upward to the surface water body. The downgradient groundwater monitoring well pairs designed for this part of the LTMP include MW-67 (shallow zone) and MW-100 (intermediate zone), and MW-101 (shallow zone) and MW-102 (intermediate zone) (see Figure 2-6 for location). Therefore, as long as the surface water monitoring network is adequate and the standards for the COCs are not exceeded at the surface water monitoring locations, the monitoring program is expected to be protective of groundwater contamination from the site. The USGS model for OU 1 includes RT3D (NA model component) to estimate the time required for the COCs to attenuate to less than GCTLs. The model and the results of the effort are reported in the USGS draft report (USGS, 2004). The purpose of the effort was to provide information that was used to evaluate the need for the contingency action in the ROD. Although the USGS report is draft, the USGS model indicates that the groundwater contamination that is associated with OU 1 will naturally attenuate to less than GCTLs prior to the 30-year deadline.

2.6.4.2 Review of NA Data for Groundwater

Following a review of the latest NA data for the site, it is reported that iron reduction appears to be the dominant electron acceptor reaction at the site for reductive dechlorination (TtNUS, 2003b). It is also reported that dechlorination by iron reduction is probably occurring in the source areas of the shallow zone, but the system is normally aerobic away from those source areas making it difficult for a migrating COC plume to continue to degrade away from the source area in the shallow zone.

2.6.4.3 Review of Surface Water COC Data

Review of records and monitoring reports indicate that long-term monitoring of the surface water through a fifth year has occurred in accordance with the LTMP for OU 1. A review of the reports covered by this five-year review indicates that two semi-annual monitoring events were conducted in 2001, one annual monitoring event was conducted in 2002, and one annual event was conducted in 2003. As part of the monitoring program, two specific surface water locations (SW-20 and SW-55) were sampled and analyzed for the COCs as indicated in the ROD and later modified by the NAS Jacksonville Partnering Team. The COCs, as analyzed for the four events covered by this review, are the same set of COCs analyzed for in the groundwater. Table 2-8 summarizes the surface water data for the four events covered by this review. The data indicates only sporadic detections of some COCs at both locations and none of the TLCAs have been exceeded.

TABLE 2-8
SUMMARY OF SURFACE WATER ANALYTICAL RESULTS

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

LOCATION	TLCA	OU1-SW20			
SAMPLE DATE		06/20/01	11/16/01	11/08/02	11/20/03
Volatile Organics (µg/L)					
1,1-DCE	3.2	<1	<1	<5	<1
1,2-DCA	---	<1	<1	<5	<1
BENZENE	71.28	<1	<1	<5	<1
CIS-1,2-DCE	---	0.2 J	0.9 J	<5.0	0.99 J
TRANS-1,2-DCE	---	<1	<1	<5	<1
TCE	80.7	<1	<1	<5.0	<1
VC	---	<1	<1	<5.0	<1

LOCATION	TLCA	OU1-SW55			
SAMPLE DATE		06/20/01	11/16/01	11/08/02	11/20/03
Volatile Organics (µg/L)					
1,1-DCE	3.2	<1	<1	<5	<1
1,2-DCA	---	<1	<1	<5	<1
BENZENE	71.28	<1	<1	<5	<1
CIS-1,2-DCE	---	0.7 J	0.9 J	4.6 J	2.7
TRANS-1,2-DCE	---	<1	<1	<5	<1
TCE	80.7	<1	<1	1.5 J	1.3
VC	---	<1	<1	<5.0	0.42 J

Notes:
J = estimated concentration.
The TLCAs listed on this table are annual averages from Chapter 62-302, FAC.

2.6.4.4 LNAPL

Documentation indicating the amount of LNAPL recovered was obtained (Appendix B). It was estimated in Appendix B that approximately 781 gal of LNAPL have been recovered to date.

Historical documents pertaining to the LNAPL system were reviewed to determine if the RAOs of the IROD and ROD were being met. The RAO presented in the IROD was to remove LNAPL from the shallow surficial aquifer at the LSA and manage it in accordance with USEPA and FDEP regulations to control a source of groundwater contamination. The LNAPL is interpreted to be a weathered petroleum waste containing greater than 50 milligrams per kilogram (mg/kg) PCBs.

The Station Public Works Center analyzes the recovered LNAPL on a yearly basis for waste characterization disposal. The LNAPL has been characterized as hazardous due to ignitability. In addition, the LNAPL has been classified as PCB-contaminated waste every year except 2001, where the recovered LNAPL was characterized only as ignitable. Although the solubility of PCBs is low, the solubility does increase in the presence of organic solvents.

As presented in Table 2-2, the ROD for OU 1 contained an RAO for the LNAPL, which stated “Remove LNAPL if greater than 0.1 inch from the water table”. However, the wells were subsequently removed and not available for confirming if this RAO had been met. In 2002, TtNUS performed an investigation to determine the extent of LNAPL contamination at OU 1. As documented in the LNAPL report (TtNUS, 2003a), only one of the temporary wells installed by TtNUS contained a measurable amount of LNAPL [0.02 feet (0.24 inches) was detected in TMW-8]. Additionally, benzene, ethylbenzene, isopropyl benzene, xylenes, TRPH, arochlor 1242 and arochlor-1260 exceeded leachability criteria in one or more samples collected during the investigation.

The Focused Remedial Investigation (FRI)/Focused Feasibility Study (FFS) (ABB-ES, 1993a) based the critical threshold value of TPH in soil above which LNAPL could be recovered using gravity flow at 20,000 mg/kg. Using this, the report estimated the volume of potentially recoverable LNAPL ranged from 5,900 to 10,200 gal. TtNUS’ investigation (2003) showed approximately four locations in the LSA that retain COCs in excess of residential SCTLs, and only one of those locations showed a TPH concentration above the established threshold value of 20,000 mg/kg.

2.6.4.5 LUC Inspections

The completed LUC Inspection Checklists for OU 1 appear to be complete except for the third quarterly inspection that was missed for the Year 2003. Completed quarterly inspections were conducted at OU 1 in 2001, 2002, 2003 and 2004 except as noted above.

2.6.5 Site Inspection and Interviews

TtNUS conducted a site inspection of OU 1, PSCs 26 and 27, on October 27, 2004. Prior to initiating the inspection, the inspector interviewed Mr. Bill Raspet, the IR Manager, for NAS Jacksonville and Ms. Jane Beason, the Hazardous Waste Manager for NAS Jacksonville. Regarding the missing LUC inspection of the past, it is likely that the multiple changes to the IR Manager position were partially responsible for this oversight. The IR Manager intends to make improvements for tracking and accomplishing future inspections as required. Later, the IR Manager accompanied the inspector for the site inspection, which included visual observations of the landfill cover, surface water, sediment, LNAPL recovery system, fence and access gate, and groundwater monitoring wells.

The landfill cover was a mixture of grass and weeds. Visual observations of the area did not provide evidence of erosion problems, trespassing, or disturbance of the landfill. Site restrictions (i.e., fence and signs) were in place and in good condition. The access gate is still serviceable and in good condition; however, the numbered entry pad and motorized drive to open it no longer worked. Surface water and sediment were not evident in the landfill area.

A site inspection was conducted at the LNAPL recovery system; however, the system was down. TtNUS met with Mr. Daniel Roberts of PWC to discuss the OU 1 LNAPL system operation in November 2004. The system consists of the North and South Trenches, each containing a recovery system. Both trench systems appeared in good condition from the exterior. The fence, equipment storage sheds, and recovery sumps were in good condition and locked. Warning signs were clearly marked and in good condition. No signs of trespassing were evident, and the IR Manager said that there have been no complaints, violations, or incidents. Health and safety and contingency plans, permits, and operational records and logs were not located on site. According to the LNAPL collection records (Appendix B), the site visits have decreased in frequency from regular monthly visits to sporadic, non-regular visits. A review of the LNAPL product recovery logs indicate that no LNAPL has been recovered from the South or North Trenches since April 2003.

TtNUS has conducted several site visits at OU 1 as part of the landfill inspections in 2002 and 2003. The site visits included semi-annual landfill inspections that were conducted in 2002 and 2003. Some minor observations were documented during these site visits, which were corrected by the time of the following

report. During the site visit with the IR Manager, TtNUS met briefly with an environmental technician (John Hubbard) from Aerostar that has recently been contracted to conduct the landfill maintenance and inspections. Mr. Hubbard was mowing the landfill's grass cover and reported nothing unusual during the visit. Later, during the tour, the IR Manager and a TtNUS inspector found monitoring well MW-67 without a lock.

TtNUS interviewed Dr. Dan Wadill, Ph.D., of NAVFAC EFD SOUTH. Dr. Wadill has completed an optimization study on the LNAPL system. Resulting from his efforts, he reports that the COCs in the soil appear to no longer present a significant LNAPL issue. His recommendation was to discontinue the operation of the system and address the remaining soil contamination in an alternate way. The NAS Jacksonville Partnering Team discussed the system during the January 2005 meeting and reached consensus to discontinue the LNAPL system operations effective February 2005.

2.7 TECHNICAL ASSESSMENT

2.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is not functioning as intended by the ROD as modified by the NAS Jacksonville Partnering Team.

- ***Health and Safety Plan (HASP)/Contingency Plan:*** A HASP and a maintenance and monitoring plan are in place for the OU 1 landfill and post-closure monitoring, sufficient to control risks as long as it is properly implemented. A HASP and a Contingency Plan are not in place for the LNAPL recovery system.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls are in place as part of the LUC program at NAS Jacksonville. There are no known current or planned land use changes at this time that would render the LUCs ineffective. OU 1 is inspected quarterly to ensure the controls remain in place. The fence and signs on site are maintained and in good condition. No water supply wells are allowed in the restricted area. The third quarterly LUC inspection in the Year 2003 was not performed. The implementation appears incomplete, however, due to the lack of preparation of the LUCIP for OU 1.

- ***Remedial Action Performance:*** The landfill cover system appears effective at isolating waste and contaminants. The optimization study performed by the Navy led the NAS Jacksonville Partnering Team to reach consensus to discontinue the LNAPL system operation. Based on the modeling effort performed by the USGS, it appears that the groundwater contamination on the eastern portion of the

site is attenuating at an acceptable rate to achieve the RAOs established in the ROD. Further, it does not appear that the contingency action is going to be needed.

- ***System Operations/O&M:*** The landfill cap and monitoring wells are in good condition and maintained with the exception that one well (MW-67) was found unlocked during the recent inspection. O&M of the landfill seems to be performed on a regular basis. The LNAPL recovery system does not appear to be operating as designed. The system has not recovered the LNAPL to the extent expected. One sump in the South Trench has not collected LNAPL since the start-up of the system.

- ***Cost of System Operations/O&M:*** As noted above in Section 2.4.3, the cost for remediation of OU 1 slightly exceeds the estimated amount provided in the ROD. Specifically, the costs have been higher with the LNAPL recovery system because the system has operated significantly longer than expected.

- ***Opportunities for Optimization:*** The LNAPL recovery system underwent an optimization study by NAVFAC EFD SOUTH and will be shut down. There are no other known opportunities for optimization.

- ***Early Indicators of Potential Remedy Failure:*** Early indicators of potential remedy failure were noted during this review as follows:

  - The TtNUS report (2003) has indicated the presence of PCBs, VOCs, and total recoverable petroleum hydrocarbons in the "soil immediately above the water table" that exceeds the applicable leachability SCTLs. The in-place LUCs are providing protection to human receptors and the depth of contamination will prevent significant ecological exposure. However, it is not apparent whether the COCs in the vadose zone soil are acting as a continuing source of contamination for the LNAPL or dissolved groundwater contamination.

2.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

2.7.2.1 Exposure Assumptions

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

2.7.2.2 Changes in Standards and To Be Considered (TBC) Criteria

In accordance with the ROD, the only chemical-specific ARARs identified for the site apply to the groundwater which still must be met. The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- Clean Water Act Regulations, Ambient Water Quality Criteria (40 CFR Part 131)
- Florida Surface Water Standards, FAC, Chapter 62-302, May 2002
- Groundwater Classes, Standards, and Exemptions, FAC, Chapter 62-520, November 2003
- Florida Water Quality Based Effluent Limitations, FAC, Chapter 62-650, December 1996

The Clean Water Act Regulations direct states to formulate standards for their own resources based on best available science and then gain approval to adopt those standards from the federal government. The July 2003 version of the Clean Water Act Regulations does not appear to cite Florida as having gone through that process. However, the National Primary Drinking Water Regulations in 40 CFR Part 141 do cite the MCLs for the several COCs monitored in the groundwater at this site. Those particular MCLs have not changed.

The Groundwater Classes, Standards, and Exemptions, FAC, Chapter 62-520, sets minimum qualitative criteria for groundwater based on its classification. The surficial aquifer at OU 1 is classified G-II (ABB-ES, 1996a). In addition to the minimum criteria for G-II water in FAC, Chapter 62-520, the rule (under 62-520.420(1)) directs that Class G-II groundwater shall meet the primary and secondary drinking water quality standards for public water systems established pursuant to the Florida Safe Drinking Water Act, which are listed in Rules 62-550.310 and 62-550.320, FAC. Those particular standards also have not changed.

Florida Surface Water Standards, FAC, Chapter 62-302, continue to apply to the TLCAs adopted for this site, and they were compared to the existing standards as modified by the NAS Jacksonville Partnering Team. In addition, Chapter 62-302.300.10(c), FAC, states the "companion provisions of Chapters 62-4, 62-6, FAC, approved simultaneously with these Water Quality Standards are incorporated herein by reference as a substantive part of the State's comprehensive program for the control, abatement, and prevention of water pollution". Therefore, standards established in Chapter 62-4 for mixing zones were compared and new or lower standards were determined for benzene, TCE, and VC.

The standards in Rule 62-777, FAC, apply directly to Brownfields and petroleum sites. However, because they provide cleanup criteria for soil, surface water, and groundwater, they are being evaluated in this five-year review as TBC criteria. Each of the seven groundwater COCs were checked in Table 1 of that rule, and each one was listed with a groundwater cleanup target level of the applicable primary

standard as provided in Rules 62-520 and 62-550, FAC. However, it does list standards for COCs that previously did not have listed surface water criteria. The following surface water criteria were included in Table 1 from that rule:

- 1,2-DCA – 5 µg/L (Human Health)
- 1,2-DCE (trans) – 11,000 µg/L (toxicity criteria)

These two compounds are currently being monitored in the surface water only because they have been detected previously in the groundwater and are potential degradation products of TCE. There is no known impact to the surface water from these constituents and 62-777, FAC, is not an ARAR; therefore, these values will not be included in the program.

The only location-specific ARAR for OU 1 is the Endangered Species Act, which has remained unchanged.

The action-specific ARARs for OU 1, governing actions such as the construction of landfills, have not changed since the signing of the ROD. These requirements are called for by the RCRA.

2.7.2.3 Changes in Exposure Pathways, Toxicity, and other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures (trespasser, neighbor, maintenance worker, recreational user of the St. Johns River) and future exposures (neighbor, recreational user of the St. Johns River, excavation worker). There have been no changes in the toxicity factors for the COCs that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

2.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

During a recent excavation adjacent to the western side of the landfill to install fencing, discolored water and various types of trash were excavated. The Navy reviewed the available data in the RI/FS to determine if there might have been any identified contaminated soil areas that were not included in the excavation plan for the presumptive remedy.

Groundwater data from the RI/FS (ABB-ES, 1996a) indicates that flow from the northwestern side of the landfill is to the west. Direct push technology (DPT) and monitoring well data from three events that were reported in the remedial investigation (RI) show organics, inorganics, and/or radionuclides exceeded Florida MCLs. The Risk Assessment in the RI indicates these data were not evaluated since it was neither inside the presumptive remedy or the defined plume.

The USGS recently revised their groundwater flow model and, based on the more recent data; it appears that all groundwater may not discharge into the unnamed creek as was modeled earlier. Specifically, groundwater near MW-89 may migrate to the east and escape collection by the groundwater control network described in the original RI/FS.

The USEPA has developed indoor air vapor intrusion guidance to screen sites in determining if the groundwater to indoor air pathway may pose a significant risk to human health. This guidance is recommended by the USEPA for CERCLA sites as TBC criteria. NAVFAC EFD SOUTH is currently evaluating indoor air intrusion at OU 1 using the USEPA guidance.

2.8 ISSUES

Issues were discovered during the five-year review and are noted in Table 2-9. None of these are sufficient to warrant a finding of not protective as long as corrective actions are taken.

TABLE 2-9
ISSUES FOR OPERABLE UNIT 1

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Issue Number	Issue	Affects Protectiveness (Y/N)	
		Current	Future
1	Soil and Groundwater contamination on NW boundary of OU 1 is not delineated.	*	*
2	All LNAPL trench sumps not being measured on a monthly basis.	N	N
3	LNAPL system not operating.	N	N
4	Lock missing on well MW-67.	N	N
5	Missed one LUC Inspection.	N	N
6	No HASP or contingency plan exists for the LNAPL system.	N	N
7	Indoor Air Intrusion potential for residences in the groundwater contamination plume area.	*	*
8	According to the most recent USGS modeling effort, there is a potential for contaminated groundwater in the northern portion of the plume to migrate beyond the currently defined groundwater system.	*	*
9	The LNAPL system operation has been discontinued, and the RAO has not been achieved. A new remedy (e.g., natural attenuation) may need selected and the proper administrative actions performed.	N	N

*A protectiveness determination cannot be made at this time until further information is obtained.

2.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendations and follow-up actions are outlined in Table 2-10.

TABLE 2-10
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

FIVE-YEAR REVIEW
OPERABLE UNIT 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Issue Number	Issue	Recommendations	Responsible Party	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
						Current	Future
1	Soil and Groundwater contamination on NW boundary of OU 1 is not delineated.	Do supplemental investigation along NW boundary to define and delineate shallow soil and groundwater issues. Make protectiveness determination.	Navy	USEPA/FDEP	04-Mar-10	*	*
2	LNAPL recovery rates slower than projected.	The LNAPL system was shutdown in February 2005. Therefore, these issues have been overcome by events.	Navy	USEPA/FDEP	28-Feb-05	N	N
3	LNAPL system not operating.		Navy	USEPA/FDEP	28-Feb-05	N	N
4	Lock missing on well MW-67.	Replace lock on well MW-67.	Navy	USEPA/FDEP	31-Mar-05	N	N
5	Missed one LUC Inspection.	Inspect site quarterly or as required by LUCIPs.	Navy	USEPA/FDEP	30-Jun-05	N	N
6	No HASP or contingency plan exists for the LNAPL system.	The LNAPL system was shutdown in February 2005. Therefore, these issues have been overcome by events	Navy	USEPA/FDEP	28-Feb-05	N	N
7	Indoor Air Intrusion potential for residences in the groundwater contamination plume area.	Evaluate this issue and take any required corrective actions.	Navy	USEPA/FDEP	04-Mar-10	*	*
8	According to the most recent USGS modeling effort, there is a potential for contaminated groundwater in the northern portion of the plume to migrate beyond the currently defined groundwater system.	Add monitoring wells located east of MW-89 to the monitoring program to verify that the groundwater contamination is contained within the monitoring network.	Navy	USEPA/FDEP	04-Mar-10	*	*
9	The LNAPL system operation has been discontinued, and the RAO has not been achieved. A new remedy (e.g., natural attenuation) may need selected and the proper administrative actions performed.	Prepare proper CERCLA documentation for alternate remedy.	Navy	USEPA/FDEP	04-Mar-10	*	*

* A protectiveness determination cannot be made at this time.

2.10 PROTECTIVENESS STATEMENT

The remedial actions at OU 1 are currently protective. However, a protectiveness determination for Issues 1, 7, 8 and 9 cannot be made at this time until further information is obtained. Further information for Issue 1 will be obtained via additional investigation on the northwestern side of the OU 1 landfill. Further information for Issue 7 will be obtained through an indoor vapor air intrusion evaluation and any required testing. It is expected that these actions will require approximately five years to complete, at which time a protectiveness determination will be made.

3.0 OPERABLE UNIT 2

Implementation of the remedial actions at OU 2, the Wastewater Treatment Area, began in 1994. The risks posed by the PSCs at OU 2 were addressed through IRAs, which were specified in the IROD dated July 1, 1994. The ROD for OU 2, which was signed in 1998, specified that No Further Action (NFA) was required except for the implementation of LUCs restricting groundwater use and land use at OU 2. This action was contingent on the RCRA groundwater monitoring program at PSCs 41, 42, and 43.

This five-year review is being conducted for OU 2 because contaminated subsurface soil and groundwater are still contained on site and do not allow for unlimited use and unrestricted exposure.

The former Fire-fighting Training Area (PSC 2) is located within OU 2. Previous burning of fuels within an unlined pit located at the training area affected the soil quality at PSC 2. Although this site is located within the area designated as OU 2, due to the presence of LNAPL and petroleum related contaminants and based on the CERCLA petroleum exclusion, PSC 2 was transferred to the State's petroleum program prior to the signing of the ROD [Harding Lawson & Associates (HLA), 1998]. Therefore, PSC 2 is not reviewed as part of this five-year review.

3.1 SITE CHRONOLOGY

A list of significant OU 2, PSC 3, PSC 4, PSC 41, PSC 42, and PSC 43 historical events and relevant dates in the site chronology are provided in Table 3-1. The identified events are illustrative, not comprehensive.

3.2 BACKGROUND

A generalized map of NAS Jacksonville showing the location of OU 2 in the northwestern portion of the facility is provided on Figure 1-1. A map of OU 2 showing the relative locations of the PSCs is provided on Figure 3-1.

TABLE 3-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 2

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event		Date
Pre-discovery of contaminants		
	PSC 2 - 6,000 gal of jet fuel and waste oil were burned annually.	1966 to 1991
	PSC 3 – 20,000 tons of sludge containing metals were dumped.	1962 to 1980
	PSC 4 – Used for disposal of paint shavings, sewage sludge, asbestos, oil, and petroleum products.	1968 to 1975
	PSC 41 – Domestic waste sludge drying beds received sludge from wastewater treatment plant (WWTP).	1970 to 1980
	PSC 42 – WWTP effluent polishing pond operational.	1970 to 1987
	PSC 43 – Industrial waste sludge drying beds operational.	1980 to 1988
Initial discovery of problem or contamination		
	PSCs 2, 3, and 4 were identified as potential sources of contamination.	1983
Pre-NPL responses		
	Hazardous Waste Permit H016-119108 issued to NAS Jacksonville.	Jun-87
	Consent Order issued to NAS Jacksonville indicating they were out of compliance with HWP.	1988
NPL Listing		Nov-89
FFA signature		1990
Post-NPL responses		
	Compliance monitoring at PSCs 41 and 42 detected contamination.	1991
	PSC 4 grouped into OU 2.	1991
Focused RI/FS conducted for PSCs 2, 41, and 43		1994
IROD for PSCs 2, 41, and 43		1994
Focused RI/FS conducted for PSCs 3 and 42		1995
IROD for PSC 42		1995
IRA for PSC 2 included soil excavation, thermal desorption, and backfill and free product removal		1995
Completion Report for PSC 2		1996
USEPA and FDEP approved transfer of PSC 2 to Florida's petroleum program since LNAPL still present		1996
Limited soil removal conducted at PSC 3 and those soils were incorporated in IRA at PSC 42		1997
Soils removed at PSC 4 and incorporated in IRA at PSC 42		1997
Certification and Closure Report for PSC 41 (work conducted in two phases)		1997
	Phase 1 included excavation and on-site stabilization of media from PSCs 41 and 43.	---
	Phase 2 included excavation/transportation of stabilized material from PSC 41 to PSC 42.	---
Certification and Closure Report for PSC 42		1997
	Closure included construction of containment berm around PSC 42 and in situ stabilization of	---
	sediment, sludge, and water.	---

TABLE 3-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 2

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event		Date
Certification and Closure Report for PSC 43		1997
	Closure included removal and disposal of non-hazardous material off site.	---
	Hazardous material was excavated, treated on site, and included in PSC 42 IRA. Site rec'd clean backfill.	---
RI conducted for OU 2		1998
Proposed Plan for Remedial Action (start of public comment period)		Apr-98
Proposed Plan for Remedial Action (end of public comment period)		May-98
MOA signed between USEPA, FDEP, and Navy to ensure land use control compliance		Aug-98
ROD signature for OU 2		Oct-98
Institutional controls for OU 2 developed through Land Use Control Implementation Program (LUCIP)		
Post-ROD RCRA activities		
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-99
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-00
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-01
Previous five-year reviews		
	First five-year review	Sep-01
Continuing Post-ROD RCRA activities		
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-02
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-03
	Groundwater Monitoring at PSCs 41, 42, and 43.	Jan-04

Note:

This table lists historical events and relevant dates for OU 2; however, it is not comprehensive. Also, due to the complex history of the site, dates may overlap or appear to be out of order as they were placed to fit certain major events.

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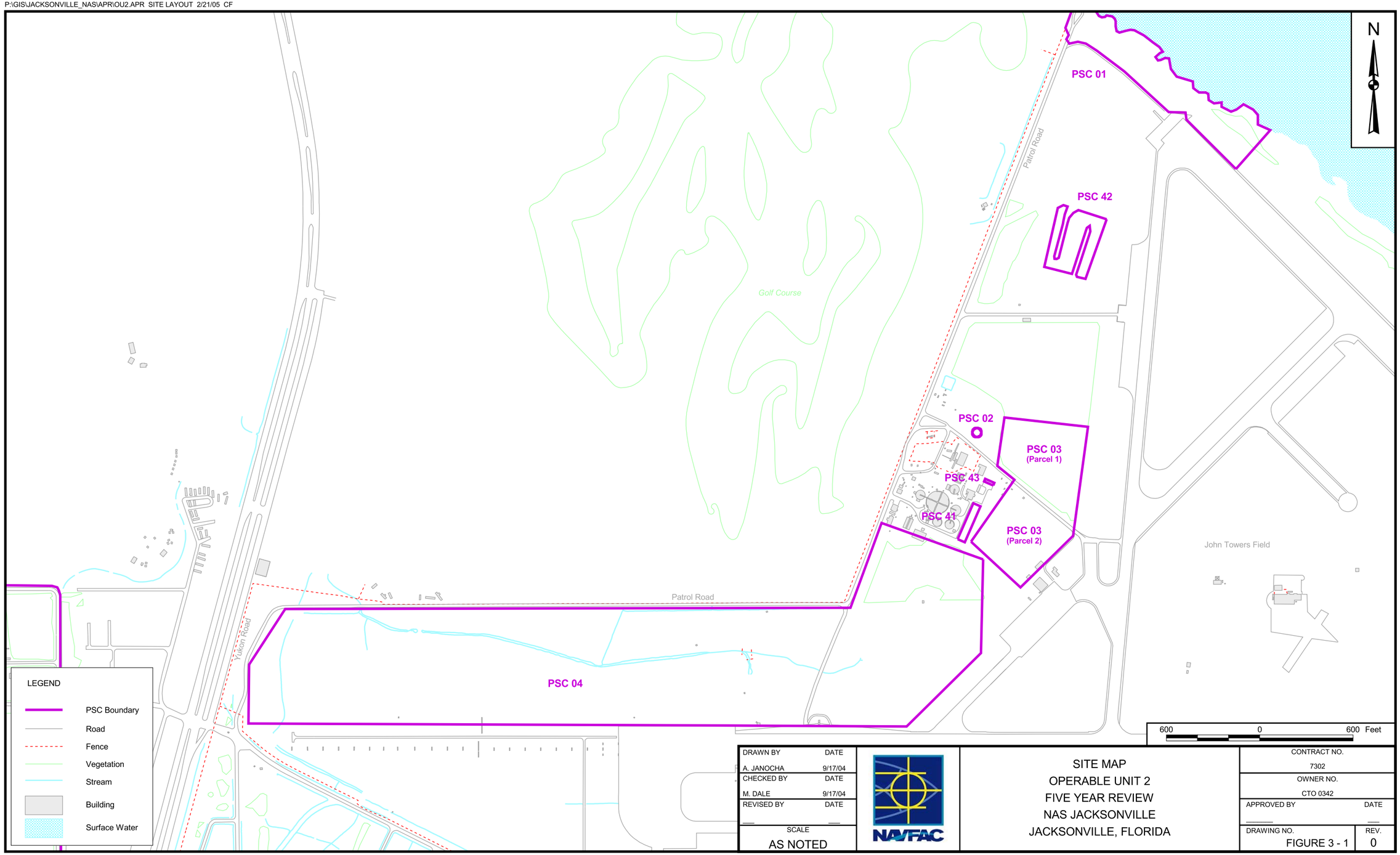

DRAWN BY	DATE
A. JANOCHA	9/17/04
CHECKED BY	DATE
M. DALE	9/17/04
REVISED BY	DATE
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SCALE	
AS NOTED	

NAVFAC

SITE MAP
OPERABLE UNIT 2
FIVE YEAR REVIEW
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	
7302	
OWNER NO.	
CTO 0342	
APPROVED BY	DATE
___	___
DRAWING NO.	REV.
FIGURE 3 - 1	0

3.2.1 Physical Characteristics of OU 2

OU 2 is on the northern portion of NAS Jacksonville and is bordered by the St. Johns River to the north, the Timuquana Country Golf Course to the northwest, Blanding Boulevard (U.S. Highway 17) to the west, and NAS Jacksonville runways to the south and east (Figure 3-1).

OU 2 contains NAS Jacksonville's WWTP, which treated both industrial and domestic waste. Buildings remain at OU 2; however, the majority of the area consists of grassland with trees in locations. The topography is generally flat with the exception of the serpentine mound created during the soil remediation. There are no surface water bodies within OU 2. However, there are small low lying areas and drainage ditches where water collects during period of heavy precipitation.

The Master Plan for NAS Jacksonville reports that the 100-year flood level for the station is 5 ft msl (AGM, 1999a); therefore, it appears that only a narrow portion of the northern part of OU 2 is inside the 100-year floodplain. PSC 42, which appears in the shape of an 'S' on Figure 3-2, is located between the 10 and 15 ft msl contours; therefore, none of the PSCs are within the 100-year flood level for the station.

3.2.2 Land and Resource Use at OU 2

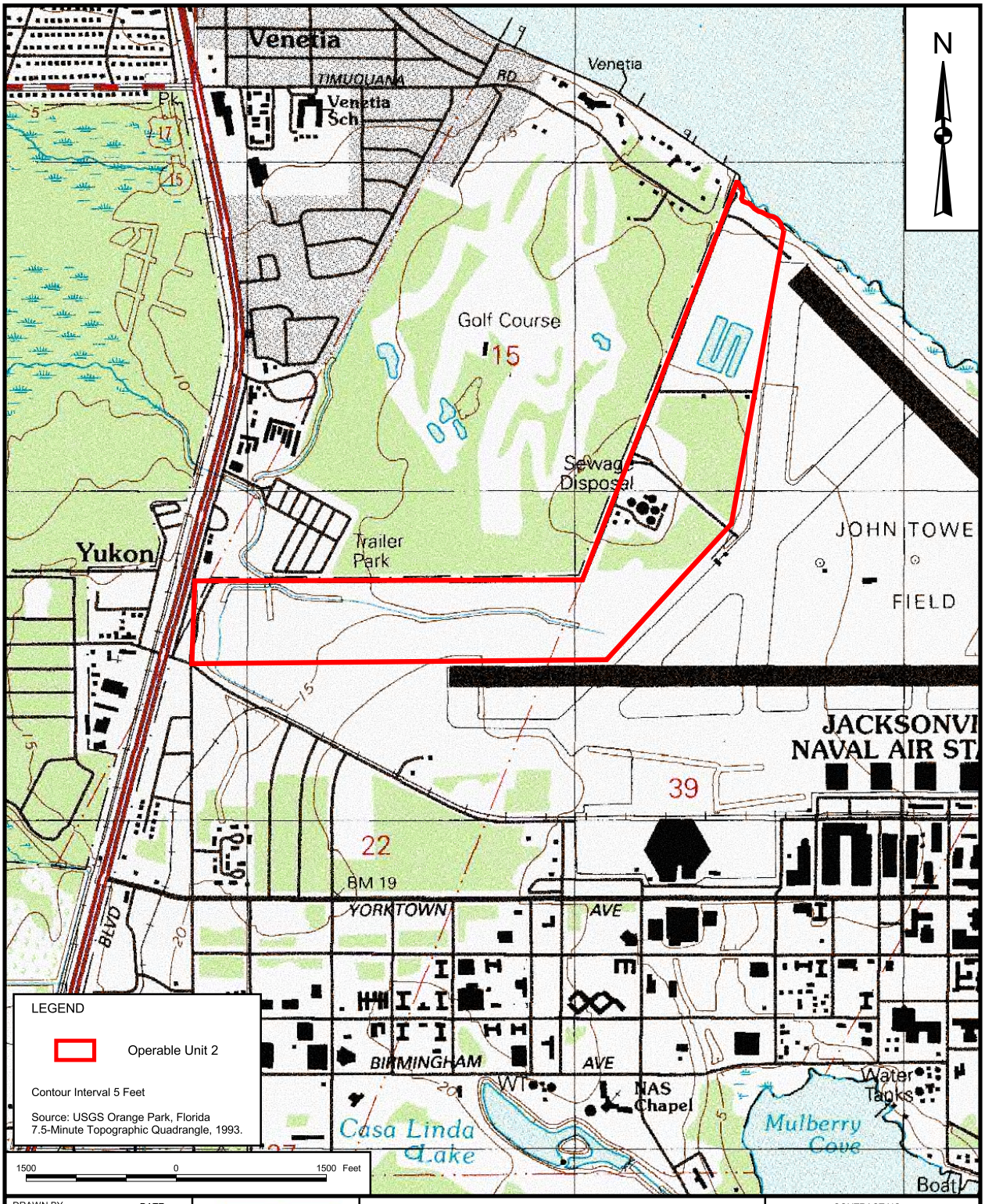
NFA was granted for OU 2 by the USEPA and FDEP in the ROD (HLA, 1998) under the condition that LUCs would be enacted to prevent exposure to the contaminated media remaining on site and also under condition that groundwater monitoring under the RCRA program be conducted at the site until cleanup is achieved.

Under the LUC program, the station maintains the existing fence, which restricts airfield trespassing, and have agreed to maintain OU 2 for industrial use. The objectives for the LUCs include preventing residential use and providing worker notification of potential hazards. The land use for the site has remained unchanged as of this writing.

3.3 HISTORY OF CONTAMINATION AND INITIAL RESPONSES AT OU 2

PSC 3 – WWTP Former Sludge Disposal Area

The former sludge disposal area for the WWTP, where domestic and industrial sludge containing organic and inorganic materials were disposed between 1962 and 1980, is approximately 15 acres in size. In 1991, various waste materials were identified including inorganics, VOCs, and SVOCs. Apparent sludge disposal practices and stressed vegetation indicated contaminants were potentially present in the soil. Although no monitoring wells were installed at PSC 3, groundwater samples from PSC 41 near PSC 3 indicated the presence of inorganic and organic contaminants in the groundwater near the WWTP.



DRAWN BY: A. JANOCHA	DATE: 9/17/04	TOPOGRAPHIC MAP OPERABLE UNIT 2 FIVE YEAR REVIEW NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
CHECKED BY: M. DALE	DATE: 9/17/04		OWNER NO.: CTO 0342
REVISED BY: —	DATE: —		APPROVED BY: — DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 3 - 2 REV: 0

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Investigations at PSC 41 indicated that the contamination detected in the groundwater at PSC 41 may have been a result of migration from PSC 3, but this could not be confirmed. Groundwater was further characterized at OU 2 through semi-annual monitoring at the sludge drying bed area. An RI was performed to address environmental concerns at OU 2. A focused RI at PSC 3, completed in 1993, indicated soil contamination from VOCs and SVOCs was not extensive, and no PCB compounds were detected. Pesticide analytes were consistent with existing station-wide background samples that were attributed to past station-wide pest control practices rather than past sludge disposal practices. The five inorganic compounds (metals) found at PSC 3 were attributed to past sludge disposal practices since these metals were known to have been used in the plating shops that discharged to the WWTP. Although contaminants were identified, the focused risk evaluation indicated that contaminants were not at unacceptable levels and did not suggest the need for remedial action or source removal. Surface soil around one area at PSC 3, where lead exceeded the guidance cleanup goals, was removed in 1997 (ABB-ES, 1998). The RI for OU 2 was completed in 1998. The ROD, signed in 1998, specified an NFA for PSC 3 with the implementation of LUCs restricting land and groundwater use at OU 2.

PSC 4 – Pine Tree Planting Area

The Pine Tree Planting Area located south of the WWTP was used for disposal of WWTP sludge, asbestos, oil, and other petroleum products from 1968 to 1975. Inspections of the area in 1983 reported visual evidence of contamination such as paint shavings and WWTP sludge. In 1985, three temporary monitoring wells were installed to confirm whether or not leachate containing heavy metals was contaminating the groundwater. Trace concentrations of organic and metals contaminants were detected in the groundwater.

In 1991, PSC 4 was grouped into OU 2, and a RI was conducted in 1992. Soils samples were collected throughout PSC 4, and laboratory testing indicated no significant VOCs or SVOCs were detected. Pesticide analytes were consistent with existing stationwide background samples that were attributed to past stationwide pest control practices. Because of metal concentrations, sludge piles and soil surrounding one soil sampling location were removed in 1997 (HLA, 1998). The RI for OU 2 was completed in 1998. The ROD was signed in 1998 and it specified that NFA was required at PSC 4 except for the implementation of land use controls for land and groundwater use at OU 2.

PSC 41 – Domestic Waste Sludge Drying Beds (DSDBs)

The DSDBs were constructed in 1970 to receive sludge from the anaerobic digester at the WWTP. Prior to the construction of the Industrial Waste Sludge Drying Beds (ISBDs) (PSC 43) in 1980, sludge from the industrial wastewater treatment operations was channeled to the DSDBs. In 1984, four shallow monitoring wells were installed. Groundwater samples were collected and analyzed from 1984 to 1991

as part of the Quarterly Compliance Monitoring Program for RCRA compliance. Based on historical data, it was concluded that the bulk of the sludge channeled to the drying beds apparently originated from paint-stripping operations with lesser contributions from the plating and metal-treating shops. Fourteen contaminants listed in Appendix IX (40 CFR 261) were detected in groundwater samples. The USEPA classified the DSDBs as a surface impoundment operated to treat hazardous wastes F006 and F019. PSC 41 was also used to store sludge from electroplating operations, wastes from paint stripping and parts cleaning operations (F001 through F005), and sludge from the anaerobic digester of the domestic WWTP. During its operations, an average of 170 gallons per day of dewatered sludge from PSC 41 was disposed at an off-site landfill. The drying beds were removed from service in 1987.

In 1988, the FDEP issued a consent order to NAS Jacksonville indicating the station was out of compliance with Permit Number H016-119108 based on hazardous constituents found in groundwater. The consent order mandated corrective actions. In 1989, additional wells were installed and sampled to characterize groundwater beneath PSCs 41 and 43. The results indicated that groundwater flow was to the northeast with a mounding effect near the beds. Groundwater sampling results indicated groundwater contamination from VOCs, SVOCs, and metals in both shallow and deep monitoring wells. In 1991, the FDEP issued a Closure permit for closure and post-closure of PSCs 41, 42, and 43.

The RA for source control at PSC 41 was to excavate and treat the sludge drying bed material and hazardous debris on-site by stabilization and solidification, backfill with the treated material, and dispose of non-hazardous debris off-site. Soil and filter media from the ground surface down to the water table were excavated and stabilized. Stabilized materials from PSC 41 and PSC 43 were used to backfill the excavation at PSC 41. In 1997, the stabilized and solidified sludge and soil materials were excavated from PSC 41 and incorporated as backfill at PSC 42. Radiological surveys conducted in 1995 indicated that the PSCs were free of radiological contaminants (ABB-ES, 1998). The RI for OU 2 was completed in 1998. The ROD was signed in 1998 that specified an NFA for PSC 41 with the implementation of land use controls and monitoring under the RCRA program until cleanup is achieved.

PSC 42 – Effluent Polishing Pond (PP)

The WWTP Effluent PP, built in 1970, provided final clarification for approximately 2.3 million gallons per day of combined domestic and industrial treated effluent prior to chlorination and discharge to the St. Johns River. In 1983, the USEPA classified the PP as a surface impoundment to treat RCRA hazardous wastes F001 through F006 and F019 (toxic hazardous wastes from non-specified sources). In 1984, three monitoring wells were installed around the PP for quarterly monitoring. In 1985, a compilation of quarterly monitoring results indicated that the analytes were below primary drinking water standards with the exception of iron, TPH, chloromethane, and 1,1,1-TCA. Additional monitoring wells were

installed and sampled in 1987. Results from wells surrounding the WWTP indicated that 14 analytes were above permit criteria.

In June 1987, the FDEP authorized Permit Certification Number H016-119108. Included in the environmental compliance requirements of the permit was that NAS Jacksonville stop adding wastes to the designated surface impoundments including the PP. In anticipation of this requirement, the PP was permanently removed from service on May 23, 1987.

Post closure monitoring reports summarized in 1991 indicated that contamination was detected at concentrations above background concentrations in the shallow aquifer wells. One plume previously identified at PSC 42 had migrated from its originally delineated location. In June 1991, six additional wells were installed. Continued post-closure monitoring revealed that groundwater flow around PSC 42 had changed as a result of dewatering and construction in the area since 1991.

In 1992, PSC 42 was included in the RI/FS for OU 2. In 1993, PSC 42 was included in a fisheries investigation. No fish were collected or observed. Some vegetation was observed and the pond provided habitat for some birds and mammals. Surface water sampling results indicated contamination of six inorganic analytes in excess of the Federal Ambient Water Quality Criteria and Florida Surface Water Standards. Sediment sample results indicated contamination of 18 inorganic analytes exceeding the USEPA Sediment Quality Criteria or the National Oceanic and Atmospheric Administration (NOAA) Effects Range for Sediments.

In 1995, the IROD, implemented in 1996-1997, selected a source control alternative that included dredging the sediment, on-site stabilization, and on-site redeposition of treated material. During that time, the pond was dewatered and the water was treated prior to discharge to the St. Johns River. Following the dewatering operations, the sediment in the pond was solidified in place. Stabilized soil and filter material from PSCs 41 and 43, and sludge and soil from PSCs 3 and 4 were incorporated into the stabilized pond. The area was then graded and covered with clean soil and grass. Radiological surveys conducted in 1995 indicate that the PSCs are free of radiological contaminants (ABB-ES, 1998). The RI was completed for OU 2 in 1998. The ROD, signed in 1998, specified an NFA for PSC 42 with the implementation of land use controls and monitoring under the RCRA program until cleanup is achieved.

PSC 43 – Industrial Waste Sludge Drying Beds (ISDBs)

The ISDBs were constructed in 1980 to dewater industrial wastewater treatment sludge from electroplating operations. Between 1980 and 1988, approximately 8,250 gallons of dried sludge was excavated and removed from the surface impoundment annually. The drying beds were removed from service in 1988.

In 1984, four shallow monitoring wells were installed. Groundwater samples were collected and analyzed from 1984 to 1991 as part of the Quarterly Compliance Monitoring Program for RCRA compliance. Based on historical data, it was concluded that the bulk of the sludge channeled to the drying beds apparently originated from paint-stripping operations with lesser contributions from the plating and metal-treating shops. Fourteen contaminants listed in Appendix IX (40 CFR 261) were detected in groundwater samples. The USEPA classified the ISDBs as a surface impoundment operated to treat hazardous wastes F006 and F019. PSC 43 was also used to dewater sludge from electroplating operations, wastes from paint stripping, and parts cleaning operations (F001 through F005).

In 1988, analytical results from groundwater monitoring wells indicated that several inorganic and some organic compounds exceeded the USEPA Groundwater Protection Standards (GWPS). In June 1988, the FDEP issued a consent order to NAS Jacksonville stating the station was out of compliance with Permit Number H016-119108 based on hazardous constituents found in groundwater. The consent order mandated corrective action including preparation of a closure plan for PSC 43. In response, NAS Jacksonville developed a closure plan for PSCs 41, 42, and 43. In 1989, additional wells were installed and sampled to characterize the plume beneath OU 2. The results indicated that groundwater flow was to the northeast with a mounding effect near the beds. Groundwater sampling results indicated that VOCs, SVOCs, and inorganics contamination in both shallow and deep monitoring wells. In 1991, the FDEP issued a Closure permit for closure and post-closure of PSCs 41, 42, and 43.

The IRA for source control at PSC 43 was to excavate and treat the sludge drying bed material and hazardous debris on-site by stabilization and solidification, then backfill with the treated material and to dispose of non-hazardous debris off-site. Soil and filter media from the ground surface to the water table were excavated and stabilized. Stabilized materials from PSCs 41 and 43 were used to backfill the excavation at PSC 41. The PSC 43 excavation was backfilled with clean soil materials. In 1997, the stabilized and solidified sludge and soil materials were excavated from PSC 41 and incorporated as backfill into the IRA at PSC 42. Radiological surveys conducted in 1995 indicate that the PSCs are free of radiological contaminants (ABB-ES, 1998). The RI for OU 2 was completed in 1998. The ROD was signed in 1998, which specified an NFA for PSC 43 with the implementation of land use controls and monitoring under the RCRA program until cleanup is achieved.

Under the LUC program, the station maintains the existing fence, which restricts airfield trespassing, and restricts OU 2 to industrial use. The objectives for the LUCs include preventing residential use and to provide worker notification of potential hazards. The land use for the site has remained unchanged as of this writing.

3.3.1 Basis For Taking Action at OU 2

Various human health Contaminants of Potential Concern (COPCs) were detected in soil and groundwater at the PSCs in OU 2 (HLA, 1998). This prevented unrestricted use and unlimited exposure. Therefore, the IROD and ROD detailed remedial actions necessary to maintain protectiveness at this operable unit.

3.4 REMEDIAL ACTIONS

3.4.1 Remedy Selections at OU 2

Investigations at OU 2 prior to the ROD indicated the presence of soil, groundwater, surface water, and sediment contamination resulting from past disposal practices. IRAs were completed prior to the ROD for OU 2 for PSCs 41, 42, and 43. In addition, "hot spot" soil removals were completed at PSCs 3 and 4. The RI for OU 2 was completed in 1998 and the ROD for OU 2 was signed in October 1998. In the ROD, it stated that because the source of contamination at OU 2 was removed during IRAs, contamination in the groundwater was expected to decline over time. Therefore, as stated in the ROD, the Navy, USEPA, and FDEP agreed that the site conditions, Risk Assessment (RA) results, and regulatory requirements (ARARs) did not warrant establishing RAOs for OU 2 (HLA, 1998).

As noted in the Declaration of the Record of Decision Section 1.0 of the OU 2 ROD, "Because PSCs 41, 42, and 43 are all classified as RCRA sites, they require a period of groundwater monitoring. The Navy, USEPA, and FDEP agreed that a post-closure monitoring program of 2 to 3 years, combined with groundwater data collected over the last decade, would meet the requirements of the RCRA. The groundwater monitoring data will be used to determine if there are any significant changes in chemical levels that could potentially impact human health and the environment over time." Section 2.7 Description of the No Action Alternative states, "However, PSCs 41, 42, and 43 have all been classified as RCRA units and require post-closure monitoring of groundwater until standards are achieved. An abbreviated monitoring program of two to three years is believed to meet such requirements. Should groundwater standards not be achieved in that time frame, groundwater will continue to be monitored as per RCRA instructions" (HLA, 1998).

Based on the risk assessment from the RI, no unacceptable human health or ecological risks were identified at OU 2 with the implementation of land use controls at OU 2 to control groundwater use. In addition, it required post-closure monitoring at PSCs 41, 42, and 43 until standards are achieved under the RCRA program.

3.4.2 Remedy Implementation at OU 2

The ROD selected remedy for OU 2, based on results of the RI and RA, determined that the preferred remedial action at OU 2 was implementation of LUCs and RCRA monitoring of the groundwater plume associated with PSCs 41, 42, and 43. The remedy was selected for OU 2 because remedy implementations for OU 2 were completed through IRAs at PSCs 3, 4, 41, 42, and 43; and PSC 2 was transferred to the underground storage tank (UST) program.

Interim Remedial Actions at PSCs 3 and 4

Approximately 20 yd^3 of previously dried sludge was transported to PSC 42 from surface layers and piles identified at PSCs 3 and 4, the wastewater treatment plant sludge disposal areas.

Paint chips, observed in the shallow surface soil during the first phase of the RI, confirmed that sludge was disposed at PSC 3. Of the two parcels of land at PSC 3, only the southern one (Parcel 2) appears to have been utilized for sludge disposal (Figure 3-1). Although risks were not expected from exposure to soil at PSC 3, there were concerns about the exceeded guidance cleanup goals for lead detected in one surface soil sample location at Parcel 2 (HLA, 1998). Metals concentrations in this sample were also much greater than those detected in other PSC 3 samples. Because of these concerns, soil around this sample was removed in January 1997 and incorporated into the ongoing IRA at PSC 42.

Sludge piles and a sludge layer containing paint chips were discovered at PSC 4 during the first portion of the RI for OU 2. Samples of the sludge material were collected and analyzed in 1995 during the OU 2 RI/FS sampling program. Samples from the piles contained high metal concentrations that further indicated that the piles consisted of sludge from the WWTP. Soils from the sludge disposal areas were contaminated with RCRA-listed hazardous wastes having the same waste codes and source (F006 and F019) as sludge at PSCs 41, 42, and 43. Because of the metals concentrations, the piles were removed in January 1997 along with soil surrounding one sampling location in the same area as the piles. Five piles of contaminated sludge material were removed from PSC 4. Waste sludge material collected from PSCs 3 and 4 were placed into the dewatered cells at PSC 42 and stabilized (i.e., treated) during the ongoing IRA at PSC 42 during that time.

Interim Remedial Actions at PSCs 41 and 43

Remediation of contaminated materials at PSCs 41 and 43 was conducted simultaneously, due to their proximity to each other (less than 200 yards apart), the same types of media being treated, similar COCs, and ultimately the same original source. COCs for PSC 41 and PSC 43 were identified as arsenic, cadmium, chromium, and nickel. According to the completion reports (ABB-ES, 1997a and 1997b), remedial activities at PSC 41 and PSC 43 were conducted in two phases.

Phase One, conducted between March and October 1995, included excavation and on-site stabilization of contaminated media (sludge/soil) from PSCs 41 and 43. Stabilized materials were temporarily stored in the excavated area of PSC 41 until the second phase of site remediation could be completed. After contaminated media from PSCs 41 and 43 had been stabilized, samples of the treated material were collected and analyzed to verify that stabilized material had met the required criteria. Selection of metals used as stabilization criteria for PSCs 41 and 43 was based on results of the risk evaluation for both PSCs 41 and 43. The total volume of stabilized material from the IRAs at both PSC 41 and PSC 43 was approximately 2,800 yd^3.

Phase Two of the IRA was initiated in January 1997. The treated sludge material from PSCs 41 and 43 was excavated from PSC 41 and incorporated into the backfill used during completion of the IRA at PSC 42. Stabilized material at PSC 41 was excavated to the depth of the sand and a plastic layer was placed at the bottom of the original 1995 excavation. The total volume of stabilized material and native soil overcuts removed from PSC 41 was approximately 3,000 yd^3. The excavated material from PSC 41 was spread onto stabilized portions of PSC 42 and used as backfill. After stabilized/solidified material at PSC 41 was excavated for transfer to PSC 42, sampling of the excavation boundary was conducted. The confirmatory sampling indicated only one COC (nickel) exceeded a standard. After the solidified/stabilized material had been excavated from PSC 41 and sidewall samples had been collected, analyzed, and accepted, the excavation was backfilled to grade. After compaction testing and verification of the backfill had been completed, site restoration was completed by hydro-seeding the newly graded area (ABB-ES 1997a and 1997b).

Interim Remedial Action at PSC 42

Contaminated media treated at PSC 42 included soils and sludges along the bottom and sides of the pond. The COCs for PSC 42 were identified as cadmium, chromium, lead, nickel, and silver. The RAOs for PSC 42 were as follows:

- Lower the risk of potential future exposure to humans and the environment by reducing the leachability of contaminated material.
- Close the PP in accordance with RCRA closure requirements.

To achieve the RAOs, cleanup criteria for the contaminated soil and sludge at PSC 42 were established. The primary cleanup objectives for the solidification/stabilization process to be used were as follows:

- Toxicity Characteristic Leaching Procedure (TCLP) extract levels for the five metals identified below to be equal to or less than the following concentrations: cadmium [0.19 milligrams per liter (mg/L)], chromium (0.86 mg/L), lead (0.37 mg/L), nickel (5.00 mg/L), and silver (0.30 mg/L).

- Unconfined Compressive Strength of stabilized material to be 30 pounds per square inch after 14 days of wet curing.

Interim remediation of the site was accomplished by in-situ stabilization of the contaminated soil and sludge material. Remediation activities were conducted between March 6, 1996 and April 21, 1997.

The PP (PSC 42) was conceptually divided into sequential cells with approximate dimensions of 40 ft by 105 ft for stabilization. Forty-two cells were stabilized in the PP. Prior to stabilization, established cells were de-watered by pumping excess water from the cells to other unstabilized portions of the pond. Approximately 12,500 yd^3 of sludge and 9,500 yd^3 of native soil were stabilized during the IRA at PSC 42. Composite TCLP samples were collected from each stabilized cell and analyzed for compliance with treatment criteria. TCLP sample results for each cell met the design criteria listed (ABB-ES, 1997c).

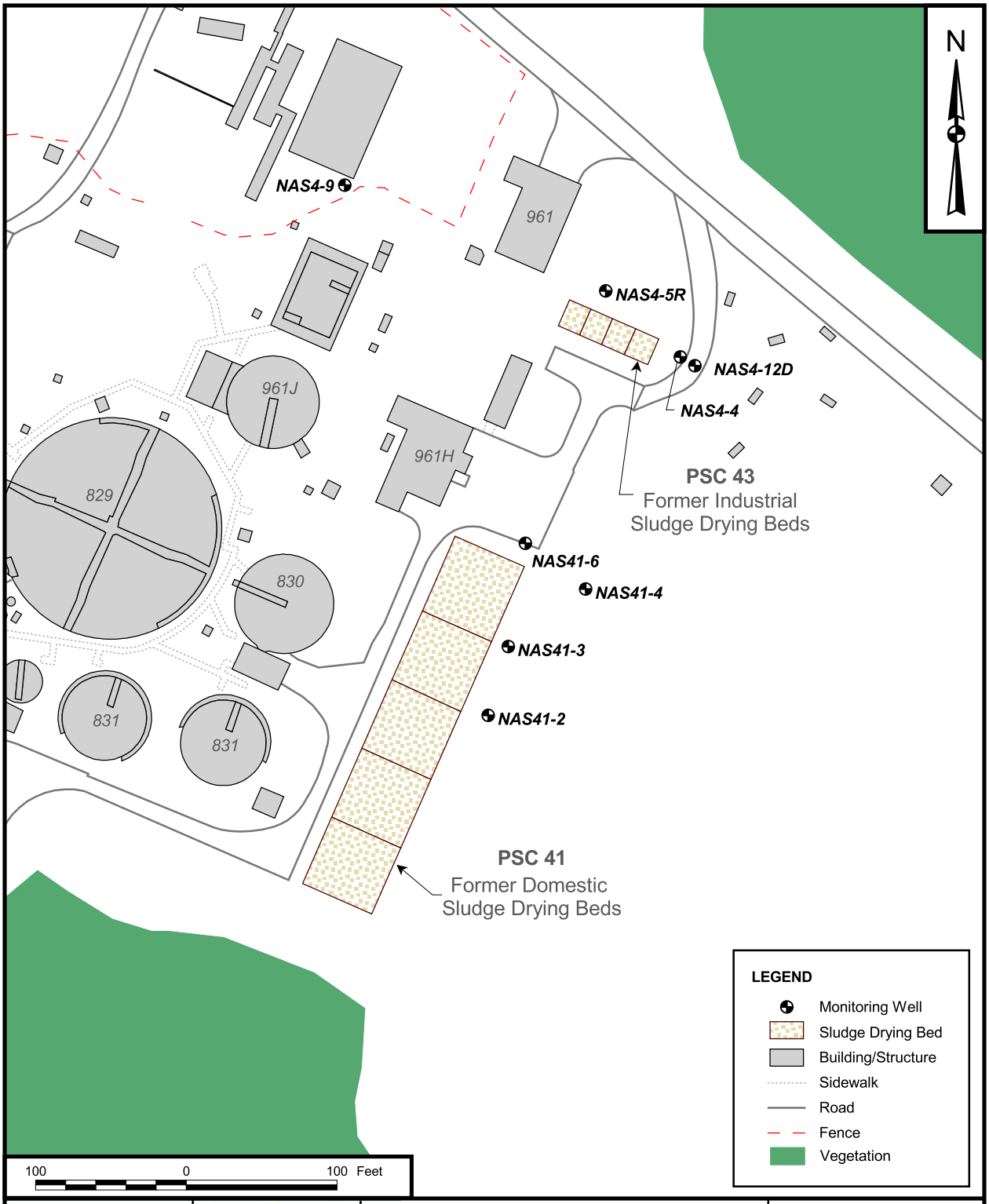
Institutional Controls

The institutional controls for OU 2 were developed through a MOA between the USEPA, FDEP, and the Department of the Navy and signed on August 31, 1998. The purpose of the MOA was to ensure compliance with land use controls to protect human health and the environment from exposure to contaminated media at NAS Jacksonville. Therefore, land and groundwater use restrictions at OU 2 were to be identified and enforced under the guidelines of the MOA (USEPA, 1998).

3.4.3 System O&M at OU 2

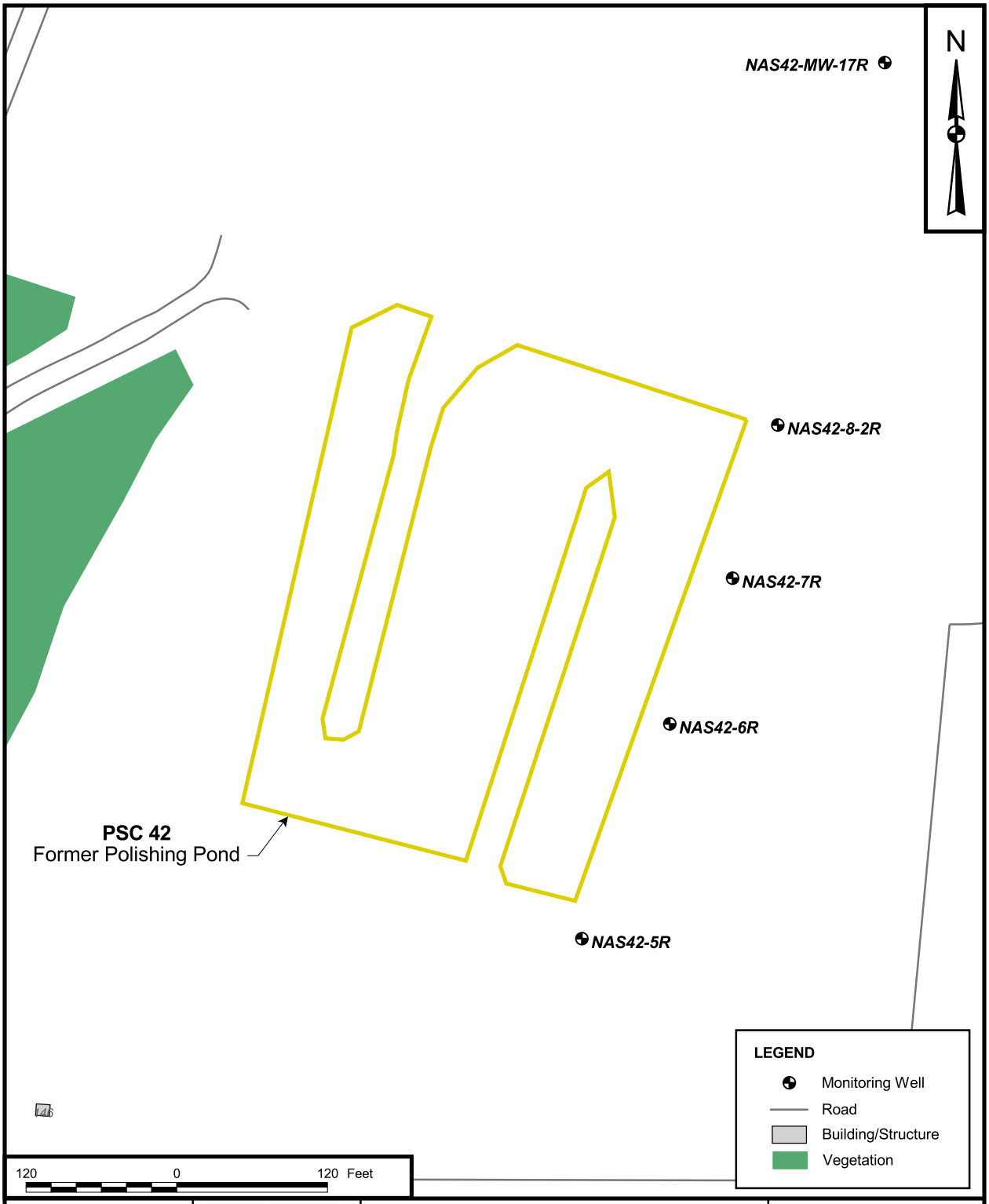
There are no system O&M at OU 2. However, RCRA groundwater monitoring is performed for the post closure of RCRA sites PSC 41, 42, and 43. As reported in the first Five-Year Review (TtNUS, 2001), the Navy contracted with two other contractors to perform the groundwater monitoring in accordance with the Post-Closure Permit (PCP) HF16-288092. RCRA groundwater monitoring for PSCs 41, 42, and 43 (after the signing of the ROD) was conducted with an annual sampling event in January 1998. Semi-annual and eventually only annual sampling events continued in 1999, 2000, and 2001. Figures 3-3 and 3-4 show the locations of the monitoring wells for each of the three sites.

PCP HF16-288092 expired in September 2001, and the new permit (0072437-005-HF) was issued on November 19, 2001, with an expiration date of September 20, 2006. Regarding the period covered by this review, TtNUS has been the contractor performing the required annual groundwater monitoring during 2002 through 2004. The work is being conducted in accordance with RCRA requirements and is not part of the CERCLA program. Results of the groundwater monitoring are discussed in the Document and Analytical Review portion of this document to provide additional information.



DRAWN BY J. LAMEY	DATE 2/23/04	PSCs 41 AND 43	CONTRACT NO. 7302
CHECKED BY J. JOHNSON	DATE 2/11/05	SITE PLAN SHOWING MONITORING WELL LOCATIONS	OWNER NO. CTO 0342
REVISED BY —	DATE —	FIVE-YEAR REVIEW	APPROVED BY — DATE —
SCALE AS NOTED		NAS JACKSONVILLE JACKSONVILLE, FLORIDA	DRAWING NO. FIGURE 3 - 3 REV 0

P:\GIS\JACKSONVILLE_NAS\APR\PSC_41_42_43.APR PSCS 41 AND 43 MONITORING WELL LOCATION MAP 2/21/05 CF



DRAWN BY: J. LAMEY	DATE: 2/23/04	PSC 42	CONTRACT NO.: 7302
CHECKED BY: —	DATE: —	SITE PLAN SHOWING MONITORING WELL LOCATIONS	OWNER NO.: CTO 0342
REVISED BY: —	DATE: —	FIVE-YEAR REVIEW	APPROVED BY: — DATE: —
SCALE: AS NOTED		NAS JACKSONVILLE JACKSONVILLE, FLORIDA	DRAWING NO.: FIGURE 3 - 4 REV: 0

P:\GIS\JACKSONVILLE_NAS\APR\PSC_41_42_43.APR PSC 42 MONITORING WELL LOCATION MAP 2/22/05 CF

Since the only required O&M for OU 2 involved RCRA groundwater monitoring, the ROD made no determination of a present worth cost estimate for implementation of the action.

3.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

3.5.1 Protectiveness Statements from the Last Review

The following list of protectiveness statements is duplicated from the first five-year review:

1. The remedy at OU 2 is protective of human health and the environment. The institutional controls (LUCs) provide a significant degree of protection of human health and the environment as long as they are conducted as required. The institutional controls help protect against exposure to groundwater and stabilized soil and sediment.

2. The remedial action for the source control was implemented. The soil excavation and stabilization remedy as a measure that would reduce exposure has been completed at OU 2, was effective and met the RAOs identified in the IRODs.

3.5.2 Status of Recommendations and Follow-up Actions from Last Review

Table 3-2 provides a list of recommendations, recommended follow-up actions from the first five-year review, the parties responsible for the follow-up, milestone dates, actions taken, outcomes, and dates of action.

3.5.2.1 Action Taken and Outcome for Issue 1-Table 3-2

LUC inspections were continued on a quarterly basis by the station as required; however, it appears that the third quarterly inspection for 2003 (circa July through September) was missed.

3.5.2.2 Action Taken and Outcome for Issue 2-Table 3-2

The then-current RCRA groundwater monitoring permit (FDEP PCP HF16-288092) was set to expire on September 20, 2001. In anticipation of that event, NAS Jacksonville submitted a permit application on March 1, 2001, and the new permit (0072437-005-HF) was issued on November 19, 2001, with an expiration date of September 20, 2006. The groundwater monitoring was to continue in accordance with this permit.

TABLE 3-2
ACTIONS TAKEN SINCE LAST FIVE-YEAR REVIEW

FIVE-YEAR REVIEW
OPERABLE UNIT 2
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Missed quarterly LUC inspection	Inspect OU 2 quarterly to assure that institutional controls remain in place.	Navy	31-Dec-2001	See Section 5.2.1	Not achieved
RCRA Program may discontinue monitoring	Determine results of RCRA Permit Renewal for PSCs 41, 42, and 43, and evaluate any required actions.	NAS Jacksonville Partnering Team	6-Mar-2001	See Section 5.2.2	03/01/01

3.6 FIVE-YEAR REVIEW PROCESS

3.6.1 Administrative Components

The NAS Jacksonville Five-Year Review team consisted of Harold McGill, Phillip McGinnis, and Anthony Robinson (NAVFAC EFD SOUTH); Bill Raspet (NAS Jacksonville); Peter Dao (USEPA); James Cason (FDEP); Hal Davis (USGS); Greg Roof (TtNUS); and Mike Halil (CCI). These organizational representatives have participated in the five-year review. No other potentially interested parties were identified or otherwise notified at the beginning of the review process.

This five-year review consisted of a review of the previous five-year review; evaluation of the issues raised in the previous review, actions taken, and results; site inspections; personnel interviews; and a technical assessment of each site and the remedial actions underway.

This five-year review was funded by NAVFAC EFD SOUTH in February 2004 and will be completed by March 2005. More detailed interview and inspection dates are included in the following sections.

3.6.2 Community Involvement

No public notice identifying that this review was published. However, at the conclusion of the review, a fact sheet is planned for production and disbursement to a Restoration Advisory Board and others.

3.6.3 Document Review

This five-year review consisted of a review of relevant documents including groundwater monitoring reports for PSCs 41, 42, and 43. The source of ARARs for groundwater cleanup at OU 2, PCP 0072437-005-HF, was also reviewed for changes to the applicable groundwater cleanup standards.

3.6.4 Data Review

The OU 2 documents covering the post-closure RCRA monitoring for PSCs 41, 42, and 43 were reviewed to determine if the sites are achieving cleanup standards set in the current permit and to determine if new information has come to light since the last five-year review. Also, a review of the LUC Inspection Checklists for OU 2 was conducted to determine if periodic inspections are being performed as required.

The completed LUC Inspection Checklists for OU 2 appear to be complete except for the third quarterly inspection that was missed for the Year 2003. Completed quarterly inspections were conducted at OU 1 in 2001, 2002, 2003 and 2004 except as noted above.

A review of the specific conditions in Part III of the PCP indicates that a total of 13 monitoring wells are included in the monitoring of OU 2 as part of the RCRA post-closure monitoring program for PSCs 41, 42, and 43 (Figures 3-3 and 3-4). The background well for the three PSCs is monitoring well NAS 4-9. The point-of-compliance (POC) wells for PSC 41 (DSDB) are as follows: NAS 41-2, NAS 41-3, NAS 41-4, and NAS 41-6. The POC wells for PSC 43 (ISDB) are as follows: NAS 4-4, NAS 4-5R, and NAS 4-12D. The POC wells for PSC 42 (PP) are as follows: NAS 42-5R, NAS 42-6R, NAS 42-7R, NAS 42-8-2R, and MW-17R. Monitoring well NAS 4-5R is a replacement well that was installed in general accordance with the original well's design prior to the last five-year review. Monitoring well MW-17R is a replacement well for MW-017 that was installed in general accordance with the original well's design and reported in the 2004 Annual Report (TtNUS, 2004a). The well network is divided into two categories: shallow (13 to 17 ft bgs) and deep (34 to 37 ft bgs). Of the 13 wells, 10 are screened in the shallow zone, and three are screened in the deeper zone. One deep well is monitored for each PSC as follows: NAS 41-2 (PSC 41), NAS 42-6R (PSC 42), and NAS 4-12D (PSC 43).

The specific conditions in Part III of the PCP were also reviewed for analytical requirements. Specific Condition 13, Part III of the PCP stipulates the COCs that will be monitored against a GWPS. Specific Condition 16, Part III of the PCP stipulates that the GWPS, "shall be the respective Florida Groundwater Guidance Concentration or, if none exists, the practical quantitation limit (PQL) unless the Department establishes such alternate concentration limits, or unless a maximum concentration level is specified in Rule 62-550.310 and .320, FAC or 40 CFR 141". Specific Condition 14, Part III of the PCP stipulates that

samples from the monitoring wells at OU 2 will be analyzed for the 40 CFR 264 Appendix IX list (VOCs, SVOCs, metals, Gross Beta, Gross Alpha, Radium-226, and Radium-228 less pesticides, herbicides, PCBs, dioxins, furans, and sulfide). Specific Condition 15, Part III of the PCP provides a procedure whereby newly detected COCs should be confirmed and added to the monitoring list in Specific Condition 13, Part III of the PCP.

3.6.4.1 Groundwater Flow at OU 2

The groundwater monitoring events for PSCs 41 through 43 from 2002 through 2004 were conducted in the month of January as required by the PCP (TtNUS, 2002b, 2003c, and 2004, respectively). Groundwater elevation data was collected during each event, and the groundwater flow direction was established for each event. Each report consistently reported the flow direction for the shallow zone wells at PSCs 41 and 43 was to the southeast; likewise, each report consistently reported shallow zone flow to the north-northeast for PSC 42.

3.6.4.2 Background Well NAS 4-9 Analytical Results

Appendix C contains copies of the tables from the 2002 through 2004 annual monitoring events. A review of that data for the background well NAS 4-9 reveals the following information:

- The iron GWPS was consistently exceeded in the samples from this well. However, the iron concentrations for the background well were typically less than the reported concentrations for each of the POC wells across PSCs 41, 42, and 43. The only exception being the reported concentration for MW-017 from the 2002 event.

- The gross beta GWPS was exceeded in the samples from this well only during the 2003 and 2004 events.

- During the 2003 event, only three wells at PSC 41 (DSDB) out of the 13 sampled for the OU 2 RCRA program exceeded the background concentration for gross beta. However, at least one or more wells in each of the PSCs exceeded the gross beta background concentration during the other annual events.

- Benzene (an unlisted Appendix IX constituent) was reported for the background well during the 2002 and 2004 sampling events at concentrations between 1 and 2 µg/L, and thus exceeded the FDEP GCTL of 1 µg/L.

- Four other unlisted Appendix IX constituents were detected in the background well, but only during the 2003 sampling event and none exceeded its respective FDEP GCTL.

3.6.4.3 PSC 41 (DSDB) Analytical Results

Appendix C contains copies of the tables from the 2002 through 2004 annual monitoring events. A review of that data for the three POC wells at the site reveals the following information:

- Iron and manganese concentrations reported for NAS 41-2 consistently exceeded the respective GWPS. Gross beta concentrations for this well were in excess of the GWPS for the last two events.

- Iron, manganese, and gross beta concentrations reported for NAS 41-3 consistently exceeded the respective GWPS. The radium-228 concentration reported for this well exceeded the GWPS during the 2003 event.

- Iron, lead, manganese, sodium, vanadium, gross alpha, and gross beta concentrations reported for NAS 41-4 consistently exceeded the GWPS. Radium-226 exceeded the GWPS for the last two events, and radium-228 exceeded its GWPS during the 2003 event.

- Manganese and gross beta concentrations reported for NAS 41-6 consistently exceeded the GWPS. Iron exceeded the GWPS in a sample from this well during the 2003 event, and Radium-228 exceeded the GWPS in a sample from this well during the 2004 event.

- 1,4-Dioxane (an unlisted Appendix IX constituent) was detected in two wells in excess of the respective FDEP GCTL during the 2002 monitoring event.

- Six unlisted Appendix IX constituents (carbon disulfide, methylene chloride, barium, copper, mercury and nickel) were detected at PSC 41 during the 2003 sampling event, but none of the concentrations exceeded its respective FDEP GCTL.

- Two unlisted Appendix IX constituents (mercury and nickel) were detected at PSC 41 during the 2004 monitoring event, but the concentrations for neither metal exceeded its respective FDEP GCTL.

3.6.4.4 PSC 42 (PP) Analytical Results

Appendix C contains copies of the tables from the 2002 through 2004 annual monitoring events. A review of that data for the three POC wells at the site reveals the following information:

- Iron concentrations consistently exceeded the GWPS as reported for well NAS 42-5R. Manganese and gross beta exceeded their respective GWPS in samples from that well during the 2003 and 2004 events. Arsenic exceeded the GWPS in the sample from that well for the 2004 event.

- Iron concentrations consistently exceeded the GWPS as reported for well NAS 42-6R. Gross beta exceeded its respective GWPS in samples from that well during the 2003 and 2004 events. Manganese exceeded it respective GWPS in only the 2002 sample from that well.

- Iron, manganese, and gross beta consistently exceeded the GWPS as reported for well NAS 42-7R. Vanadium exceeded the GWPS in the sample from that well for the 2004 event.

- Iron, manganese, and gross beta were consistently in excess of the GWPS in well NAS 42-8-2R.

- Iron and gross beta inconsistently exceeded their GWPS in samples for well MW-17R.

- 1,4-Dioxane was detected in one well in excess of its FDEP GCTL during the 2002 monitoring event.

- Carbon disulfide, di-n-butylphthalate, and barium (unlisted Appendix IX constituents) were detected at PSC 42 during the 2003 monitoring event; however, only di-n-butylphthalate exceeded its FDEP GCTL and in three of the five site wells.

- No unlisted Appendix IX constituents were detected in the samples collected at PSC 42 during the 2004 monitoring event.

3.6.4.5 PSC 43 (ISDB) Analytical Results

Appendix C provides figures from each of the annual monitoring events under this review that depict the data that exceeded respective GWPS for each well at each PSC including the background well. Appendix C also contains copies of the tables from the 2002 through 2004 annual monitoring events. A review of that data for the three POC wells at the site reveals the following information:

- Gross beta exceeded the GWPS in samples fom the 2003 and 2004 monitoring events for well NAS 4-4. Cadmium exceeded the GWPS in the sample from the 2002 monitoring event for this well.
- Gross beta exceeded the GWPS in samples from the 2003 and 2004 monitoring events for well NAS 4-5R. Iron exceeded the GWPS in the sample from the 2004 monitoring event for this well.
- Iron consistently exceeded the GWPS in samples from well NAS 4-12D. Gross beta exceeded the GWPS in samples from the 2003 and 2004 monitoring events for this well.
- No unlisted Appendix IX constituents were detected in the samples collected at PSC 43 during the 2002 monitoring event.

- Carbon disulfide, bis(2-ethylhexyl)phthalate, naphthalene, barium, and copper (unlisted Appendix IX constituents) were detected in wells at this site during the 2003 event; however, only concentrations for bis(2-ethylhexyl)phthalate exceeded the FDEP GCTL.
- Cobalt was the only unlisted Appendix IX constituent detected at PSC 43 during the 2004 event; however, it did not exceed the FDEP GCTL.

3.6.5 Site Inspection and Interviews

TtNUS conducted a site inspection of OU 2 and PSCs 41, 42, and 43 on October 27, 2004. Prior to initiating the inspection, the inspector interviewed Mr. Bill Raspet, the IR Manager for NAS Jacksonville and Ms. Jane Beason, the Hazardous Waste Manager for NAS Jacksonville. The IR Manager intends to make improvements for tracking and accomplishing future inspections as required. Later, the IR Manager accompanied the inspector during the site inspection, which included visual observations of the landfill cover at PSC 42, fences, access gate, and groundwater monitoring wells for OU 2. The fence and signs at the site were in good condition, and several wells were observed with locks in place. The security and fence restricting access to the airfield also provide restrictive access to the sites. The ground cover at PSC 42 is in good condition, and the IR Manager reports that there have been no incidents of trespassing or vandalism in the area.

3.7 TECHNICAL ASSESSMENT

3.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD.

- ***HASP/Contingency Plan:*** A HASP is in place for the required RCRA groundwater monitoring at this time. The contingency plan for the current remedy consists of continuing the groundwater monitoring for up to 30 years or until groundwater contamination levels decrease to less than the applicable groundwater standards.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls are in place for OU 2. The implementation appears incomplete, however, due to the lack of preparation of the LUC for the sites within OU 2.

- ***Remedial Action Performance:*** Not applicable.
- ***System Operations/O&M:*** Not applicable.
- ***Cost of System Operations/O&M:*** Not applicable.
- ***Opportunities for Optimization:*** Not applicable.
- ***Early Indicators of Potential Remedy Failure:*** None noted.

3.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC Criteria

In accordance with the ROD, the only chemical-specific ARARs identified for the site are as follows:

- Occupations Safety and Health Administration permissible exposure limits for workers in 29 CFR Part 1910, Subpart Z
- RCRA, Identification and Listing of Hazardous Wastes in 40 CFR Part 261
- RCRA, Releases from Solid Waste Management Units in 40 CFR Part 264, Subpart F

The chemical-specific ARARs in the PCP 0072437-005-HF are listed as a set of GWPS that "shall be the respective Florida Groundwater Guidance Concentration". THE GWPS contained in the permit are less than and more protective than the current GCTLs for iron and 1,2-dichlorobenzene.

The ROD indicated that no location-specific or action-specific ARARs were identified for OU 2.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures (worker exposure to surface soil, diver exposure to sediment and surface water, and fish ingestion by off-site residents) and future exposures (same scenarios). There have been no changes in the toxicity factors for the COCs that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

3.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy.

3.8 ISSUES

Issues were discovered during the five-year review and are noted in Table 3-9. None of these are sufficient to warrant a finding of not protective as long as corrective actions are taken.

TABLE 3-3
ISSUES FOR OPERABLE UNIT 2

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

ISSUES	AFFECTS PROTECTIVENESS (Y/N)	
	CURRENT	FUTURE
Missed LUC quarterly inspection for the year 2003.	N	N

3.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendations and follow-up actions are outlined in Table 3-4.

TABLE 3-4
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

FIVE-YEAR REVIEW
OPERABLE UNIT 2
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

ISSUES	RECOMMENDATIONS	PARTY RESPONSIBLE	OVERSIGHT AGENCY	MILESTONE DATE	AFFECTS PROTECTIVENESS (Y/N)	
					CURRENT	FUTURE
Missed LUC quarterly inspection for the year 2003.	Inspect site quarterly or as required by LUCIPs.	Navy	FDEP	30-Jun-05	N	N

3.10 PROTECTIVENESS STATEMENT

The remedy at OU 2 is protective of human health and the environment. The institutional controls and RCRA groundwater monitoring at OU 2 provide an acceptable degree of protection of human health and the environment as long as they are conducted as required. The institutional controls help protect against exposure to groundwater and the stabilized soil and sediment.

4.0 OPERABLE UNIT 3

OU 3 is located within a large industrial area of NAS Jacksonville. OU 3 contains PSC 11 (Building 101), PSC 12 (the old Test Cell Building), PSC 13 (the Radium Paint Disposal Pit), PSC 14 (the Battery Shop area), PSC 15 (the Solvent and Paint Sludge Disposal area), PSC 16 (the Black Point Storm Sewer Discharge), PSC 48 (the Station's Dry Cleaners – Building 106), and Building 780. In addition to the PSCs and Building 780, there are also seven isolated areas of elevated groundwater contamination identified as Areas A through G within OU 3. Additionally, the storm sewer was included in the OU 3 ROD due to elevated concentrations of COCs detected during storm sewer sampling activities.

Implementation of the remedial actions at OU 3, the NADEP Area, commenced with IRAs at Building 106 and Building 780 which began operation in 1998. The ROD was signed for this OU in September 2000. In this ROD the following actions were specified:

- PSC 11 – No Further Remedial Action Planned (NFRAP)
- PSC 12 – NFRAP
- PSC 13 – NFRAP
- PSC 14 – NFRAP with implementation of LUCs for an industrial scenario
- PSC 15 – NFRAP with implementation of LUCs for an industrial scenario
- PSC 16 – Selective removal of the tar balls
- PSC 48 (Building 106) – Continuation of the IRA as the selected remedy
- Building 780 – Continuation of the IRA as the selected remedy
- Area B – MNA
- Area C – Enhanced biodegradation
- Area D – Enhanced biodegradation
- Area F – Chemical Oxidation
- Area G – MNA
- Storm Sewer – Monitor the water quality after clean up of Area F is complete. If the storm sewer remains contaminated after Area F groundwater is remediated, then cured-in-place pipe (CIPP) will be installed.

Areas A and E were withheld from the ROD to allow for additional investigation. A ROD has yet to be signed for these sites.

This five-year review is being conducted for OU 3 because contaminated subsurface soil, sediment, and groundwater did not allow for unlimited use and unrestricted exposure.

4.1 SITE CHRONOLOGY

The OU 3 area is large and has a lengthy operational history. However, to achieve the purpose of this document, an extremely abbreviated list of the operational history is included herein. A more involved report on the historical operations is available in the OU 3 RI/FS (HLA, 2000b). A list of significant OU 3 historical events and relevant dates in the site chronology is provided in Table 4-1. The identified events are illustrative, not comprehensive.

4.2 BACKGROUND

A generalized map of NAS Jacksonville showing the location of OU 3 in the eastern portion of the facility is provided on Figure 1-1. A map of OU 3 showing the relative locations of the PSCs is provided on Figure 4-1.

4.2.1 Physical Characteristics of OU 3

The 134-acre site consists mainly of the activities associated with NADEP, which is the largest tenant command at NAS Jacksonville and dry cleaner operations. Due to the industrial nature of the site, the majority of OU 3 is paved. The physical setting of the OU has undergone numerous changes over time. Old buildings have been demolished and new buildings constructed. In fact, during the early-to-mid 1940s in order to meet the growing needs for repair of aircraft, hydraulic fill was used to expand the land area of NADEP along the St. Johns River. Since that time, over 90 percent of OU 3 has been covered with buildings or thick (greater than 1 ft in thickness) concrete pavement in order to accommodate both aircraft and associated industrial activities. Generally, the only exposed soil is at the southern end of the OU near PSC 16 or in small, generally non-vegetated strips along a few of the buildings. As a result of all the buildings and pavement, there are no surface water bodies, wetlands, or drainage courses on OU 3. Storm water runoff is picked up in drainage inlets or catch basins and directed to the storm sewer system, which discharges to the St. Johns River. Section 3 of the RI/FS (HLA, 2000b) provides details of the physical characteristics (including geology, hydrology, and groundwater flow).

4.2.2 Land and Resource Use at OU 3

Past and current land uses at OU 3 remain mostly unchanged since NADEP became the primary tenant in the 1940s. NADEP is a major industrial complex with a primary mission of performing in-depth rework, repair, and modification of aircraft engines and aeronautical components. NADEP also maintains a variety of ground support equipment. OU 3 also contains the helicopter flightline and associated hangar plus the Station's dry cleaner and various other industrial, shop, and office buildings. Other tenants include various helicopter squadron commands.

TABLE 4-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 3

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)	Date
Pre-discovery of contaminants	n/a
NADEP began performing rework, repair, and modification of aircraft.	1940
Hydraulic fill brought in to expand NADEP work area.	Early-to-mid 1940s
Radium paint waste, discarded luminous dials, and associated contaminated soils removed from pit at PSC 13.	1950s
Hazardous Waste Management Plan recommended OU 3 PSCs for study. (1)	1982
Initial Assessment Study recommended PSCs 11, 12, 14, and 15 .	1983
Sediment sampling at Plating and Cleaning Shop (Building 101) reported no risk to humans.	1985
Initial discovery of problem or contamination	n/a
Verification Study of groundwater at PSCs 11 through 15 indicated contamination at each PSC except PSC 13.	1985
Pre-NPL responses	n/a
Report to characterize groundwater contamination at OU 3 recommended well resampling program for risk assessment.	1986
Report of subsurface investigation at Wright Street issued and recommended Level C PPE for excavation work therein. (2)	Feb-88
Report issued that identified leaks in OU 3 sewer and industrial lines.	Jul-88
Contamination assessment of Building 795 issued with recommendation that only standard safety practices required for site work.	Feb-89
NPL Listing	Nov-89
Post-NPL responses	n/a
Technical memo on Building 780 concluded further work was necessary to assess the site.	Jul-90
FFA signature	Oct-90
Post-NPL responses (cont'd)	n/a
Report on proposed construction site (MILCON P615) found no health threat to construction workers.	Jul-92
Emergency response removal action conducted on tank system at Old Plating Shop in Building 101. (3)	Aug-92
Report of contamination at Building 780 proposed construction site recommended Level C PPE for workers.	Oct-92
Contaminated soil removal and underground liner system installation conducted at Building 780.	1992
Environmental health survey at construction site at Albemarle and Wasp Street indicated no special precautions needed.	Jan-93
Field closure activities initiated at Old Plating Shop in Building 101. (3)	Apr-93
Initial contamination assessment of Building 101 USTs issued with conclusion that additional work was required. (4)	Jun-93
Environmental sampling at proposed construction site (P159) detected VOCs in groundwater and further work recommended. (5)	Jun-93
SSFP screened soil/groundwater at OU 3, which identified 10 areas of groundwater contamination, but no soil issues. (6)	1993
Focused field investigation conducted at Building 106 (PSC 48) and Building 780.	Oct to Nov 1994
SSFP data reported in Navy Installation Restoration Program Plan, Volume 7.	Mar-95
EECA for Building 106 (PSC 48) and Building 780 issued with recommendation for IRAs. (7) (8)	Aug-95
Closure activities completed at Old Plating Shop in Building 101.	Aug-95
Radiological survey and contaminated soil removal conducted at PSC 13. (3)	Sep-95
U.S. Navy Radiological Affairs Support Office issued letter releasing PSC 13 for unrestricted use.	1995
Closure report for Old Plating Shop issued stating that RCRA closure requirements were satisfied for Building 101. RCRA groundwater monitoring of site was reported as ongoing. (9)	Nov-95

TABLE 4-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 3

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)	Date
Focused field investigation into groundwater contamination at eight 'hot spots' (Areas A - H) identified in the SSFP.	1996 to 1997
Interim remedial design start for Building 106 (PSC 48) and Building 780	1996
Interim remedial design complete for Building 106 (PSC 48) and Building 780	1997
Building 106 (PSC 48) built with AS/SVE system. [10] Monitoring of 8 piezometers and 1 well also included in program.[11]	n/a
Building 780 built with groundwater extraction and treatment and SVE. Monitoring of 4 wells is also included in program.	n/a
Construction dates	n/a
AS/SVE system at PSC 48.	Apr-97
Groundwater extraction and treatment and SVE at Building 780.	Jun-97
Post-NPL responses (cont'd)	n/a
Radiological survey and contaminated soil removal conducted at PSC 15. NFA planned with land use controls. [3] [12]	1997 to 1998
Sampling Event Report for PSC 12 issued with recommendation of NFA with no conditions.	Feb-98
Sampling Event Report for PSC 14 issued with recommendation of NFA with LUCs recommended for soil contamination that was less than Florida industrial cleanup standards. [13]	Feb-98
EECA for 'hot spots' (Areas A - H) issued with claim that IRAs not warranted. It recommended that an FS evaluate groundwater treatment alternatives. [14]	Mar-98
Construction completion date for PSC 48	Mar-98
Construction completion date for Building 780	Apr-98
IRA system startup for Building 106 (PSC 48)	Mar-98
IRA system startup for Building 780. Continuous operation of this system did not begin until March 1999	Apr-98
MOA signed between USEPA, FDEP, and Navy to ensure LUC compliance [15] [16]	31-Aug-98
RI/FS complete for OU 3 [17]	Apr-00
Proposed Plan for Remedial Action (start of public comment period)	Apr-00
End of Public Comment Period	May-00
Proposed remedial actions accepted with two exceptions as indicated below.	n/a
Area B changed from enhanced bioremediation to MNA.	n/a
Area G changed from chemical oxidation to MNA.	n/a
ROD signature for OU 3 (IRAs for Buildings 106 and 780 attain status as final remedy in this document)	25-Sep-00
Selected remedy for Areas B and G is MNA.	n/a
Selected remedy for Areas C and D is enhanced biodegradation.	n/a
Selected remedy for Area F is chemical oxidation.	n/a
PSCs 11 through 13 were determined to pose no risk to human health or environment, and NFAs were assigned to them.	n/a
PSCs 14 and 15 were assigned NFA on condition that land use controls would restrict future activities at the sites.	n/a
Areas A and E require additional assessment work and they will be addressed in a separate ROD.	n/a
Current remedial activities (note these are grouped by site and not necessarily in chronological order)	n/a
Area B - First and second semi-annual sampling events held in July and December.	2002
Area B - Third semi-annual sampling event held in September.	2003
Area B - Fourth semi-annual sampling event held in January.	2004

TABLE 4-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 3

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)		Date
	Area C - Wells for monitoring program installed in October and baseline sampling done in November.	2001
	Area C - First planned Hydrogen Release Compound (HRC) injection completed.	Feb-03
	Area C - First year of semi-annual sampling conducted in July and December.	2003
	Area C - Third semi-annual sampling event held in July.	2004
	Area D - Wells for monitoring program installed in October and baseline sampling done in November.	2001
	Area D - First planned HRC injection completed.	Dec-02
	Area D - First year of semi-annual sampling conducted in July and December.	2003
	Area D - Third semi-annual sampling event held in July.	2004
	Area F - Chemical oxidation pilot study cancelled when contractor encountered lower levels of groundwater contamination than expected.	2001
	Area F - Reassessment sampling event confirmed level of groundwater contamination reported in RI/FS.	Sep-02
	Area F - Chemical oxidation work rescheduled and currently in design phase.	Ongoing
	Area G - First and second semi-annual sampling events held in July and December.	2002
	Area G - Third semi-annual sampling event held in September.	2003
	Area G - Fourth semi-annual sampling event held in January.	2004
	PSC 16 - Tar ball removal held in April and May, and final sediment sampling held in September.	2002
	PSC 48 - O&M.	Ongoing
	Building 708 - O&M.	Ongoing

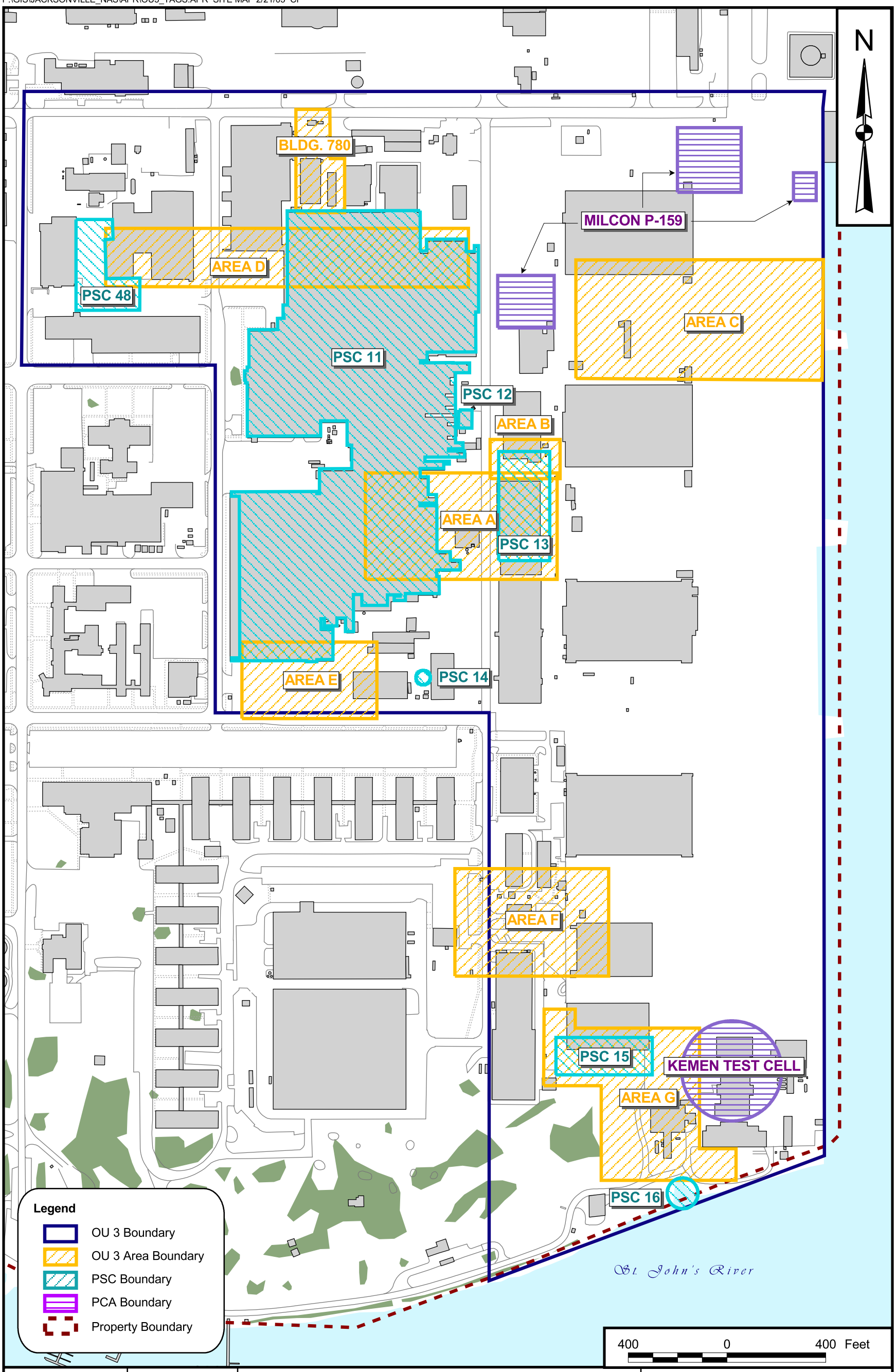
Notes:

Applicable report references available for items pre-dating the RI/FS on Table 2-1 of the ROD.

(1) PSC = potential source of contamination
(2) PPE = personal protective equipment
(3) Removal actions.
(4) UST = underground storage tank
(5) VOC = volatile organic compound
(6) SSFP = scoping study field program
(7) EECA = engineering evaluation and cost analysis
(8) IRA = interim remedial action
(9) RCRA = Resource Conservation and Recovery Act
(10) AS/SVE = air sparge with soil vapor extraction
(11) NA LTM = natural attenuation long term monitoring
(12) NFA = no further action
(13) LUC = land use controls
(14) FS = feasibility study
(15) USEPA = United States Environmental Protection Agency
(16) FDEP = Florida Department of Environmental Protection
(17) Area H dropped from further consideration since only low levels of contamination were encountered in the RI/FS.

n/a not applicable

P:\GIS\JACKSONVILLE_NAS\APR\OU3_TAGS.APR SITE MAP 2/21/05 CF



DRAWN BY: J. LAMEY	DATE: 8/26/04	SITE MAP OPERABLE UNIT 3 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO.: 7302
CHECKED BY: J. JOHNSON	DATE: 2/11/05		OWNER NO.: CTO 0342
REVISED BY: —	DATE: —		APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 1 REV: 0

OU 3 also consists of runways, hangars, roads, buildings, and largely paved areas between the buildings. There is very little unpaved surface area. Being a heavily industrial area, access to OU 3 is restricted by fence and security guards and is limited to NADEP personnel and authorized visitors with water access limited by security patrols.

NADEP is bordered on the east and south by the St. Johns River, on the west by various NAS Jacksonville operations such as offices and a machines shop, and on the north by the flightline. The St. Johns River shoreline at OU 3 is mostly paved (pavement ends at the seawall) except on the southern shore where it is rocky.

Groundwater Use: Groundwater beneath OU 3 is not currently used at NADEP. Although it is unlikely and infeasible (due to low aquifer yield) that drinking water wells would be installed at OU 3 in the surficial aquifer, the NAS Jacksonville Partnering Team agreed to take a conservative approach and consider potential beneficial use as drinking water during the RI and risk assessments.

Surface Water Use: There is no surface water located within the boundaries of OU 3; however, OU 3 does abut the St. Johns River on the east and south. Currently, the St. Johns River is used for commercial and recreational purposes by adults and adolescents. It is anticipated that the St. Johns River will always be used for commercial and recreational purposes.

4.3 HISTORY OF CONTAMINATION AT OU 3

The industrial nature of the OU 3 area and the past operational practices are believed to be major factors in the contamination beneath OU 3. As reported in the RI/FS (HLA, 2000b), the following are events that may have contributed to the current conditions at OU 3:

PSC 11 – Hazardous materials storage, unauthorized disposal of potentially 2,000 gal of waste solvents and other materials beneath steel plates (inside Building 101), plating shop operations and its cyanide and chromium waste treatment facility, anodizing process in northern portion of the building (generated chromium and nickel waste products), and 150 pounds of mercury were spilled in the northeastern portion of Building 101.

PSC 12 – Chemical storage, spills of toxic and reactive chemicals from rusted and ruptured drums, and solvent and other waste releases due to ruptures of storm, sanitary, and industrial sewer connections.

PSC 13 – Operated as a radium paint disposal pit from World War II until the late 1950s.

PSC 14 – Was the Battery Shop and included a seepage pit. The seepage pit was used for the disposal of lead battery acid via a seepage pit (estimated at 100 gallons per year) from 1959 to 1982. The pit was reportedly still in place when the RI was written. According to the ROD, lead concentrations in soil exceeds the acceptable level for residential development but is less than the industrial criteria. This is believed to be based on one soil sample.

PSC 15 – Operated as a 10,000-square foot paint sludge and solvent disposal pit for between 10 and 36 years. The estimated disposal amount was 2,000 gal per year. According to the ROD, the radium contaminated soil was removed except for a location beneath a thick concrete pad or in soils greater than 3 ft bgs.

PSC 16 – Multiple spills reported for this area including JP-5 fuel, hydraulic oil, chrome, and cyanide; and releases of oils and various other chemicals into the storm sewer, which discharged at PSC 16.

PSC 48 – Operated as base dry cleaners from 1962 until 1990. This facility reportedly used 150 gal per month of TCE. No report of on-site disposal was included in the RI/FS.

Former Plating Shop, Building 101 – Tin, copper, cadmium, lead, nickel, silver, chromium, and gold electroplating operations were conducted between 1940s and 1990. This facility included a wastewater treatment system located outside of the building.

4.3.1 Initial Response for OU 3

According to the RI/FS (HLA, 2000b), numerous removal actions have been performed at OU 3 to reduce contaminant source areas. These actions involved the removal of contaminated soil and groundwater and removal of USTs and tank system piping and equipment. Brief descriptions of the initial responses for OU 3 are as follows:

- PSC 13 – Removal of radiological contaminated soil and asphalt was performed.
- PSC 15 – Removal of radiological contaminated soil.
- PSC 48 – IRA was performed involving the installation and operation of an AS/SVE system.
- Building 870 - IRA was performed involving the installation and operation of a groundwater pump and treat and SVE system.

- Former Plating Shop – Removal of tanks, building demolition, and soil removal.

4.3.2 Basis for Taking Action at OU 3

The following paragraph from the Executive Summary of the RI/FS (HLA, 2000b) indicates the contaminated media of concern and, thus, the basis for the remedial actions detailed in the ROD (HLA, 2000a): "Evaluation of the findings from the first, second, and third stages of the RI indicate there is no evidence to suggest that ongoing point sources of contamination are present within the vadose zone at OU 3. Based on the risk assessments, only the following two environmental media present risk to human health or the environment: groundwater (at Areas B, C, D, F and G) and a localized area of sediment (containing "tar balls") in the St. Johns River near PSC 16. In addition, water in the storm sewers at the southern end of OU (3) exceeds Florida Surface Water Standards (FSWS)."

According to the RI/FS (HLA, 2000b), the COCs that pose a risk at OU 3 and exist at concentrations that are above background can be summarized as follows:

Groundwater	Tetrachloroethene (PCE) TCE 1,1-DCE VC
Storm Sewer Water	TCE
Soil	Lead Radium
Sediment	PAHs Lead

For more detail on the COCs observed, Appendix D provides some tables and figures from the RI/FS (HLA, 2000b) that show the detected COCs for the media indicated above. The RI/FS for OU 3 was focused on the areas of significant groundwater contamination and, as such, did not reference the soil contamination resulting in the implementation of LUCs at PSCs 14 and 15 or the two sites within OU 3 that were transitioning from IRAs to CERCLA Remedial Actions.

4.4 REMEDIAL ACTIONS FOR OU 3

According to the ROD (HLA, 2000a), "the overall strategy at OU 3 is to devise and implement cleanup remedies which minimize the need for LUCs or other administrative controls. Therefore, the basis and rationale for developing remedial action objectives (RAOs) for storm sewer water, groundwater, and sediment was to bring storm sewer water effluent into compliance with FSWS, to make groundwater suitable for drinking water purposes, and to remove ecological mortality risk in sediment. Hence, RAOs

were established for storm sewer water due to a maximum detected concentration of TCE that exceeded the FSWS. RAOs for groundwater were established because of the excessive human health risk due to chlorinated VOC concentrations above Federal and State MCLs. RAOs for sediment were established due to a small area of lethal toxicity to aquatic receptors…The objectives are intended to be the design basis for a final remedy for media at OU 3. RAOs were not established for soil or surface water at OU 3 because no risks were predicted for human or ecological receptors exposed to those media." A brief synopsis of these objectives is provided in Table 4-2.

TABLE 4-2
REMEDIAL ACTION OBJECTIVES FOR OPERABLE UNIT 3

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Medium	Contaminants Causing Unacceptable Risk	Remedial Action Objectives
Storm Sewer Water	TCE	Manage contaminated storm sewer water to achieve FSWS within the zone of tidal influence.
Groundwater	Chlorinated VOCs	Address groundwater contamination at Areas B, C, D, F, and G containing concentrations of chemicals above ARARs.
Sediment	PAHs Lead	Reduce ecological receptor exposure to sediment containing lethal concentrations of PAHs and lead.

PSC 48 and Building 780 remedies were selected as IRAs and made permanent in the OU 3 ROD. Active cleanup consisting of an AS/SVE system for PSC 48 and a groundwater extraction and treatment/SVE system for Building 780 is now in process. The interim RAOs established for these areas in the EECA (ABB-ES, 1995a) consist of the following:

- Reduce present or future risks posed to human health and to the environment.
- Reduce contaminant concentrations in hot spots or source areas to adjacent levels of contamination.
- Collect data that can be used to focus the RI/FS.

The EECA (ABB-ES, 1995b) specifically states that, "it is not the objective of the IRA (for PSC 48 and Building 780) to achieve endpoints for remediation that consist of Federal maximum contaminant levels (MCLs), Florida "free-froms," or other final clean-up criteria". That document also stated that they anticipated after successfully lowering hot spot concentrations a final OU-wide remedy could be selected to address residual contaminants. The Action Memorandum (ABB-ES, 1996b) states that the IRAs were not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, and that subsequent actions were planned to address potential risks posed by residual

contamination at OU 3. However, the ROD selected these as permanent remedies without further evaluation in the RI/FS.

4.4.1 Remedy Selections at OU 3

The following sections detail the remedies chosen for each portion of OU 3.

4.4.1.1 OU 3-Storm Sewer Water

The ROD (HLA, 2000a) reports that a video inspection of the storm sewers verified that groundwater is infiltrating the sewer pipes through leaking joints and cracks. It was surmised that the likely source of TCE at concentrations exceeding the FSWS in the storm sewer water is infiltrating groundwater. TCE was detected in the storm sewer near groundwater hot spot Area F. The TCE concentrations "upstream" of Area F were either non-detect or less than FSWS; therefore, the following course of action was selected as the preferred remedial alternative for the storm sewer water at OU 3:

- Collect samples of water in the storm sewers within the zone of tidal influence and analyze for VOCs after completion of the remedial activities at groundwater Area F. If the concentrations of VOCs are below the FSWS, no further action is required for the storm sewer water. If the concentrations of the VOCs exceed FSWS, installation of CIPP will be the selected remedial alternative for the storm sewer water followed by regular monitoring until the VOCs are below the FSWS.

It is possible that once the Area F groundwater has been treated by its selected remedial alternative that TCE may no longer exceed the FSWS in the storm sewer water.

Whether as a result of Area F groundwater remediation or installation of CIPP, the storm sewer remedy reportedly complies with ARARs (FSWS) and eliminates the potential for migration of the contaminated groundwater to the St. Johns River, via the storm sewers. Although TCE has been detected in the storm sewer water at concentrations exceeding the FSWS (maximum of 170 µg/L versus the 80.7 µg/L standard), unacceptable risks to human health or the environment were not predicted based on exposure to VOCs in the storm sewer water.

4.4.1.2 OU 3- Areas C and D

Enhanced biodegradation was chosen as the preferred remedial alternative for the contaminated groundwater at Areas C and D. It was chosen for its low cost and short implementation time (4 years to remediate and 5 years for O&M). This alternative was accomplished by injecting nutrients to enhance bacterial growth and increase natural biodegradation of organic compounds. The contamination in these

areas is in the intermediate zone of the surficial aquifer, which is under anaerobic conditions. Additionally, the primary COC was TCE; therefore, hydrogen release compound (HRC®) injection was used because it is easily metabolized by anaerobic bacteria in that zone. The FS called for applying the material twice during the first four years of remediation.

Also, as part of the remedial action, the groundwater is monitored for both the COCs and NA parameters that indicate the likelihood of ongoing and potential future biodegradation. The ROD (HLA, 2000a) stipulated that the monitoring would occur on a quarterly basis for five years until the five-year review. It also stipulated that both sites would be monitored for target compound list (TCL) VOCs, and Area D would also be monitored for target analyte list (TAL) inorganics since arsenic had exceeded drinking water standards at that site.

This remedial alternative was expected to effectively destroy the VOCs in the intermediate zone of the surficial aquifer at Areas C and D and achieve the RAO for OU 3 groundwater at both areas by achieving ARARs.

Implementation of groundwater use restrictions until RAOs have been achieved was also selected to provide protection of human health. This remedial action was expected to achieve the RAO within 5 years of implementation such that no controls (administrative or physical) of residual risk will be required.

4.4.1.3 OU 3- Area F

In-situ Chemical Oxidation (ISCO) was selected as the preferred alternative for the contaminated groundwater in the upper 40 ft of the surficial aquifer at Area F. ISCO was also considered a low cost alternative with short implementation time (5 years for remediation, 5 years for treatment system O&M, and 10 years for concurrent administration which would allow for two five-year site reviews). The FS reported that the ISCO process involves active in-situ treatment with the creation of a treatment cell through a combination of injection of an oxidant compound (e.g., potassium permanganate) and extraction of groundwater. This process would control the groundwater flow paths within the contaminated plume thus preventing contaminant migration during the remedial action while effectively oxidizing the VOCs.

The ROD (HLA, 2000a) stipulated that annual monitoring of the groundwater for TCL VOCs would be used to track progress of the cleanup, and for TAL inorganics to track proper utilization of the ISCO compound.

This remedial alternative is expected to destroy up to 90 to 95 percent of the VOCs in the intermediate zone of the surficial aquifer at Area F, and it will achieve the RAO for OU 3 groundwater at in that area by achieving ARARs.

Implementation of groundwater use restrictions until RAOs have been achieved was also selected to provide protection of human health. This remedial action was expected to achieve the RAO within 5 years of implementation such that no controls (administrative or physical) of residual risk will be required.

4.4.1.4 OU 3-Areas B and G

The selected remedy for both Areas B and G is MNA. The contaminated plume (in the intermediate zone of the surficial aquifer) at Area B has been modeled to slowly migrate into a 'clay plug' within 41 years. Meanwhile, it has been determined that the plume associated with Area G will naturally decay to non-detectable levels in 39 years. The plume in Area G appears to be unconfined in the surficial aquifer. Even though the plumes at Areas B and G would have to be monitored 41 and 39 years, respectively, the relative cost was considered low enough to be worthwhile. Additionally, the Restoration Advisory Board members were adamant during the public comment period that active remediation was too costly since the exposure potential was extremely low, causing the human health and ecological risk to be minimal.

The ROD (HLA, 2000a) stipulated that sampling events would be required every 6 months for the first 2 years, then annually for 3 years until the five-year review, and, finally, bi-annually. As for monitoring specifics, the ROD explains that "the wells will be sampled and groundwater will be analyzed for parameters which indicate the likelihood of ongoing and potential future biodegradation as well as groundwater contaminants". Modeling of the progress of each plume toward final decay (Area G) or assimilation into a clay unit (Area B) is expected every 5 years. If the remediation of each plume does not appear to be on track, a contingent action would be implemented.

Based on observed and modeled data for each plume, it was assumed that MNA will effectively destroy the VOCs in both areas, and the alternative would achieve the RAO for groundwater at both areas.

4.4.1.5 OU 3-PSC 16

The preferred remedial alternative for sediment at PSC 16 is selective removal of tar balls that are believed to contain the toxic components (i.e., PAHs and lead) that resulted in 100 percent mortality in toxicity testing for the site. The alternative involved the use of a sediment-sifting device designed to selectively remove the tar balls from the river bed.

The steps expected for this event were as follows:

1. Baseline analytical and toxicity sampling to confirm or change the remediation boundary. Grain sized analyses were also to be performed to aid in determining the required mesh size for the sifting device.
2. Installing a silt-screen barrier at the boundary to minimize off-site migration of suspended sediment.
3. Sifting of sediment to a depth of 6 inches with the manufactured sifter. The tar balls will be placed into drums for eventual proper disposal, while any marine wildlife will be returned to the water.
4. Post-remediation analytical and toxicity sampling to confirm the removal of the contaminated sediments.

This alternative was expected to take as little as 1 month to implement. The toxic chemicals that were reported were believed to be primarily contained in the tar balls, so their removal would mitigate the source and prevent future risks to the local fauna. Promulgated ARARs for sediment were not available; however, the removal of the tar balls was expected to meet the RAO for the sediment by meeting the exposure endpoints selected in the baseline ecological risk assessment. Thus the PAH and lead levels should decrease to levels that would not adversely affect the survival and growth of amphipods exposed to sediment in PSC 16. Also, this effort was not expected to adversely affect the overlying surface water.

4.4.1.6 OU 3-Building 106 (PSC 48)

The remedial action at PSC 48 was developed as an IRA and involves an air sparging (AS) system emitting air into the groundwater to volatilize dissolved VOCs in the shallow zone of the surficial aquifer. The COCs are then captured with a vapor extraction system for removal and discharged through two granular activated carbon (GAC) beds (configured in series). The GAC beds are used to adsorb the chlorinated VOCs prior to exhaust through a 10-ft high stack (HLA, 1999a). The system consists of the following major components:

- Eleven air sparging (AS) wells (AIW-1061 through AIW-10611) installed into the saturation zone with 18-inch well screens on top of the shallowest confining strata (approximately 13.5 ft bgs).
- Two horizontal vapor extraction wells (designated as north and south legs) installed in trenches in the vadose zone (approximately 2 ft bgs) near the AS points (approximately 5 to 15 ft away).
- A positive displacement rotary low pressure blower for AS.

- A regenerative type vacuum blower for vapor extraction.

- Subsurface pipelines to connect the AS wells to the positive displacement blower.

- Subsurface pipelines (SVE laterals) to connect the vapor extraction trenches to the vacuum blower.

- Two 5,000 pound vapor-phase GAC treatment units for off-gas treatment.

- Nine groundwater monitoring points consisting of eight piezometers (PZ-1061 through PZ-1068) and one monitoring well (MW-028) to measure the influence and effectiveness of the AS system. Also, eight vapor probes to concentrate influence from the horizontal extraction wells and provide monitor points to characterize the vadose zone vacuum being created.

HLA (1999a) stated in their report that there were several minor changes to the treatment system during the construction with no substantive changes to the design intent.

The ROD implemented the IRA as originally designed as the final remedial action for this site until the five-year review. The ROD stated that during the five-year review the system performance should be evaluated to determine if the, "VOC concentration (expressed as the total ethane equivalent) in groundwater is decreasing such that ARARs will be met in a reasonable timeframe (e.g., 30 years)".

4.4.1.7 OU 3-Building 780

The remedial action for Building 780 was developed as an IRA and involves a groundwater extraction treatment (GWT) and SVE system designed to treat VOCs in the shallow zone of the surficial aquifer. The SVE system was designed to collect contaminated soil vapor from six, equally-spaced, vertical SVE wells installed in the vadose zone around Building 780. The vapors were transported via a piping network to a skid-mounted vacuum system and discharged through a thermal oxidation (Therm-Ox) unit and acid gas scrubber before going out a stack to the atmosphere. The GWT uses a pre-existing well (U3MW029) with a pneumatic well pump to pull groundwater from the source area and send it to an equalization tank. When a certain level of liquid is reached, it is pumped to a shallow-tray air stripper to remove the VOCs in the groundwater. Afterward, the treated water is discharged to the base sanitary sewer. Contaminated gases from the SVE and GWT systems are combined and sent through the Therm-Ox and a scrubber unit for final treatment prior to venting to the atmosphere (HLA, 1999b). The system was designed with the following components:

- One groundwater extraction well (MW-029) installed previously into the saturated zone with a well screen on top of the shallowest confining strata (estimated at 15 ft bgs).

- One pneumatically operated automatic well pump and an air pressure regulator installed in well MW-029.

- Vapor extraction trenches installed in the vadose zone near the groundwater extraction well (approximately 2 ft bgs).

- Six vapor extraction wells (VEW-7801 through VEW-7806) installed to approximately 4 ft bgs and screened in the vadose zone around Building 780.

- A regenerative vacuum blower for vapor extraction.

- Subsurface and above-grade pipelines to connect the groundwater extraction network to the groundwater pretreatment system and then to the sanitary sewer.

- Subsurface pipelines [SVE laterals of which there are two and they are called 780-1 (with wells VEW-7801, VEW-7805, and VEW-7806) and 780-2 (with wells VEW-7802 through VEW-7804)] to connect the vapor extraction trenches to the vacuum blower.

- A groundwater pretreatment system consisting of a shallow-tray air stripper and blower to remove VOCs prior to discharge in the sanitary sewer for treatment at the facility's treatment works.

- A thermal oxidation unit to treat vapor off-gas from the air stripper and the VES prior to exhaust.

- Monitoring points (MW-780-1, MW-780-2, and EW-780) to measure the influence and effectiveness of the GWT/VES on the groundwater plume and to collect samples for biodegradation modeling.

According to the ROD, the long-term plan for this IRA was to continue O&M of the system with groundwater monitoring until the five-year review. The five-year review is to evaluate if the VOC concentrations in groundwater are decreasing such that ARARs will be met in a reasonable timeframe. If that expectation is met, then the ROD states that the system would continue to be operated with appropriate LUCs in place.

4.4.1.8 OU 3-PSC 14 and PSC 15

The remedial action for PSC 14 and PSC 15 was listed in the ROD as LUCs for an industrial scenario. The lead contaminated soil beneath PSC 14 and radium contaminated soil beneath portions of PSC 15 were the reasons for the LUCs.

4.4.2 REMEDY IMPLEMENTATION AT OU 3

The remedial actions selected for implementation at OU 3 are consistent with CERCLA and the NCP. The selected remedies satisfy the statutory preference for treatment to the extent practicable, which permanently and significantly reduces the mobility, toxicity, and/or volume of hazardous substances as a principle element.

4.4.2.1 OU 3-Storm Sewer

Remedy implementation for the storm sewers is on hold per the OU 3 ROD, pending remediation of Area F and subsequent verification sampling.

4.4.2.2 Areas C and D

The remedial design phase for Areas C and D has been completed and the HRC® was injected. The remedial action phase for this site continues with groundwater monitoring and potentially additional HRC® injection. The following explains actions completed at this site to date.

An injection work plan with a HASP was issued by CCI (CCI, 2001a) for Area C. The main components of the plan included a DPT groundwater investigation from the source area around CW-16 and monitoring well MW-31 at intervals of 22 to 26 ft bgs (or directly above the clay layer), 26 to 30 ft bgs, 30 to 34 ft bgs, 34 to 38 ft bgs, 38 to 42 ft bgs, and 42 to 46 ft bgs (to verify the vertical extent of the plume). In addition, a groundwater sample would be collected from MW-31. Following review of the DPT data, the plan anticipated the installation of four wells for baseline and periodic monitoring (following the HRC® injection) of the following parameters: TCL VOCs, dissolved iron and manganese, nitrate, sulfate, sulfide, chloride, alkalinity, total organic carbon (TOC), dissolved gases, and metabolic acids. The last component of the plan involved an initial HRC® injection in the source area and around the MW-31 area followed by a one-year barrier application of the same compound.

The same work plan and HASP issued for Area C also addressed Area D (CCI, 2001a). The main components of that plan included a DPT groundwater investigation around the source area (adjacent to CW-43 and D01) at intervals of 23 to 27 ft bgs (or directly above the clay layer), 27 to 31 ft bgs, 31 to

35 ft bgs, 35 to 39 ft bgs, 39 to 43 ft bgs, 43 to 47 ft bgs, 47 to 51 ft bgs, and 51 to 55 ft bgs (to verify the vertical extent of the plume). In addition, groundwater samples would be collected from existing pump test well GEW002 and existing monitoring well MW-30. Following review of the DPT data, the plan anticipated the installation of four wells for baseline and periodic monitoring (following the HRC® injection) of the following parameters: TCL VOCs, TAL metals, dissolved iron and manganese, nitrate, sulfate, sulfide, chloride, alkalinity, TOC, dissolved gases, and metabolic acids. The last component of the plan involved an initial HRC® injection in four zones: the source area (CW-43 area), upgradient of Wasp Street, upgradient of Building 103, and in the Building 103 keyway. From August 2002 through 2003, CCI performed the first HRC® injection event. Monitoring began in June 2003.

Available details concerning the injection are included in Appendix E.

4.4.2.3 Area F

Mantech Environmental Corporation (Mantech) began the remedial design phase for Area F. However, the demonstration project was cancelled when an unexpectedly low VOC results during the design phase were received. TtNUS performed a sampling effort to confirm the groundwater conditions at the site. Subsequently, CCI is in the remedial design phase of the Area F corrective action. The following explains actions completed at this site to date.

In February 2001, Mantech performed the initial characterization efforts for the ISCO technology demonstration project at the site. After reviewing the results of the sampling, Mantech concluded that TCE was not present at levels reported by HLA's 2000 FS (TtNUS, 2003a). Thus, Mantech changed the venue for the demonstration project. Following discussions by the NAS Jacksonville Partnering Team, TtNUS was contracted by the Navy to re-assess the site to determine whether the current site conditions were as reported in the RI/FS or by Mantech. TtNUS conducted the first phase of the investigation in September 2002. The following conclusions were included in the TtNUS report:

- The groundwater concentrations TtNUS encountered in the 2002 re-assessment were similar to the TCE concentrations originally reported in the RI/FS (HLA, 2000b).

- Subsurface heterogeneities, which are believed to exist between 30 and 40 ft bgs, retard the downward migration of contaminants.

- The results of this study confirm the prior determination that conditions at Area F are not conducive for biodegradation of the contaminants. Although some biodegradation may occur as evidenced by limited detections of breakdown products near the downgradient edge of the plume, biodegradation processes do not appear to be active over the majority of the contaminant plume area.

- The groundwater plume delineation is not complete at Area F.

On November 12, 2002, the NAS Jacksonville Partnering Team reviewed the first phase of the TtNUS re-assessment and decided that ISCO would remain the preferred remedial action for Area F.

CCI (CCI, 2004a) submitted a work plan to collect soil and groundwater analytical data to supplement the data collected by TtNUS, determine the location for monitoring well installation, and develop the ISCO injection design. As of this writing, the work is still underway.

4.4.2.4 Areas B and G

Area B has transitioned through the remedial design phase, which included the development of an LTMP and Quality Assurance Project Plan (QAPP) and design of a monitoring well network. Area G remains in the remedial design phase of the post-ROD era due to the need for additional investigation to completely define the horizontal and vertical extent of the groundwater contamination. The following explains actions completed at these sites to date.

In May 2002, TtNUS received approval of the QAPP that detailed the proposed LTMP for Area B. A two-stage approach was indicated with the first stage including installation of a multi-chamber well (MCW) to monitor seven intervals of the surficial aquifer. The well was planned for installation in the originally identified source area (i.e., CPT location CW31). Prior to initiating the second stage, the number and location of additional wells were selected. The analyses (COCs and NA parameters) are as follows: TCL VOCs, alkalinity, total iron and manganese, select anions (nitrite, nitrate, chloride, and sulfate), dissolved gases (methane, ethene, and ethane), TOC, and sulfide.

The QAPP (TtNUS, 2002c) designed for Area B included the LTMP for Area G. The QAPP also indicated that a DPT groundwater investigation was performed for Area G by J. A. Jones in June 2000 and indicated the presence of several VOCs (TCE; cis-1,2-DCE; and 1,1-DCA). The VOCs detected were at depths ranging from 15 to 40 ft bgs; however, horizontal and vertical delineation were not demonstrated by the action. The QAPP indicated that six MCWs would be installed with monitoring planned for seven intervals at each location to determine the future course of the MNA at the site. At the time of the QAPP, no additional wells were anticipated. The same analyses (COCs and NA parameters) listed above for Area B were applied in the QAPP for Area G.

4.4.2.5 PSC 16

The remedial design phase for PSC 16 has been completed and the remedial action was implemented. The following explains actions completed at this site to date.

In accordance with the work plan (CCI, 2001a), CCI was to conduct the tar ball removal. The plan called for the following steps to take place:

- Initial site visit with visual inspection for presence of tar balls in the locations previously indicated (see Appendix F).

- Set up a work perimeter replete with a silt fence and rake the river bed to a depth of 6 inches in accordance with the ROD (HLA, 2000a).

- Load the waste into drums and properly characterize it for disposal at an approved facility.

- Return any fauna caught during the raking to its natural habitat and conduct site restoration to the extent that is practicable.

- Resample the sediment for PAHs and lead approximately 6 to 8 weeks after the tar ball removal to determine if the remediation achieved the RAO.

CCI completed the sediment removal (approximately 2 ft depth) and performed sampling for chemical analysis and toxicity testing. The testing indicated that the sampling had not achieved the anticipated results. The NAS Jacksonville Partnering Team discussed the remaining contamination and determined it is as likely due to contribution from other sources as it was from the station. An oil-water separator, monitored under the storm water program, had been recommended; however, recent information indicates that this is not feasible and other actions are being considered.

CCI has not issued the final removal action report to date; therefore, a condensed version of the applicable notes from the NAS Jacksonville Partnering Team meeting minutes is presented in Appendix G.

4.4.2.6 OU 3-Building 106 (PSC 48) and Building 780

The remedial design phase for these sites was completed under an IRA. The remediation system has been constructed, and the remedial action phase continues with system O&M and groundwater monitoring. The following explains actions completed to date.

Following the EECA (ABB-ES, 1995a), ABB-ES issued the Final Design for the proposed systems at Buildings 106 and 780. The Remedial Work Plan for Buildings 106 and 780 was issued by BEI in August 1996. Also, the final changes to the design for both sites were issued (ABB-ES, 1997). Construction of the proposed AS/SVE system for Building 106 began in April 1997, and it was completed in March 1998. System startup for the AS/SVE system was in March 1998. Construction of the GWT/SVE system for Building 780 began in June 1997, and it was completed on April 28, 1998. System startup for the GWT/SVE system at Building 780 began on April 29, 1998. With the exception of intermittent downtime, the systems at both sites have been in operation since startup.

4.4.2.7 OU 3, PSC 14 and PSC 15

The remedial action (LUCs) for PSC 14 and PSC 15 were implemented in December 2004 via inclusion in the LUC inspection process. No LUCIP documents were prepared for these sites.

4.4.3 System Operation/O&M at OU 3

4.4.3.1 OU 3-Storm Sewer Water

This remedy is on hold pending the completion of the Area F remediation and subsequent storm sewer sampling. Therefore, no O&M activities have been performed.

4.4.3.2 OU 3-Areas C and D

The Navy has contracted with CCI to perform the enhanced bioremediation remedy for Areas C and D. With one exception, it appears that the work is being conducted in accordance with the ROD (HLA, 2000a) and the Remedial Action Contractor's (RAC) work plan (CCI, 2001a). The exception to the plan is that the monitoring program calls for quarterly sampling during the first five years of O&M and thus far, the sampling has been completed on a semi-annual basis.

The completed activities for Area C include:

- Development of an HRC® Injection Groundwater Monitoring Program including monitoring wells U3C-MW31, U3C-MW35, U3C-MW36, U3C-MW37, U3C-MW38, U3C-MW39, U3C-MW40, U3C-MW41, and U3C-MW42.

- Baseline Groundwater Monitoring Event performed November 5 to 13, 2001.

- HRC® injection performed between December 16, 2002 and February 26, 2003, and involving the injection of 3,710 gal of HRC® into 262 injection points.

- First post-injection monitoring event performed July 15 to 30, 2003. The results were presented to the NAS Jacksonville Partnering Team at the October 28, 2003 meeting.

- Second post-injection monitoring event performed December 15 to 20, 2003, approximately 10 months following HRC® injection.

The completed activities for Area D are as follows:

- Development of the HRC® Injection Groundwater Monitoring Program, which includes monitoring wells U3D-MW30, U3D-GEW002, U3D-MW43, U3D-MW44, U3D-MW46, U3D-MW47, and U3D-MW48.

- Abandonment of monitoring well U3D-MW45 in January 2003 to facilitate paint booth construction in Hangar 101S.

- Baseline groundwater monitoring event performed November 5 to 13, 2001.

- HRC® injection completed from August 12, 2002 to December 13, 2002, with approximately 4,156 gal of HRC® injected into 346 injection points.

- First post-injection monitoring event performed July 15 to 30, 2003. The results were presented to the NAS Jacksonville Partnering Team at the October 28, 2003 meeting.

- Second post-injection monitoring event performed December 15 to 20, 2003, approximately 1 year following HRC® injection completion.

No written report has been issued as of this writing for the enhanced bioremediation work that has been accomplished at Areas C and D; however, a presentation was made on March 30, 2004 to the NAS Jacksonville Partnering Team. The presentation detailed the events that have occurred to date and was provided in lieu of a written report.

The Navy's original cost estimate for implementation of the enhanced bioremediation alternative at Area C was $819,300, which included quarterly groundwater monitoring (for five years) and two injection treatments. Similarly, the cost for the Area D alternative was estimated at $956,600. It also included quarterly groundwater monitoring (for five years) and two injection treatments. The estimated cost to date for the work performed to date for Area C is approximately $580,853. The estimated cost to date for the work performed to date for Area D is approximately $612,526.

4.4.3.3 OU 3-Area F

The Navy has contracted with CCI to perform the ISCO remedy for Area F. The remedial design phase has begun and is in process. No remedial actions have been performed to date.

The Navy's original cost estimate for the remedy selected was $1,178,300, which included system installation with new wells, O&M for 10 years, and annual groundwater monitoring for 10 years. The remedy has not yet been initiated; however, the cost for confirmation of site contamination, accomplished by TtNUS, has been tabulated at approximately $134,000.

4.4.3.4 OU 3-Area B

The LTMP for this site was handled for the first year by TtNUS, and then it was transferred to Apex Environmental (Apex). The work is being done in general accordance with the ROD (HLA, 2000a) and the QAPP (TtNUS, 2002c).

The completed activities for Area B include:

- Installation of MCW OU3-B1 in source area in June 2002.
- Year 1, Semi-annual Groundwater Monitoring Event 1 performed in July 2002.
- Installation of conventional wells OU3-B2 and OU3-B3 in November 2002.
- Year 1, Semi-annual Groundwater Monitoring Event 2 performed in December 2002.
- Year 2, Semi-annual Groundwater Monitoring Event 1 performed in September 2003.
- Year 2, Semi-annual Groundwater Monitoring Event 2 performed in January 2004.

The Navy's original cost estimate for implementation of this work (including new wells and monitoring for 41 years) was $462,000. The cost for the work performed by TtNUS was approximately $89,000. As reported to TtNUS, the monitoring performed by Apex was approximately $10,000 to date.

4.4.3.5 OU 3-Area G

The LTMP for this site was handled for the first year by TtNUS, and then was transferred to Apex. The work is being done in general accordance with the ROD (HLA, 2000a) and the QAPP (TtNUS, 2002c).

The completed activities for Area G include:

- Installation of MCWs OU3-G1 through OU3-G6 in June 2002.
- Year 1, Semi-annual Groundwater Monitoring Event 1 performed in July 2002.
- Installation of MCWs OU3-G7 and OU3-G8 in November 2002 and June 2003, respectively.
- Year 1, Semi-annual Groundwater Monitoring Event 2 performed in December 2002 for first seven wells, and OU3-G8 sampled in July 2003.
- Year 2, Semi-annual Groundwater Monitoring Event 1 performed in September 2003.
- Year 2, Semi-annual Groundwater Monitoring Event 2 performed in January 2004.

The Navy's original cost estimate for implementation of this work (including new wells and monitoring for 39 years) was $462,000. The cost for the work performed by TtNUS was approximately $89,000. The cost for the monitoring performed by Apex (Apex, 2004a) was approximately $10,000 to date.

4.4.3.6 OU 3-PSC 16

CCI, acting as the Navy's RAC, implemented and completed the remedial action for this site. As indicated earlier, there are no published reports on the effort. The RAC representative (Section 6.13) indicated that the remedy was implemented. However, no O&M are required.

The Navy's original cost estimate for implementation of this work was $79,900. The actual cost for the removal came to $77,350.

4.4.3.7 OU 3-Building 106 (PSC 48)

The O&M for this site was handled by BEI from system startup in March 1998 until the end of March 2000, when CCI took over as the RAC from April 2000 to August 2003. Apex has been responsible for O&M at the site since July 2003 to present. The work is being accomplished in general accordance with the Remedial Work Plan (BEI, 1996) and the O&M Manual (FD-GTI, 1998).

The completed activities for PSC 48 include:

- Installation of the AS/SVE system in general accordance with the design and work plan documents.

- System startup and first year of operation from March 1998 to March 1999 by BEI, including quarterly monitoring of the groundwater.
- Continued O&M by BEI and successive contractors (CCI and Apex) from April 2000 to the present, including quarterly monitoring of the groundwater.

The Navy's original cost estimate for implementation of this work (including 2 years of O&M) was $490,000 (ABB-ES, 1996b). The costs incurred for the system installation are not available at this time; however, the costs on a yearly basis for O&M by the RAC are as follows:

- 2001-2002 $96,503
- 2002-2003 $63,888

Apex (Apex, 2004b) estimates that their cost for the O&M is approximately $9,000 per quarter.

4.4.3.8 OU 3-Building 780

The O&M for this site was handled by BEI from system startup beginning in April 1998. However, HLA (HLA, 1999b) reported that continuous and dependable operation of the system did not actually begin until March 1, 1999, due to equipment and process problems. BEI remained the RAC for the site until March 2000. Afterward, CCI took over as the RAC from April 2000 to the present. The O&M work is being accomplished in general accordance with the Remedial Work Plan (BEI, 1996) from which the current RAC has prepared its own work plan.

The completed activities for Building 780 include:

- Installation of the GWT/SVE system in general accordance with the design and work plan documents.
- System startup by BEI in April 1998.
- The first year of operation from March 1999 to March 2000. However, quarterly monitoring data for this time period appears to be non-existent as indicated by the available quarterly reports by BEI (BEI, 1999c and 2000b).
- Continued O&M by CCI from April 2000 to the present, including quarterly monitoring of the groundwater.

The Navy's original cost estimate for implementation of this work (including 2 years of O&M) was $1,102,000 (ABB-ES, 1996b). The costs incurred for the system installation are not available at this time; however, the costs on a yearly basis for O&M are as follows:

- 2001-2002 $167,558
- 2002-2003 $201,338
- 2003-2004 $185,604

4.4.3.9 OU 3, PSC 14 and PSC 15

The remedial action for PSC 14 and PSC 15 does not involve operations and maintenance. Therefore there is nothing to report.

4.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This site was not included in the last five-year review. As such, all work described herein represent the progress since the last five-year review.

4.5.1 Protectiveness Statements from the Last Review

This site was not included in the last five-year review.

4.5.2 Status of Recommendations and Follow-up Actions from Last Review

This OU was not included in the last review.

4.6 FIVE-YEAR REVIEW PROCESS

4.6.1 Administrative Components

The NAS Jacksonville Five-Year Review team consisted of Harold McGill, Phillip McGinnis, and Anthony Robinson (NAVFAC EFD SOUTH); Bill Raspet (NAS Jacksonville); Peter Dao (USEPA); James Cason (FDEP); Hal Davis (USGS); Greg Roof (TtNUS); and Mike Halil (CCI). These organizational representatives have participated in the five-year review. No other potentially interested parties were identified or otherwise notified at the beginning of the review process.

This five-year review consisted of a review of the previous five-year review; evaluation of the issues raised in the previous review, actions taken, and results; site inspections; personnel interviews; and a technical assessment of each site and the remedial actions underway.

This five-year review was funded by NAVFAC EFD SOUTH in February 2004 and will be completed by March 2005. More detailed interview and inspection dates are included in the following sections.

4.6.2 Community Involvement

No public notice identifying that this review was beginning was published. However, at the conclusion of the review, a fact sheet is planned for production and disbursement to a Restoration Advisory Board and others.

4.6.3 Document Review

Several documents including the RI/FS, ROD, quarterly monitoring reports, work plans, remedial design document, etc. were reviewed during this five-year review. The reference list at the end of this document contains these documents.

4.6.4 Data Review

4.6.4.1 Storm Sewer

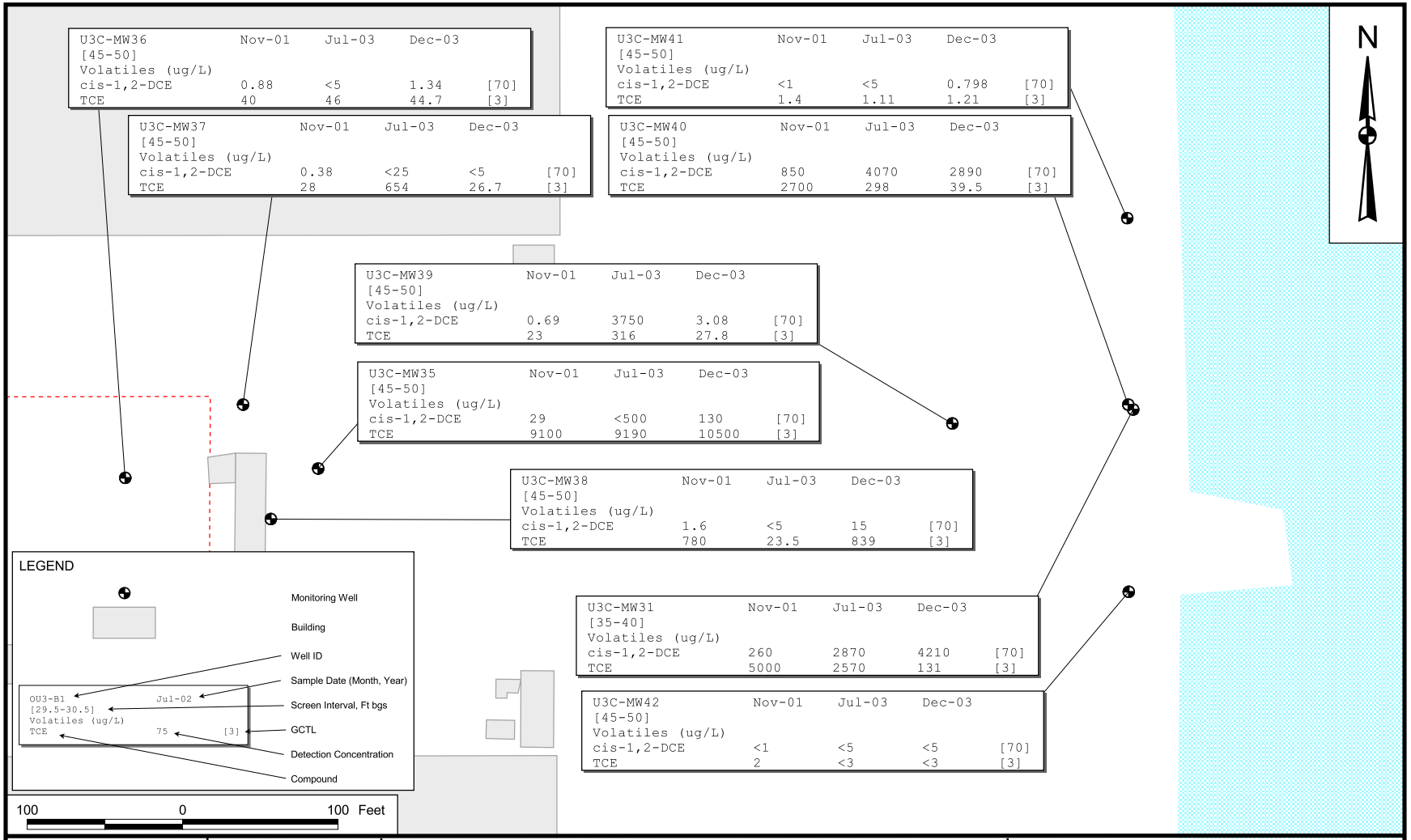
No remedial actions have occurred as of this review.

4.6.4.2 Area C

Appendix E contains the available documentation for the enhanced bioremediation that has been ongoing at Area C since the signing of the ROD. Appendix E includes a table with the COC concentrations from the current monitoring well network of nine wells. TCE is present in excess of its preliminary remedial goals in seven of the nine monitoring wells used in the current program. Figure 4-2 was created to show the TCE distribution on site. Table 4-3 shows the maximum concentrations for several VOCs from the RI and for the subsequent monitoring events as compared to the GCTL.

Several observations were made following a review of this data set:

- The monitoring frequency (quarterly) established in Section 2.12.1 of the OU 3 ROD is not being followed. This is a minor deviation from the ROD; however, since no written reports have been prepared, it likely has not been recorded. Per USEPA guidance (USEPA, 1999), “Any non-significant or minor changes should be recorded in the post-ROD site file…Although not legally required, a written statement describing the change is generally recommended”.
- The horizontal and vertical extent of contamination (particularly, TCE) is not completely delineated with the monitoring well network.



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NAVFAC

COC CONCENTRATION MAP

OU3, AREA C

NAS JACKSONVILLE

JACKSONVILLE, FLORIDA

CONTRACT NO.	7302
OWNER NO.	CTO 0342
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P:\GIS\JACKSONVILLE_NAS\TCE_TAGS.APR AREA C LAYOUT 2/21/05 CF

TABLE 4-3
MAXIMUM CONCENTRATION OF THE COCS FOR AREA C

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Chemicals of Concern	Frequency of Detection [1]	Remedial Investigation Maximum Concentration (µg/L)	November 2001 Maximum Concentration (µg/L)	July 2003 Maximum Concentration (µg/L)	December 2003 Maximum Concentration (µg/L)	GCTLs [2] (µg/L)
VOLATILE ORGANIC COMPOUNDS						
1,1-DCE	NR	NR	**12.0**	*<250*	*<500*	7
1,2-DCE (CIS)	NR	NR	**850**	**4070**	**4210**	70
1,2-DCE (TRANS)	NR	NR	5.5	*<500*	*<500*	100
1,2-DCE (TOTAL)	2/4	27	**855.5**	**4070**	**4210**	63
PCE	NR	NR	1.1	*<300*	*<300*	3
TCE	5/5	**5000**	**9132.1**	**9190**	**10630**	3
VC	NR	NR	**100**	*<100*	*<100*	1
Methylene Chloride	1/4	**27**	NA	NA	NA	5

Notes:

[1] Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the RI (HLA, 2000a).

[2] GCTL as promulgated in Chapter 62-777, FAC.

2001 through 2003 data copied from Area C and D presentation made by CCI at NAS Jacksonville Partnering Team meeting of March 2004.

NR = Not reported on RI, Table 6-17 as Human Health COPC.

NA = Data not available.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL.

The high detection limits appear to have been caused by high dilutions required to 'see' the correspondingly high concentrations.

< = below laboratory detection limit

4.6.4.3 Area D

Appendix E contains the only available documentation for the enhanced bioremediation that has been ongoing at Area D since the signing of the ROD. Appendix E includes a table with the COC concentrations detected during the current monitoring program. Figure 4-3 shows the TCE distribution on site. Table 4-4 shows the maximum concentrations for several VOCs and metals from the RI and for the subsequent monitoring events as compared to GCTLs.

Several observations were made following a review of this data set:

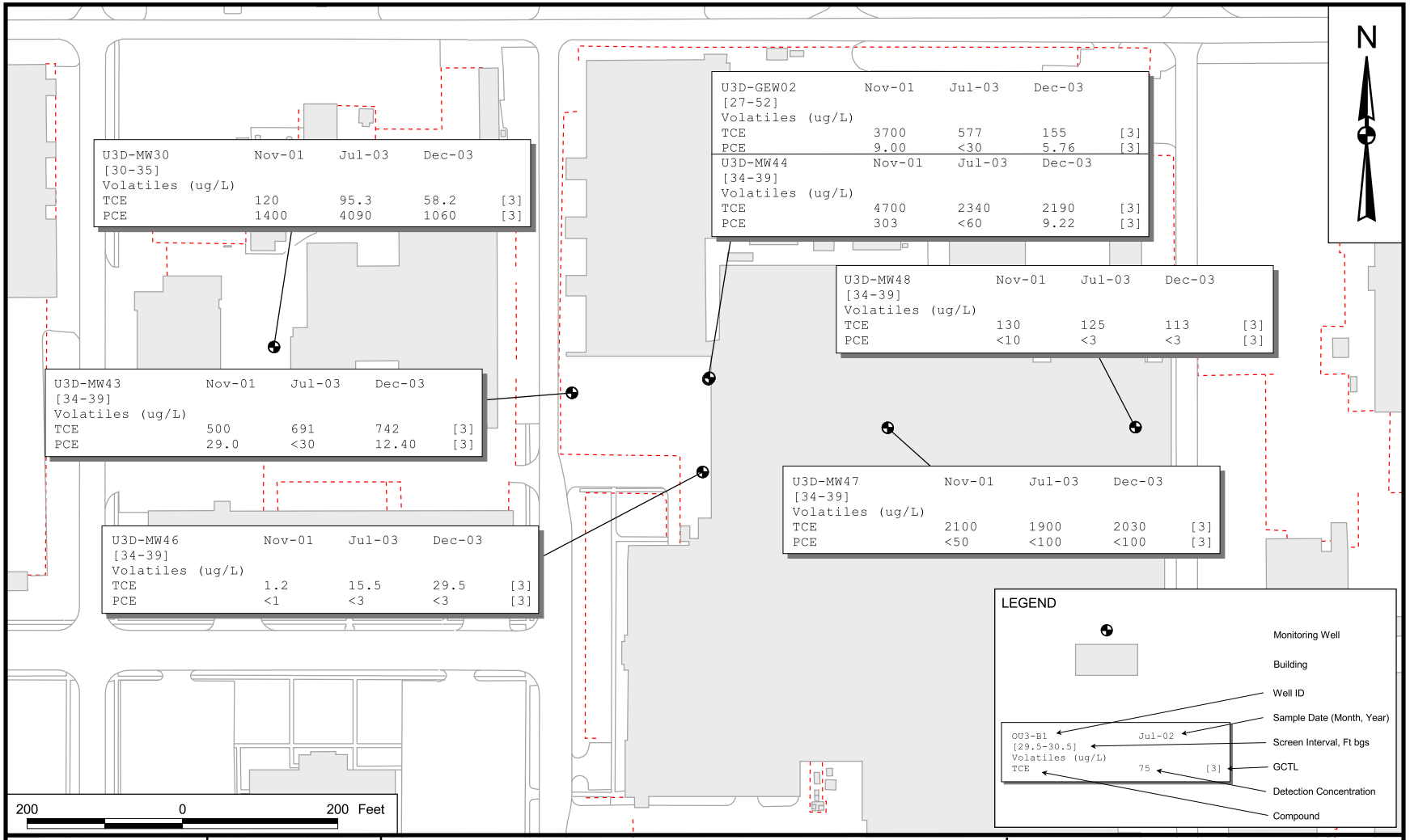
- The monitoring frequency (quarterly) established in Section 2.12.1 of the OU 3 ROD is not being followed. This is a minor deviation from the ROD; however, since no written reports have been prepared, it likely has not been recorded. Per USEPA guidance (USEPA, 1999) "Any non-significant or minor changes should be recorded in the post-ROD site file…Although not legally required, a written statement describing the change is generally recommended".

- Arsenic exceeded the GCTL in one well, U3D-GEW002. However, it is not a COC in the ROD.

- Source area reductions of PCE and TCE have been observed, but typical daughter by-products of reductive dechlorination are not as prevalent as expected. While TCE concentrations have decreased by approximately 300 percent, the other by-products of reductive dechlorination have increased almost 100 percent.

4.6.4.4 Area F

The remedial action, ISCO, that is planned for Area F has not commenced yet, but a review of the data collected recently by TtNUS (TtNUS, 2003a) was conducted. This assessment confirmed the concentrations reported in the RI. It also provided a better understanding of the spatial distribution of COCs. After reviewing data, the Navy contracted CCI to prepare the remedial design for the ISCO treatment. This involved additional delineation of the extent of the groundwater plume. The field work has reportedly been completed, and the results will be included in the remedial design document.



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NAVFAC

COC CONCENTRATION MAP
OU3, AREA D
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	7302
OWNER NO.	CTO 0342
APPROVED BY	DATE —
DRAWING NO.	FIGURE 4 - 3
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P:\GIS\JACKSONVILLE_NAS\TCE_TAGS.APR AREA D LAYOUT 2/21/05 CF

TABLE 4-4
MAXIMUM CONCENTRATION OF THE COCS FOR AREA D

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Chemicals of Concern	Frequency of Detection [1]	Remedial Investigation Maximum Concentration (µg/L)	November 2001 Maximum Concentration (µg/L)	July 2003 Maximum Concentration (µg/L)	December 2003 Maximum Concentration (µg/L)	GCTLs [2] (µg/L)
VOLATILE ORGANIC COMPOUNDS						
Bromoform	1/9	**8.8**	NA	NA	NA	4.4
1,1-DCE	2/9	4.1	2.0	*< 100*	*< 100*	7
1,2-DCE (CIS)	NR	NR	55	**932.0**	**1520.0**	70
1,2-DCE (TRANS)	NR	NR	2.4	3.82	11.5	100
1,2-DCE (TOTAL)	8/9	**190**	57.4	**935.8**	**1531.5**	63
PCE	8/9	**34**	**1400**	**4090**	**1060**	3
1,1,2-TCA	2/9	0.56	NA	NA	NA	5
TCE	9/9	**6800**	**4700**	**2340.0**	**2190.0**	3
VC	NR	NR	0.54	*< 50*	*< 20*	1
Methylene Chloride	5/9	**11.3**	NA	NA	NA	5
INORGANIC COMPOUNDS						
Arsenic	2/2	23	10.0	**53.0**	**63.0**	50
Manganese	2/2	**662**	**632**	**840**	NA	50

Notes:

[1] Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the RI (HLA, 2000a).

[2] GCTL as promulgated in Chapter 62-777, FAC.

2001 through 2003 data copied from Area C and D presentation made by CCI at NAS Jacksonville Partnering Team meeting of March 2004.

NR = Not reported on RI, Table 6-18 as Human Health COPC.

NA = Data not available or not analyzed.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL.

< = below laboratory detection limit

4.6.4.5 Area B

The review of the groundwater monitoring reports through June 2004 indicates that four semi-annual long-term monitoring sampling events were conducted between July 2002 and January 2004 with the following reports: semi-annual report (TtNUS, 2003b) and annual report (TtNUS, 2004b) for 2003 and the semi-annual report (Apex, 2004c) and annual report (Apex, 2004d) for 2004. Table 4-5 shows the concentration data for several VOCs from the three existing monitoring wells on site. Figure 4-4 is provided to show the TCE data for the four events previously mentioned at the horizontal interval of concern that coincides with the source area. Table 4-6 shows the maximum concentrations for several VOCs from the RI and for subsequent LTM events as compared to the NADSC.

Several observations were made following a review of this data set:

- The flow map indicates that flow for that event was northwesterly rather than easterly toward the St. Johns River as previously indicated in the RI.

- TCE is the only COC currently exceeding a GCTL in MCW OU3-B1-3.

- Perimeter monitoring wells (OU3-B2 and OU3-B3) are located southeast and east of OU3-B1 while groundwater flow appears to be to the northwest.

- There has been a definite decrease in the TCE level in the source area by two orders of magnitude since the RI activities; however, the levels observed for the last two years appear to be static.

- Only TCE has been reported in significant quantities at this site and almost none of the common daughter products from reductive dechlorination were detected.

At previous sampling location B03 TCE was detected at 20 µg/L. Although this represents a GCTL exceedance, the point was not included in the MNA program.

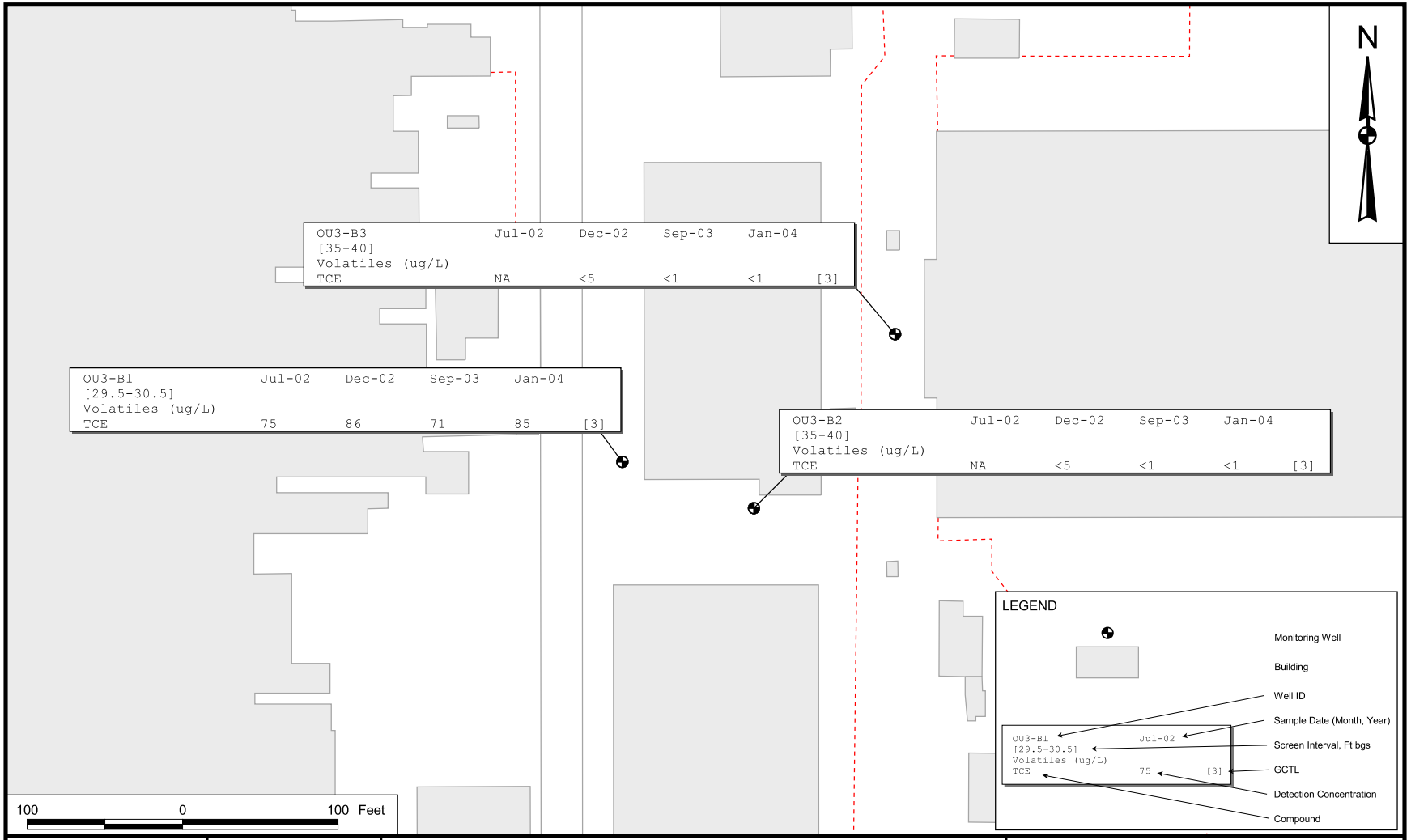
TABLE 4-5
GROUNDWATER COC ANALYTICAL RESULTS FOR AREA B

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Compound of Concern	GCTL [1] (µg/L)	NADSC [2] (µg/L)	JAX-OU3-B1-3	JAX-OU3-B1-4	JAX-OU3-B1-3	JAX-OU3-B2	JAX-OU3-B3	JAX-OU3-B1-3
			29.5-30.5 ft bgs	36.5-37.5 ft bgs	29.5-30.5 ft bgs	35-40 ft bgs	35-40 ft bgs	29.5-30.5 ft bgs
			7/2/2002	7/2/2002	12/4/2002	12/4/2002	12/5/2002	9/26/2003
			Reported Concentrations (USEPA Method 8260B) (µg/L)					
Chloroform	5.7	570	5 U	5 U	5 U	5 U	0.4 J	1 U
Chloromethane	2.7	270	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	1 U
1,1-DCE	7	700	5 U	5 U	5 U	5 U	5 U	1 U
1,2-DCE (CIS)	70	700	5 U	5 U	3 J	5 U	5 U	7
1,2-DCE (TRANS)	100	1000	5 U	5 U	5 U	5 U	5 U	1 U
PCE	3	300	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	2 U
1,1,2-TCA	5	500	5 U	5 U	5 U	5 U	5 U	1 U
TCE	3	300	**75**	*5 U*	**86**	*5 U*	*5 U*	**71**
VC	1	100	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	1 U

Compound of Concern	GCTL [1] (µg/L)	NADSC [2] (µg/L)	JAX-OU3-B2	JAX-OU3-B3	JAX-OU3-B1-3	JAX-OU3-B2	JAX-OU3-B3
			35-40 ft bgs	35-40 ft bgs	29.5-30.5 ft bgs	35-40 ft bgs	35-40 ft bgs
			9/26/2003	9/27/2003	1/11/2004	1/11/2004	1/11/2004
			Reported Concentrations (USEPA Method 8260B) (µg/L)				
Chloroform	5.7	570	1 U	1 U	1 U	1 U	1 U
Chloromethane	2.7	270	1 U	1 U	1 U	1 U	1 U
1,1-DCE	7	700	1 U	1 U	1 U	1 U	1 U
1,2-DCE (CIS)	70	700	1 U	1 U	8.4	1 U	1 U
1,2-DCE (TRANS)	100	1000	1 U	1 U	1 U	1 U	1 U
PCE	3	300	2 U	2 U	3 U	3 U	3 U
1,1,2-TCA	5	500	1 U	1 U	1 U	1 U	1 U
TCE	3	300	1 U	1 U	**85**	1 U	1 U
VC	1	100	1 U	1 U	**1.5**	1 U	1 U

Notes:
[1]GCTL as promulgated in Chapter 62-777, FAC.
[2]NADSC - Natural Attenuation Default Source Concentrations as promulgated in Chapter 62-777, FAC.
Bold indicates GCTL exceeded.
Italics indicates detection limit exceeds GCTL.
U = below laboratory detection limit
J = estimated value



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CHECKED BY	DATE
M. DALE	8/19/04
REVISED BY	DATE
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TCE CONCENTRATION MAP
OU3, AREA B
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	
7302	
OWNER NO.	
CTO 0342	
APPROVED BY	DATE
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FIGURE 4 - 4	0

P:\GIS\JACKSONVILLE_NAS\TCE_TAGS.APR AREA B LAYOUT 8/21/04 CF

TABLE 4-6
MAXIMUM CONCENTRATION OF THE COCS FOR AREA B

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Compounds of Concern	Frequency of Detection [1]	Remedial Investigation Maximum Concentration (µg/L)	July 2002 Maximum Concentration (µg/L)	December 2002 Maximum Concentration (µg/L)	September 2003 Maximum Concentration (µg/L)	January 2004 Maximum Concentration (µg/L)	GCTL [2] (µg/L)
VOLATILE ORGANIC COMPOUNDS							
Chloroform	1/1	3	5 U	5 U	1 U	1 U	5.7
Chloromethane	1/1	**14**	*5 U*	*5 U*	1 U	1 U	2.7
1,1-DCE	1/1	3	5 U	5 U	1 U	1 U	7
1,2-DCE (CIS)	NR	NR	5 U	5 U	7	8.4	70
1,2-DCE (TRANS)	NR	NR	5 U	5 U	1 U	1 U	100
PCE	1/1	**40**	*5 U*	*5 U*	2 U	3 U	3
1,1,2-TCA	1/1	2	5 U	5 U	1 U	1 U	5
TCE	1/1	**9800**	**75**	**86**	**71**	**85**	3
VC	NR	NR	*5 U*	*5 U*	1 U	**1.5**	1

Notes:

[1] Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the RI (HLA, 2000a).

[2]GCTL as promulgated in Chapter 62-777, FAC.

Data from 2002 copied from TtNUS reports (2003 and 2004, respectively).

Data from 2003 and 2004 copied from Apex reports (2004a and 2004b, respectively).

NR = Not reported in RI, Table 6-16 as Human Health COPC.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL.

U = below laboratory detection limit.

4.6.4.6 Area G

The review of the groundwater monitoring reports through June 2004 indicates that four semi-annual long-term monitoring sampling events were conducted between July 2002 and January 2004 with the following reports: the semi-annual report (TtNUS, 2003b) and annual report (TtNUS, 2004b) for 2003, and the semi-annual report (Apex, 2004c) and annual report (Apex, 2004d) for 2004. Appendix F contains figures of VOC contaminant spatial distribution from the first annual sampling report by TtNUS; a summary of detected COCs compiled from the four semi-annual LTM events and the second annual sampling report by Apex; and, a groundwater flow map from the last sampling event conducted in January 2004 (also by Apex). Table 4-7 shows the maximum concentrations for several VOCs from the RI.

Several observations were made following a review of the data in Appendix F and Table 4-7:

- The first annual figures and Figure 4-5 indicate that the plume is not delineated, as TCE levels that exceed GCTLs are present in six of the eight monitoring wells on site.

- As pointed out in the first annual report (TtNUS, 2004b), the contamination first encountered in the source area around OU3-G1 has been shown to migrate southeast toward the St. Johns River. However, at the location of new well OU3-G8 shallow contamination of a similar nature was encountered. TtNUS performed an additional investigation to address the leading edge and attempt to define the horizontal and vertical extent of the plume. This work is ongoing and the scope of the assessment work currently being performed by TtNUS is the first portion of a planned multi-phase effort.

- The ROD stipulates the use of groundwater restrictions until the RAOs have been achieved. The LUC/groundwater use restriction in the ROD is listed as the last major component of the selected remedy for OU 3 and does not specify the areas to which it applies. However, the facility has yet to implement the LUCs/groundwater restrictions. Additional, a LUCIP defining the areas in OU 3 under the control has not been prepared.

TABLE 4-7
MAXIMUM CONCENTRATION OF THE COCS FOR AREA G

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Chemicals of Concern	Frequency of Detection [1]	Remedial Investigation Maximum Concentration (µg/L)	July 2002 Maximum Concentration (µg/L)	December 2002 Maximum Concentration (µg/L)	September 2003 Maximum Concentration (µg/L)	January 2004 Maximum Concentration (µg/L)	GCTLs [2] (µg/L)
VOLATILE ORGANIC COMPOUNDS							
Chloroform	1/4	0.63	*< 100*	< 5	1.2	*< 10*	5.7
1,1-DCE	2/4	**760**	**340**	**240**	**280**	**230**	7
1,2-DCE (CIS)	NR	NR	**350**	**490**	**680**	**540**	70
1,2-DCE (TRANS)	NR	NR	<100	< 5	31	< 10	100
1,2-DCE (TOTAL)	3/4	**1600**	**350**	**490**	**711**	**540**	63
1,1,1-TCA	2/4	**570**	< 100	19	5.3	<10	200
1,1,2-TCA	1/4	**5.1**	*< 100*	*< 50*	< 1	*< 10*	5
TCE	4/4	**3800**	**2100**	**1200**	**1200**	**900**	3
VC	3/4	**66**	*<100*	**< 5**	**4.7**	**<10**	1

Notes:

[1] Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the RI (HLA, 2000a).

[2] GCTL as promulgated in Chapter 62-777, FAC.

Data from 2002 copied from TtNUS reports (2003 and 2004, respectively).

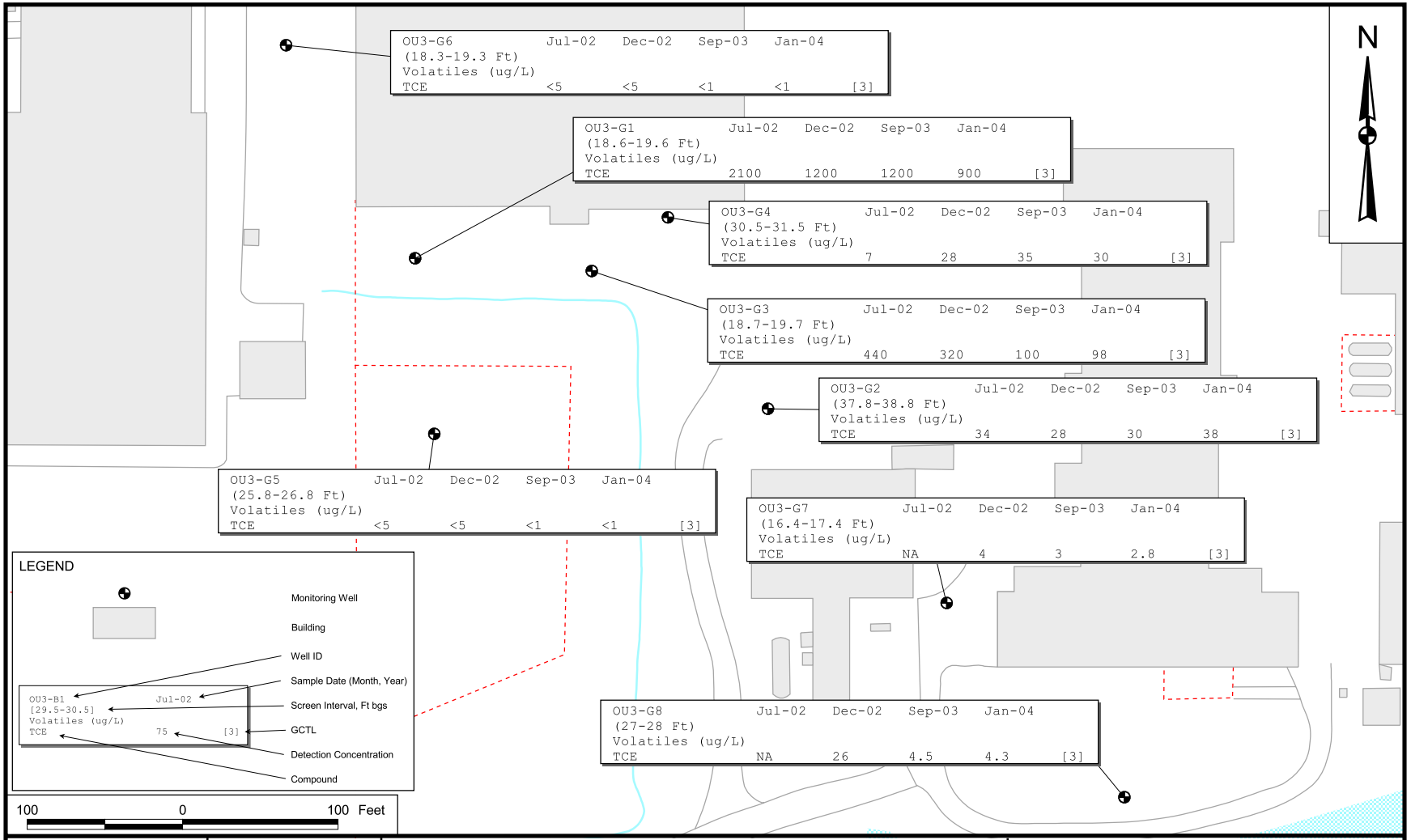
Data from 2003 and 2004 copied from Apex reports (2004a and 2004b, respectively).

NR = Not reported in RI, Table 6-21 as Human Health COPC.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL, and high dilution used by lab is the cause.

< = less than laboratory detection limit



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M. DALE	8/19/04
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SCALE	
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NAVFAC

TCE CONCENTRATION MAP

OU3, AREA G

NAS JACKSONVILLE

JACKSONVILLE, FLORIDA

CONTRACT NO.	
7302	
OWNER NO.	
CTO 0342	
APPROVED BY	DATE
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DRAWING NO.	REV
FIGURE 4 - 5	0

P:\GIS\JACKSONVILLE_NAS\TCE_TAGS.APR AREA G LAYOUT 02/22/05 CF

4.6.4.7 PSC 16

There have been no formal written reports prepared for this site as of this writing. However, CCI has completed the sediment and tar ball removal. According to CCI, the removal was performed until there was visual evidence that the sediment was free from the heavy petroleum staining associated with the tar balls. After the removal, CCI collected and analyzed sediment samples for chemical parameters and ecological toxicity. The chemical testing indicated the presence of PAHs and metal compounds in excess of regulatory criteria. The samples collected for ecological toxicity testing failed to meet regulatory standards.

After the PSC 16 remediation efforts for the sediment and tar balls were complete, CCI presented the information to the NAS Jacksonville Partnering Team. The regulators concurred that the contamination beyond the tar balls could be due to numerous upstream sources as well as the static sources and will likely re-contaminate over time. Therefore, it was agreed to not perform additional cleanup actions beyond the gross tar ball removal and to manage the storm water outfall under the base's storm water program, which included the installation of an oil-water separator. However, subsequent efforts and discussions for this site have resulted in the re-evaluation of a corrective action for PSC 16.

4.6.4.8 PSC 48 (Building 106)

The data review for PSC 48 encompassed the following documents that have been issued since system startup: a startup and operations report from HLA (HLA, 1999a), two quarterly reports from BEI (BEI, 1999a and 2000a), three annual reports from CCI (CCI, 2001b, 2003a, and 2004b), and two quarterly reports from Apex (Apex, 2003 and 2004e). Operating data from each of those reports for each portion (SVE and AS) of the remediation system were summarized in Table 4-8. The system appears to be operating as designed.

The RAC (CCI) has recommended that the site's soil and groundwater should be re-assessed. Table 4-9 includes recent analytical results from CCI's sampling efforts. Of the four of the COCs reported in the EECA, three remain elevated in excess of the EECA concentrations and all four continue to exceed the applicable GCTLs.

The samples from the piezometers and the monitoring well continue to exceed GCTLs for various chlorinated VOCs, and it appears that the current monitoring network does not adequately delineate the COC plume horizontally. Also, there is no vertical extent well currently in the program to monitor potential descent of these COCs beyond the current treatment zone.

TABLE 4-8
OPERATIONS AND MAINTENANCE DATA SUMMARY-PSC 48

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

SVE System Side												
Quarter Number	**Start Date**	**End Date**	**Hours of Possible Operation**	**Hours of Possible Operation To Date**	**Hours of Actual Operation**	**Hours of Actual Operation To Date**	**Total Hours of Shutdown**	**% Hours of Operation**	**% Hours of Operation To Date**	**Avg. Combined Laterals Flow Rate (cfm)**	**Laterals Vacuum (inches of water)**	**Avg. Vacuum at Wells (inches of water)**
2,3,4,1	3/16/1998 (2)	3/31/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	~280	~17	n/a
2	4/1/1999	6/30/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	7/1/1999	9/30/1999	2208	13536	2076	13092	132	94.0	96.7	213.8 (3)	29.1	0.95
4	10/1/1999	12/31/1999	2208	15744	1855	14947	353	84.0	94.9	179.4 (3)	29.8	0.53
1	1/1/2000	3/31/2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	8760	26688	8527	25528	233	97.3	95.7	171.9 (4)	32.2	0.53
2,3,4,1	4/1/2001	3/31/2002	8760	35448	8454	33982	306	96.5	95.9	129.3 (4)	31.5	0.87
2,3,4,1,2,3 (1)	4/1/2002	8/30/2003	12432	47880	11632	45614	800	93.6	95.3	124.1 (4)	33.0	0.73
3	7/1/2003	9/30/2003	1488	49368	1440	47054	48	96.8	95.3	~264 (4)	~28.4	~0.76
4	10/1/2003	1/11/2004	2440	51808	2313	49367	127	94.8	95.3	~273 (4)	~32.6	~2.8
AS System Side												
Quarter Number	**Quarter Start Date**	**Quarter End Date**	**Hours of Possible Operation**	**Hours of Possible Operation To Date**	**Hours of Actual Operation**	**Hours of Actual Operation To Date**	**Total Hours of Shutdown**	**% Hours of Operation**	**% Hours of Operation To Date**	**Total Air Flow Rate (cfm)**	**AS System Pressure (inches of water)**	**Avg. Pressure at AIW Wells (inches of water)**
2,3,4,1	3/16/1998 (2)	3/31/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	~40.8	~140	~141.8
2	4/1/1999	6/30/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	7/1/1999	9/30/1999	2208	13536	2073	13078	135	93.9	96.6	92.5 (3)	152.2	154.4
4	10/1/1999	12/31/1999	2208	15744	1855	14933	353	84.0	94.8	90.6 (3)	148.0	143.1
1	1/1/2000	3/30/2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	8760	26688	8290	25224	470	94.6	94.5	45 (4)	148.1	141.2
2,3,4,1	4/1/2001	3/31/2002	8760	35448	7348	32572	1412	83.9	91.9	24.8 (4)	145.5	139.9
2,3,4,1,2,3 (1)	4/1/2002	8/30/2003	12432	47880	10911	43483	1521	87.8	90.8	35.4 (4)	149.1	149.0
3	7/1/2003	9/30/2003	1488	49368	1440	44923	48	96.8	91.0	~49 (4)	~140.1	~150.9
4	10/1/2003	1/11/2004	2440	51808	2313	47236	127	94.8	91.2	~54.7 (4)	~136.1	~151.2

See notes at end of table.

TABLE 4-8
OPERATIONS AND MAINTENANCE DATA SUMMARY-PSC 48

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

AS/SVE System							
Quarter Number	**Quarter Start Date**	**Quarter End Date**	**Pounds of VOCs Removed by SVE**	**Vendor**	**Comment**	**Recommendation**	**System Downtime [5]**
2,3,4,1	3/16/1998 [2]	3/31/1999	199	BEI	System operating normally.	Continue operation.	None reported.
2	4/1/1999	6/30/1999	n/a	BEI	n/a	n/a	n/a
3	7/1/1999	9/30/1999	1.3	BEI	System operating normally.	Continue operation.	RM-20hr, AC-64hr, MN=50hr.
4	10/1/1999	12/31/1999	1.4	BEI	System operating normally.	Continue operation.	RM-10hr, AC-13hr, AIC-330 hr.
1	1/1/2000	3/30/2000	n/a	BEI	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	15.3	CCI	System operating normally.	Continue operation, but need DPT investigation for continuing source search.	RM-2.5hr, AIC-81hr, PP-64.5hr, MN-246hr.
2,3,4,1	4/1/2001	3/31/2002	5.7	CCI	System operating normally.	Continue operation, but need investigation to determine source of ongoing contamination.	RM-2 hr; SVE AC-304hr; AS [AC-351hr, BE-1059hr].
2,3,4,1,2,3 [1]	4/1/2002	8/30/2003	17.8	CCI	System operating normally.	Conduct soil/GW assessment and design alternative remedy for increasing GW contamination.	[AS: RM-8hr; AC-428.3hr; BE-962.4hr; PP-2.1hr; AIC-119.2hr] [SVE: RM-16hr; AC-663.1hr; PP-2.1hr; AIC-119.2hr]
3	7/1/2003	9/30/2003	n/a	Apex	None.	None.	RM-48hr.
4	10/1/2003	1/11/2004	n/a	Apex	None.	None.	RM-72hr.

Notes:
[1] Partially into third quarter of 2003, CCI turned over to Apex.
[2] System start-up date was March 1998 near the end of the 1st calendar quarter of 1998.
[3] Flow rate in units of standard cubic feet per minute (scfm).
[4] Flow rate in units of actual cfm (acfm).
[5] Hours shown are per side unless shown as applying to one side or other.
The SVE laterals design flow rate is 300 scfm or 326 acfm.
There are 8 vapor probe wells.
The AS system design flow rate is 100 scfm or 81 acfm.
There are 11 air injection wells (AIW).

n/a = not available.
hr = hours.
RM = routine maintenance.
AC = alarm conditions.
BE = broken equipment.
PP = power problems.
AIC = administrative shutdowns or infrastructure changes.
MN = Mother Nature-mandated shutdowns.
~ = approximated value.

TABLE 4-9
MAXIMUM CONCENTRATION OF THE COCS, PSC 48

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Chemicals of Concern	Frequency of Detection [1]	EECA Maximum Concentration (µg/L)	February 2003 Maximum Concentration (µg/L)	May 2003 Maximum Concentration (µg/L)	September 2003 Maximum Concentration (µg/L)	January 2004 Maximum Concentration (µg/L)	GCTLs [2] (µg/L)
VOLATILE ORGANIC COMPOUNDS							
1,2-DCE (cis)	NR	NR	**20000**	**21500**	**26000**	**16000**	70
1,2-DCE (trans)	NR	NR	**17400**	**17500**	**19000**	**13000**	100
1,2-DCE (total)	1/1	**4000**	**37400**	**39000**	**45000**	**29000**	63
Isopropylbenzene	NR	NR	**11.7**	**18.7**	**21**	**18**	0.8
PCE	1/1	**36000**	**33000**	**14300**	**20000**	**15000**	3
TCE	1/1	**11000**	**22300**	**20900**	**20000**	**13000**	3
VC	1/1	**150**	**3940**	**3330**	**5000**	**3700**	1

Notes:

[1] Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the EECA (ABB-ES, 1995).

[2] GCTL as promulgated in Chapter 62-777, FAC.

Data from 1st half of 2003 copied from CCI (2004).

Data from 2003 and 2004 copied from Apex reports (2004a and 2004b, respectively).

NR = Not reported in EECA, Table 3-3.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL, and high dilution used by lab is the cause.

< = below laboratory detection limit

The Navy is evaluating this remediation system under an optimization program. The preliminary recommendations of that effort are to discontinue the system operations and re-assess the site. The NAS Jacksonville Partnering Team was presented the optimization study results. During the January 2005 meeting, the team agreed that this system is ineffective as a final remedy. Further, the team agreed that the O&M funding would be better spent in re-assessing the site and finding a new remedy. The system is planned to be shut down in early 2005.

4.6.4.9 Building 780

The data review for Building 780 utilized the following documents that have been issued since the system startup: a startup report from HLA (HLA, 1999b), two quarterly reports from BEI (BEI, 1999b and 2000b), and three annual reports from CCI (CCI, 2001c, 2003b, and 2004c). Operating data from each of those reports for each side (SVE and GWT) of the remediation system were summarized in Table 4-10. The system appears to be operating as designed.

The data on Table 4-11 indicate that four of the seven COCs reported by the EECA remain elevated in excess of the EECA concentrations, and all four continue to exceed the applicable GCTLs. Several other compounds (i.e., toluene and some SVOCs) are shown by Table 4-11 that were not previously reported in the EECA; these exceed their respective GCTLs. PCE, which was not previously detected during the EECA, exceeds its GCTL and the concentrations are increasing. The GWT/SVE system, which has been operational for six years, has not met its design goal of source removal.

Figure 4-6 provides some of the groundwater monitoring data for the four monitoring wells at the site from the RAC's last report (CCI, 2004c). The figure shows that the GCTL for TCE and/or 1,1-DCA have been exceeded at each location. It is apparent that the current monitoring network does not adequately delineate the COC plume.

The Navy is evaluating this remediation system under an optimization program. The preliminary recommendations of that effort are to discontinue the system operations and re-assess the site. The NAS Jacksonville Partnering Team was presented the optimization study results. During the January 2005 meeting, the team agreed that this system is ineffective as a final remedy. Further, the team agreed that the O&M funding would be better spent in re-assessing the site and finding a new remedy. The system is planned to be shut down in early 2005.

TABLE 4-10
OPERATIONS AND MAINTENANCE DATA SUMMARY-BUILDING 780

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

SVE System Side												
Quarter Number	Start Date	End Date	Hours of Possible Operation	Hours of Possible Operation To Date	Hours of Actual Operation	Hours of Actual Operation To Date	Total Hours of Shutdown	% Hours of Operation	% Hours of Operation To Date	Avg. SVE Combined Laterals Flow Rate (cfm)	SVE System Vacuum (inches of water)	Avg. Vacuum at VEWs (inches of water)
2,3,4,1	4/29/1998 (1)	3/31/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	4/1/1999	6/30/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	7/1/1999	9/30/1999	2208	12480	1817	7991	391	82.3	64.0	93.8 (2)	39.5	40.0
4	10/1/1999	12/31/1999	2208	14688	2106	10097	102	95.4	68.7	97.4 (2)	43.8	41.2
1	1/1/2000	3/31/2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	8760	25632	4522	16203	4238	51.6	63.2	67 (4)	34.8	35.5
2,3,4,1	4/1/2001	3/31/2002	8760	34392	6820	23023	1940	77.9	66.9	54 (4)	33.9	32.4
2,3,4,1	4/1/2002	3/31/2003	8760	43152	7577	30600	1183	86.5	70.9	41.6 (4)	38.1	32.4

GWT System Side											
Quarter Number	Quarter Start Date	Quarter End Date	Hours of Possible Operation	Hours of Possible Operation To Date	Hours of Actual Operation	Hours of Actual Operation To Date	Total Hours of Shutdown	% Hours of Operation	% Hours of Operation To Date	GW Influent Flow Rate (gpm)	Air Stripper Flow Rate (cfm)
2,3,4,1	4/29/1998 (1)	3/31/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	4/1/1999	6/30/1999	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	7/1/1999	9/30/1999	2208	12480	1806	5020	402	81.8	40.2	0.16 (3)	183 (2)
4	10/1/1999	12/31/1999	2208	14688	2141	7161	67	97.0	48.8	0.15 (3)	185 (2)
1	1/1/2000	3/30/2000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	8760	25632	7799	17287	961	89.0	67.4	0.06 (3)	140.3 (4)
2,3,4,1	4/1/2001	3/31/2002	8760	34392	7742	25029	1018	88.4	72.8	0.06 (3)	172.8 (4)
2,3,4,1	4/1/2002	3/31/2003	8760	43152	8425	33454	335	96.2	77.5	0.09 (3)	185.6 (4)

See notes at end of table.

TABLE 4-10
OPERATIONS AND MAINTENANCE DATA SUMMARY-BUILDING 780

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

GWT/SVE System								
Quarter Number	**Quarter Start Date**	**Quarter End Date**	**Pounds of VOCs Removed by SVE**	**Pounds of VOCs Removed by GWT**	**Vendor**	**Comment**	**Recommendation**	**System Downtime [5]**
2,3,4,1	4/29/1998 [1]	3/31/1999	n/a	n/a	BEI	System operated during startup (14 days) and "only intermittently until 3/1/99.	None.	System down most of the time due to equipment and process problems. Continuous and dependable operation of system began on 3/1/99.
2	4/1/1999	6/30/1999	n/a	n/a	BEI	n/a	n/a	n/a
3	7/1/1999	9/30/1999	153	457	BEI	System operating normally.	Continue operations to optimize performance.	[SVE: RM-48.5hr; BE-87hr; PP-8.5hr; AIC-197hr; MN-50hr] [GWT: RM-50.5hr; BE-96hr; PP-8.5hr; AIC-197hr; MN-50hr]
4	10/1/1999	12/31/1999	38	430	BEI	System operating normally.	Continue operations to optimize performance.	[SVE: RM-6.5hr; AC-29hr; BE-29.5hr; AIC-37hr] [GWT: RM-26hr; AC-4hr; AIC-37hr]
1	1/1/2000	3/31/2000	n/a	n/a	BEI	n/a	n/a	n/a
2,3,4,1	4/1/2000	3/31/2001	104.8	18.8	CCI	System operating normally.	Continue operations and conduct a groundwater investigation to delineate contamination.	[SVE: RM-6hr; BE-3462hr; AIC-81hr; PP-492hr; MN-197] [GWT: RM-3hr; BE-680hr; AIC-81hr; MN-197hr]
2,3,4,1	4/1/2001	3/31/2002	41.7	28.0	CCI	System operating normally.	Determine alternative source control remedy. System no longer effective at reducing source concentrations.	[SVE: BE-1453hr; PP-341hr; AC-146hr] [GWT: BE-1018hr}
2,3,4,1	4/1/2002	3/31/2003	5.16	11.6	CCI	System operating normally.	Continue operations while conducting a groundwater investigation.	[SVE: BE-567.5; PP-32.5hr; AC-583hr] [GWT: BE-201.1hr; AC-133.9hr]

See notes at end of table.

TABLE 4-10
OPERATIONS AND MAINTENANCE DATA SUMMARY-BUILDING 780

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Notes:
[1] System start-up date was April 29, 1998.
[2] Flow rate in units of standard cubic feet per minute (scfm).
[3] Extraction well (U3MW029) design flow rate is 1.5 gallons per minute (gpm).
[4] Flow rate in units of actual cfm (acfm).
[5] Hours shown are per side unless shown as applying to one side or other.
The SVE system design flow rate is 120 scfm or 132 acfm.
The air stripper design flow rate is 142 acfm or 150 scfm.
There are 6 vapor extraction wells (VEW).
There is 1 groundwater extraction well.

n/a = not available.
hr = hours.
RM = routine maintenance.
AC = alarm conditions.
BE = broken equipment.
PP = power problems.
AIC = administrative shutdowns or infrastructure changes.
MN = Mother Nature-mandated shutdowns.

TABLE 4-11
MAXIMUM CONCENTRATION OF THE COCS-BUILDING 780

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Chemicals of Concern	Frequency of Detection (1)	EECA Maximum Concentration (µg/L)	May 2002 Maximum Concentration (µg/L)	August 2002 Maximum Concentration (µg/L)	November 2002 Maximum Concentration (µg/L)	February 2003 Maximum Concentration (µg/L)	GCTLs (2) (µg/L)
VOLATILE ORGANIC COMPOUNDS							
1,1,1-TCA	2/2	**260**	**51000**	**70300**	**45700**	**40800**	200
1,1-DCA	2/2	**8900**	**25000**	**29800**	**14900**	**9220**	70
1,1-DCE	2/2	**1000**	**17000**	**35500**	**27000**	**14300**	7
1,2-DCA	NR	NR	**16**	**578 J**	*300 U*	*300 U*	3
1,2-DCE (cis)	NR	NR	**7800**	**16500**	**15400 J**	**7400**	70
1,2-DCE (total)	2/2	**7800**	NR	NR	NR	NR	63
Chloroethane	2/2	**6900**	**1200**	*5000 U*	**169 J**	*2500 U*	12
PCE	0/2	ND	*300 U*	**799 J**	**1280 J**	**1350 J**	3
Toluene	NR	NR	**50**	**3150 J**	**976 J**	**2130 J**	40
TCE	2/2	**870**	**3000**	**4170**	**3580**	**3720**	3
VC	2/2	**6400**	**2400**	**5270**	**2980 J**	**1840**	1
SEMI-VOLATILE ORGANIC COMPOUNDS							
2-Methylphenol	NR	NR	**290**	**583**	**244**	**144**	35
4-Methylphenol	NR	NR	**340**	NA	NA	NA	4
Phenol	NR	NR	**120**	**238**	**106**	**48**	10

Notes:

(1) Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values) from the EECA (ABB-ES, 1995).

(2) GCTL as promulgated in Chapter 62-777, FAC.

Data from 2002 and 2003 copied from CCI report (2004).

NR = Not reported in EECA, Table 3-3.

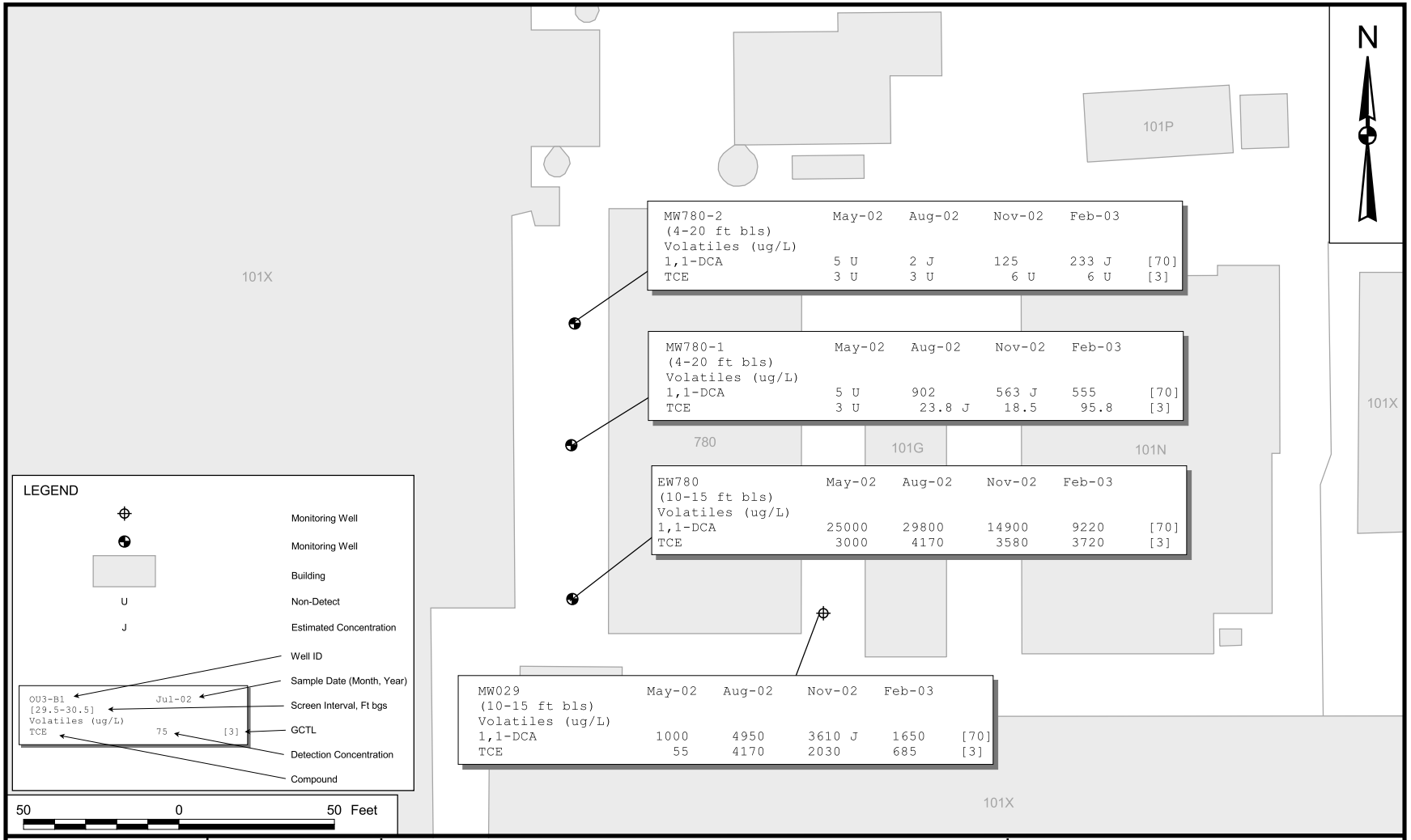
ND = Non-detect as reported in EECA, Table 3-3.

NA = Not analyzed.

Bold indicates GCTL exceeded.

Italics indicates detection limit exceeds GCTL, and high dilution used by lab is the cause.

< = below laboratory detection limit



DRAWN BY	DATE
A. JANOCHA	8/19/04
CHECKED BY	DATE
M. DALE	8/19/04
REVISED BY	DATE
—	—
SCALE	
AS NOTED	

NAVFAC

COC CONCENTRATION MAP
OU3, BUILDING 780
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO.	7302
OWNER NO.	CTO 0342
APPROVED BY	DATE
—	—
DRAWING NO.	REV
FIGURE 4 - 6	0

P:\GIS\JACKSONVILLE_NAS\TCE_TAGS.APR BUILDING 780 LAYOUT 2/22/05 CF

4.6.4.10 OU 3, PSC 14 and PSC 15

No post-ROD documents have been prepared for PSC 14 and PSC 15.

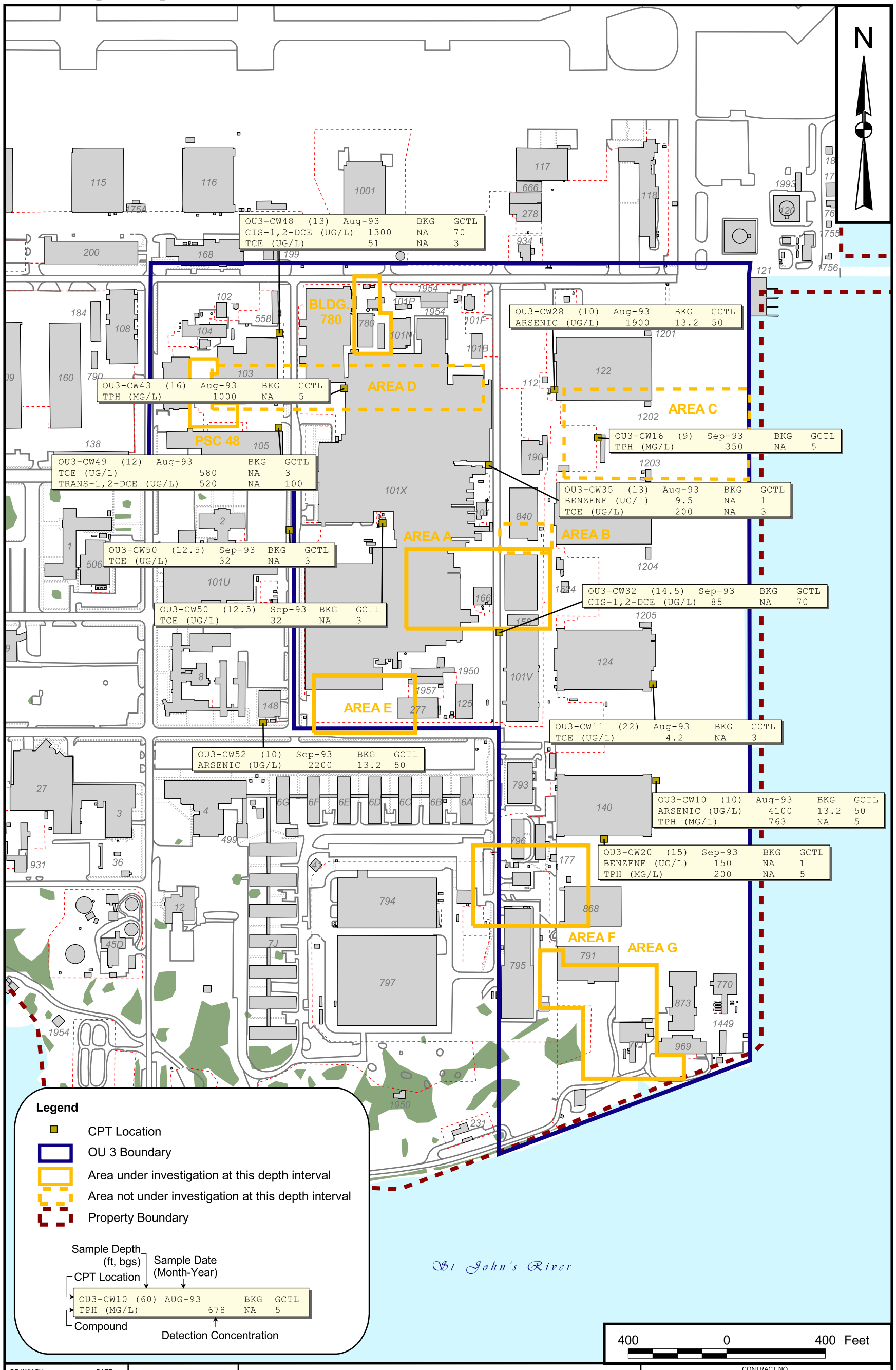
4.6.4.11 Outside Areas at OU 3

The RI/FS (HLA, 2000b) commented that, "there appears to be ubiquitous low-level contamination (less than 100 ppb) throughout most of OU 3". So, the RI/FS focused its efforts on "contamination exceeding 1,000 ppb…isolated and confined to about nine or ten specific locations". A review of the CPT data that was used to help establish the areas of investigation at OU 3 agrees with HLA's observation that low-level contamination is 'ubiquitous' at the site. The CPT data fits into three depth intervals (shallow, intermediate, and deep); therefore, a separate figure for each interval was generated to show those areas that lie 'outside' current areas under investigation. The shallow zone (from approximately 9 to 22 ft bgs), Figure 4-7, shows data for 12 locations across OU 3; however, one additional location, OU3-CW52 (near the southwestern corner of Building 148) was not included within the current defined boundaries of OU 3. The intermediate zone (from approximately 19 to 55 ft bgs), Figure 4-8, shows data for 17 locations across OU 3 similar to the shallow zone. There are two additional locations (OU3-CW52 and OU3-CW50) that lie outside OU 3. OU3-CW50 appears to lie within 25 ft of the boundary for OU 3. The deep zone (from approximately 58 to 72 ft bgs), Figure 4-9, shows the data for 4 locations within OU 3 with one additional location, OU3-CW56, approximately 75 ft outside OU 3.

4.6.5 Site Inspection and Interviews

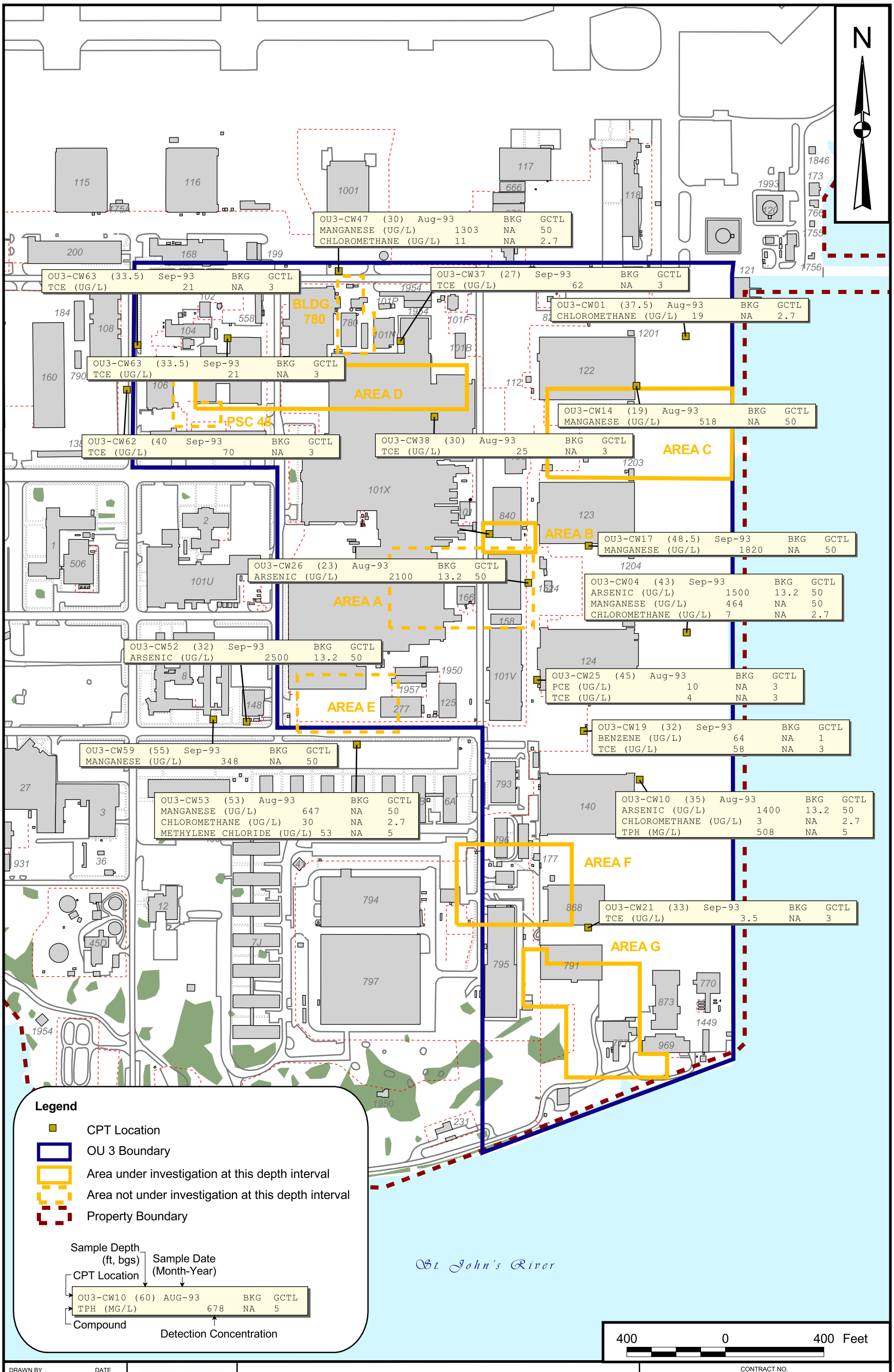
TtNUS conducted a site inspection of OU 3, PSCs 16 and 48 and Areas B, C, D, F and G and Building 780, on October 27, 2004. Prior to initiating the inspection, the inspector interviewed Mr. Bill Raspet, the IR Manager and Ms. Jane Beason, the Hazardous Waste Manager (previous IR Manager) for NAS Jacksonville. Later, the IR Manager accompanied the inspector for the site inspection, which included visual observations of the fences, access gates, the remediation systems at PSC 48 and Building 780, the surface water at PSC 16, and the groundwater monitoring wells for OU 3. During the inspection at Building 780, representatives from the RAC were observed making repairs to one of the underground lines to the system. The dig permit was observed in place, and the RAC indicated that the system was down only about two weeks for this repair, which would be completed by the end of the day. The fences at the site were in good condition, and the well covers were observed to be in place. A security fence does not surround all of OU 3; however, the security and fence restricting access to the station also provide restrictive access to the sites from non-military personnel. The IR Manager reported that there have been no incidents of trespassing or vandalism in the area.

P:\GIS\JACKSONVILLE_NAS\APR\OU3_TAGS.APR CPT SHALLOW GROUNDWATER DATA 2/21/05 CF



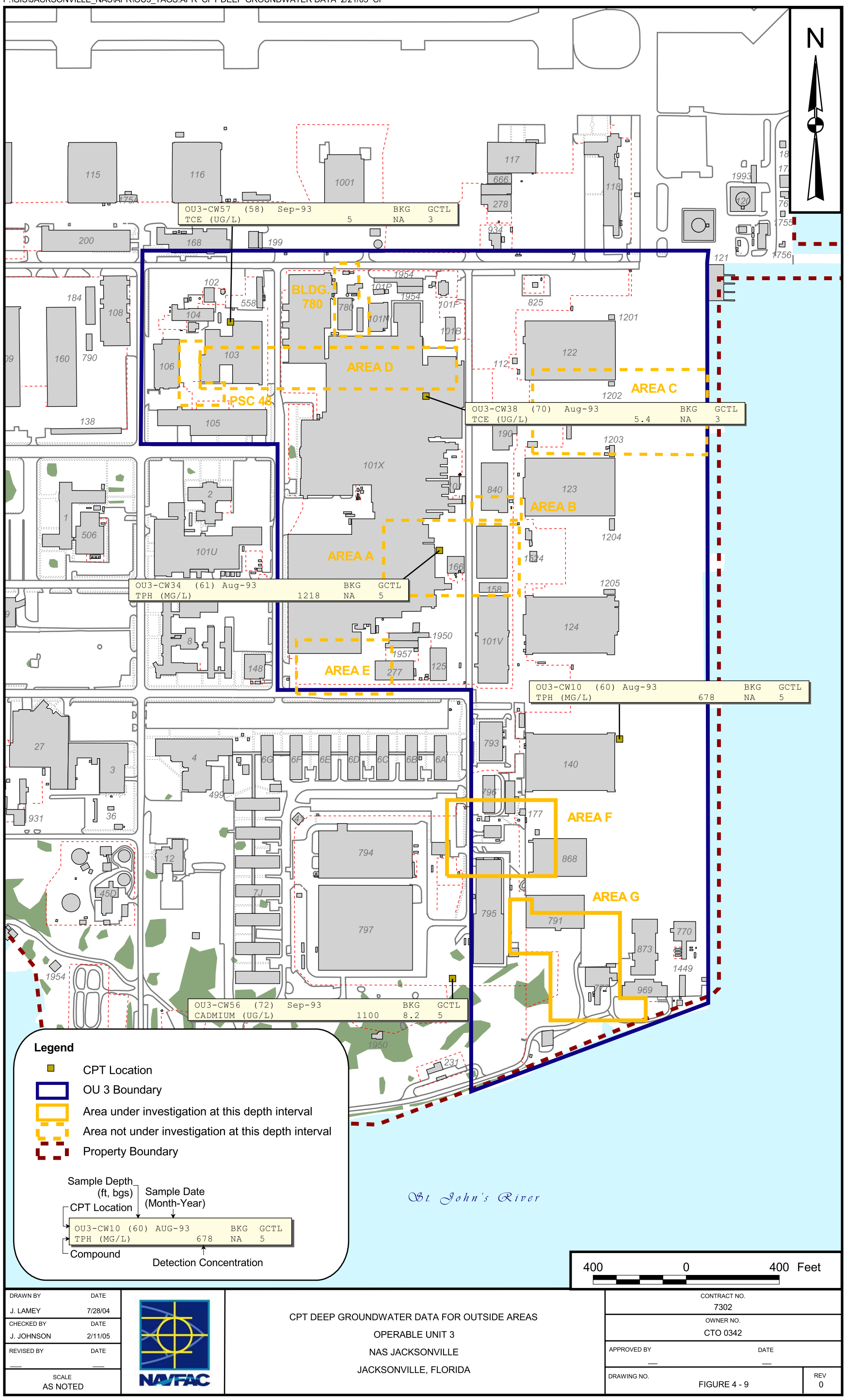
DRAWN BY: J. LAMEY	DATE: 8/25/04	CPT SHALLOW GROUNDWATER DATA FOR OUTSIDE AREAS	CONTRACT NO.: 7302
CHECKED BY: J. JOHNSON	DATE: 2/11/05	OPERABLE UNIT 3	OWNER NO.: CTO 0342
REVISED BY: —	DATE: —	NAS JACKSONVILLE	APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC	JACKSONVILLE, FLORIDA	DRAWING NO.: FIGURE 4 - 7 REV: 0

P:\GIS\JACKSONVILLE_NAS\APR\OU3_TAGS.APR CPT INTERMEDIATE GROUNDWATER DATA 2/21/05 CF



DRAWN BY J. LAMEY	DATE 7/28/04	CPT INTERMEDIATE GROUNDWATER DATA FOR OUTSIDE AREAS OPERABLE UNIT 3 NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO. 7302
CHECKED BY J. JOHNSON	DATE 2/11/05		OWNER NO. CTO 0342
REVISED BY —	DATE —		APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4 - 8 REV 0

P:\GIS\JACKSONVILLE_NAS\APR\OU3_TAGS.APR CPT DEEP GROUNDWATER DATA 2/21/05 CF



DRAWN BY J. LAMEY	DATE 7/28/04	CPT DEEP GROUNDWATER DATA FOR OUTSIDE AREAS	CONTRACT NO. 7302
CHECKED BY J. JOHNSON	DATE 2/11/05	OPERABLE UNIT 3	OWNER NO. CTO 0342
REVISED BY ___	DATE ___	NAS JACKSONVILLE	APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC	JACKSONVILLE, FLORIDA	DRAWING NO. FIGURE 4 - 9 REV 0

The RAC representative, Mr. Mike Halil, was later interviewed on November 2, 2004 regarding the following sites at which CCI has been or still is involved: PSC 48, Building 780, Area C, Area D, Area F, and PSC 16. Health and safety and contingency plans, operational records, and logs were not located on site for the remediation systems at PSC 48 and Building 780; however, Mr. Halil maintains the documentation at his office. The RAC indicated that there are no permits required to operate the systems. Air emissions operate under the station's air permit, and the RAC is only required to keep air emissions at each system below the state standard of 13.7 pounds of total VOCs per day. Records indicate emissions are maintained below that standard. Regarding the water discharged from the system at Building 780, Mr. Halil reported that it meets the requirements necessary for discharge to the station's wastewater treatment plant.

Mr. Halil believes that the remediation systems at PSC 48 and Building 780 are insufficient for achieving a final remedy since both were intended only as interim measures to control the source areas at each site. However, since both sites are currently under an optimization study, he thinks the systems may be removed and replaced with a more appropriate remediation technology. As for Areas C and D, the field injection remedies for each site have been accomplished and a detailed performance evaluation (including groundwater modeling) for each site is currently in process. The RAC representative indicated that they are still designing the final remedy for Area F.

Mr. Halil was asked about the tar ball removal at PSC 16 and provided the following information:

- Tar balls were not found during the initial inspection. Rather, petroleum tar-like material that reminded Mr. Halil of "Jello molds" was found in the sediments.

- Due to the consistency of the material, an alternate removal method using an air bucket was used.

- The RAC skimmed to about 2 ft deep in the recommended area around the mouth of the outlet.

- The post-visual inspection showed no such "Jello mold" material remained.

- The post-removal sampling still indicated elevated COCs (PAHs and lead) and ecological mortality rates were still elevated.

In addition, the RAC indicated that the FDEP has provided a course of action for transfer of the site from the CERCLA program to the station's storm water program in the form of a letter. A copy of that letter is provided in Appendix G. The IR Manager has indicated that the station is currently studying how best to implement that course of action for PSC 16.

4.7 TECHNICAL ASSESSMENT

4.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is not functioning as intended by the ROD.

- ***HASP/Work Plans:*** HASPs and work plans are in place for Buildings 106 (PSC 48) and 780, and Areas B, C, D, F, and G that are maintained by the responsible contractor.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls are specifically called for at PSC 14 and PSC 15 within OU 3. The ROD also refers to the use of groundwater use restrictions for most of the contaminated groundwater areas within OU 3 The implementation appears incomplete, however, due to the lack of preparation of the LUCIP for both PSC 14 and PSC 15.

- ***Remedial Action Performance:*** The selected remedies (active remediation) for Buildings 106 and 780 remain operational; however, they do not appear to be achieving the remedial objectives intended in the ROD. Additionally, the monitoring well network at these sites does not encompass the groundwater contamination. The selected remedy (MNA) for Areas B and G is early in the NA process and is anticipated to require a substantial timeframe to complete. The selected remedy (enhanced bioremediation) for Areas C and D is also at the initial stages of cleanup. One injection of HRC® has been completed and the Navy is currently evaluating the next phase of treatment. The remedy intended for PSC 16 does not appear to have achieved the RAO established in the ROD. Area F and the Storm Sewer System cannot be evaluated at this time since construction on the selected remedies have not begun yet.

- ***System Operations/O&M:*** Operation of the AS/SVE system at Building 106 (PSC 48) appears to have worked as designed; however, the possible existence of a continuing source appears to have made the task of source removal unattainable with the current setup. Despite a slow start, the operation of the GWT/SVE system at Building 780 appears to have worked as designed; however, the possible existence of a continuing source appears to have made the task of source removal unattainable with the current setup. The optimization effort also questions the effectiveness of these systems as final remedies.

- ***Cost of System Operations/O&M:*** As noted above in Section 4.3, actual costs, for the most part, have been within the acceptable range. For this review, Area F, the Storm Sewer System, and PSC 16 will not be evaluated for costs since those remedial actions are still ongoing.

- ***Opportunities for Optimization:*** The remediation systems for Building 106 and 780 are currently being evaluated by the Navy under an optimization program. At the January 2005 NAS Jacksonville Partnering Team meeting, the team reached consensus that the systems at these sites could be shutdown and removed as they were not sufficient as the final remedies. Additionally, the monitoring well network at Buildings 106 and 780 are currently inadequate and should be expanded to provide sufficient data to assess the progress of the selected remedies at each site. There currently appear to be no other opportunities for optimization at the other sites within OU 3.

- ***Early Indicators of Potential Remedy Failure:*** Early indicators of potential remedy failure were noted during this review as follows:

  - The lack of LUCs makes it a concern that accidental exposure to groundwater contamination at OU 3 could occur. However, there are two PSCs within OU 3 that are inspected under the LUC program.
  - The lack of adequate monitoring networks at each of the sites under investigation makes it a concern that the groundwater contamination at these sites may not be attenuating as desired.
  - The continuing high level of contamination at Buildings 106 and 780 appear to indicate that the contingency action recommending expansion and/or alteration of the current system should be enacted coupled with new site investigations to determine if there exist continuing sources of contamination that are not currently addressed by the existing systems.

4.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the intended protectiveness of the remedies.

Changes in Standards and TBC Criteria

As the remedial work has not been completed for OU 3, the ARARs in the ROD still apply and must be met wherever applicable. The Florida GCTLs have been developed and should be added as a chemical-specific ARAR. Additionally, Florida SCTLs are chemical-specific TBC criteria replacing the Soil Cleanup Goals.

The chemical-specific ARAR (Florida GCTL) for 1,1-DCE has been reduced since the ROD. The new value is 63 µg/L.

Changes in Exposure Pathways, Toxicity, and other Contaminant Characteristics

OU 3 is a heavily industrialized area, and it is intended to retain that land use well into the future. Therefore, the complete exposure pathways remain unchanged from the following:

- Occupational workers exposed to groundwater via limited ingestion of drinking water from hypothetical future drinking water wells (a showering scenario is not considered probable in this limited occupational setting, and dermal exposure via hand-washing would be minimal).

- Utility workers exposed to storm sewer water via limited dermal contact with storm sewer water while maintaining or repairing the storm sewers (incidental ingestion of storm sewer water is not assessed because it is considered insignificant with good hygiene/work practices).

These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

4.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The "low-level" groundwater contamination at OU 3 defined by ABB-ES remains at the facility and is not included in any of the treatment processes for the sites within OU 3. As such, it provides potential exposure to receptors and also violates chemical-specific ARARs. There are no controls or remedies proposed in any of the OU 3 decision documents for this groundwater contamination.

4.8 ISSUES

Issues were discovered during the five-year review and are noted in Table 4-12.

4.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendations and follow-up actions are outlined in Table 4-13.

TABLE 4-12
ISSUES AT OPERABLE UNIT 3

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

ISSUE NUMBER	ISSUES	AFFECTS PROTECTIVENESS (Y/N)	
		Current	Future
1	Monitoring well networks at Buildings 106 and 780 are insufficient.	Y	Y
2	The Response Action for PSC 48 and Building 780 is not expected to achieve cleanup levels; plume containment has not been confirmed or achieved.	Y	Y
3	Areas C and D not being monitored quarterly as stipulated in the ROD. Documentation of this was not found.	N	N
4	Monitoring well networks at Areas C and D do not encompass all of the groundwater contamination (e.g., the COC concentrations in the perimeter wells exceed GCTLs).	Y	Y
5	The COC list for Area C (from the ROD) does not include several other chlorinated VOCs that are exceeding groundwater standards. There appears to be no documentation of the change to add these to the monitoring program.	N	N
6	There are no LUCs in place for PSCs 14 and 15 at OU 3 for groundwater, though it was mentioned as part of the selected remedy for other areas of elevated groundwater contamination.	Y	Y
7	Low levels of contamination (less than 100 ppb) exist across most of OU 3 without a selected remedy.	Y	Y
8	Reported groundwater contamination exists just outside the existing boundary of OU 3.	Y	Y
9	The documentation for the future course of action for PSC 16 and regulatory approvals are incomplete to date.	N	N
10	The RAO for sediment does not appear to have been achieved.	*	*
11	Missed LUC inspection for 2003.	N	N

*A protectiveness determination cannot be made at this time until further information is obtained.

TABLE 4-13
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

FIVE-YEAR REVIEW
OPERABLE UNIT 3
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Issue Number	Issues	Recommendations	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
						Current	Future
1	Monitoring well networks at Buildings 106 and 780 are insufficient.	This should be addressed in the planned additional investigation resulting from the optimization study.	Navy	USEPA/FDEP	4-Mar-10	Y	Y
2	The Response Action for PSC 48 and Building 780 is not expected to achieve cleanup levels; plume containment has not been confirmed or achieved.	Complete the actions required from the optimization effort.	Navy	USEPA/FDEP	4-Mar-10	Y	Y
3	Areas C and D not being monitored quarterly as stipulated in the ROD. Documentation of this was not found.	Prepare documentation and regulatory approvals.	Navy	USEPA/FDEP	31-Dec-05	N	N
4	Monitoring well networks at Areas C and D do not encompass all of the groundwater contamination (e.g., the COC concentrations in the perimeter wells exceed GCTLs).	Implement LUC including groundwater use restrictions for areas around OU 3 Areas C and D.	Navy	USEPA/FDEP	31-Dec-05	Y	Y
5	The COC list for Area C (from the ROD) does not include several other chlorinated VOCs that are exceeding groundwater standards. There appears to be no documentation of the change to add these to the monitoring program.	Prepare documentation and regulatory approvals for the new COCs in this program.	Navy	USEPA/FDEP	31-Dec-05	N	N
6	There are no LUCs in place for PSCs 14 and 15 at OU 3 for groundwater, though it was mentioned as part of the selected remedy for other areas of elevated groundwater contamination.	Draft and enact appropriate institutional controls for OU 3 to restrict access and exposure to various COCs in media as indicated by the ROD.	Navy	USEPA/FDEP	4-Mar-10	Y	Y
7	Low levels of contamination (less than 100 ppb) exist across most of OU 3 without a selected remedy.	As part of LUCIPs for OU 3, restrict groundwater use from beneath OU 3 until RAOs are achieved.	Navy	USEPA/FDEP	4-Mar-10	Y	Y
8	Reported groundwater contamination exists just outside the existing boundary of OU 3.	Redraw existing boundary of OU 3 to include identified groundwater contamination.	Navy	USEPA/FDEP	4-Mar-10	Y	Y
9	The documentation for the future course of action for PSC 16 and regulatory approvals are incomplete to date.	Prepare documentation and regulatory approvals for the proposed future course of action.	Navy	USEPA/FDEP	4-Mar-10	N	N
10	The RAO for sediment does not appear to have been achieved.	Address this issue with Issue 9.	Navy	USEPA/FDEP	4-Mar-10	*	*
11	Missed LUC inspection.	Inspect site quarterly or as required by LUCIPs.	Navy	USEPA/FDEP	30-Jun-05	N	N

4.10 PROTECTIVENESS STATEMENT

The following protectiveness statements apply to the various remedies for OU 3:

1. The remedial actions for PSC 14 and PSC 15 are protective of human health and the environment.

2. The remedial actions at PSC 48 and Building 780 are not protective because of the following issues:

   - The monitoring well networks at these sites are insufficient to define the extent of groundwater contamination.
   - The response actions for PSC 48 and Building 780 are not expected to achieve cleanup levels; plume containment has not been confirmed or achieved.

   The following actions need to be taken:

   - Implement groundwater restrictions and LUCs at the site to ensure short term protectiveness.
   - Completely assess the horizontal and vertical extent of groundwater contamination at each site.
   - Through the optimization effort, provide a different remedy for each site that will meet the CERCLA criteria.

3. The remedial actions at Area B at OU 3 are expected to be protective of human health and the environment, and, in the interim, exposure pathways that could result in unacceptable risks are being controlled.

4. The remedial actions at Areas C and D at OU 3 are not protective because of the following issue: the monitoring well networks at these sites are insufficient to define the extent of groundwater contamination. The following action needs to be taken: implement groundwater restrictions and LUCs at the site to ensure short term protectiveness.

5. A protectiveness determination of the remedy for OU 3 Areas F and G cannot be made at this time until the remedial design is completed and implemented.

6. A protectiveness determination of the remedy for PSC 16 cannot be made at this time until further information is obtained by making a formal determination of the actions required for this site. Specifically, the RAO has yet to be achieved. Future actions should address this issue. It is expected that this will require approximately one year to complete, at which time a protectiveness determination will be made.

7. The remedies at OU 3 are not protective because there are multiple locations of groundwater contamination exceeding ARARs that have no remedy in place. The following actions should be taken to ensure protectiveness:

   - Determine the required extent of groundwater restrictions via literature search to find wells that were sampled for the various COCs within OU 3 and had results which were less than regulatory levels.
   - Implement groundwater use restrictions through a LUC for OU 3 to prevent exposure to groundwater at OU 3.

5.0 OPERABLE UNIT 4

Casa Linda Lake (PSC 21) is an 11-acre man-made surface water body (approximately 1,800 ft long with an average width of 250 ft). The lake was designed as a storm water retention basin, and it is functioning as designed receiving storm water runoff. When the lake's level exceeds the height of the dam spillway at the eastern end of the lake, the surface water enters a ditch that flows east to Turtle Pond and from there to Mulberry Cove and the St. Johns River. The lake is approximately 1,800 ft from the St. Johns River. The elevation around the lake's top of bank averages about 15 ft msl (see Figure 5-1), and the lake averages about 9 ft deep. Hydrogeologic data from the RI (AGM, 1999a) indicates that groundwater typically discharges to the lake.

Casa Linda Lake is surrounded by Casa Linda Oaks Golf Course. The fairways and greens of the golf course are principally south of the lake, and one green exists on a peninsula in the lake itself. Golf course facilities and parking lie within a few hundred ft of the lake's northern side, and two roads border the golf course just north of those facilities (Birmingham Avenue and Mustin Road). As indicated by Figure 1-2, the lake and surrounding golf course are within the property boundary of NAS Jacksonville.

It is reasonable to assume that the site will remain a storm water retention basin, and that the golf course will be maintained. Development of some of the green space north of the basin may be expected, which would increase the storm water runoff into the basin (AGM, 2000).

5.1 SITE CHRONOLOGY FOR OU 4

Casa Linda Lake was identified as a PSC during the IAS because of a fish kill that occurred there on May 6, 1979. The fish kill was caused by the application of Dasanit™ (a pesticide). The chemical name for this product is fensulfothion, which is an organophosphorusnematicide. Following applications of the pesticide between April 23 and May 3, 1979, heavy rains between May 5 and 11, 1979, were sufficient to wash the compound into Casa Linda Lake. Approximately 300 to 1,000 fish were reportedly killed in addition to a dozen ducks. The surface water and sediment were immediately tested, and the results indicated the chemical at 1,000 times the level that would kill fish or ducks. However, the half-life of the pesticide is known to be about three to five weeks; thus, this chemical has been ruled out as a continuing source of contamination. The investigations conducted in 1993 and 1997 (see Table 5-1) detected various COCs; however, none were associated with fensulfothion, and they were attributed to surface water run-off from the surrounding areas as a more likely source (AGM, 1999a).

DRAWN BY: A. JANOCHA	DATE: 8/27/04	TOPOGRAPHIC MAP OU 4 FIVE YEAR REVIEW NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NO. 7302
CHECKED BY: J. JOHNSON	DATE: 2/11/05		OWNER NO. CTO 0342
REVISED BY: —	DATE: —		APPROVED BY: — DATE: —
SCALE: AS NOTED			DRAWING NO. FIGURE 5 - 1 / REV 0

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TABLE 5-1
CHRONOLOGY OF SITE EVENTS FOR OPERABLE UNIT 4

FIVE-YEAR REVIEW
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Event (Sub-events indented)		Date
Pre-discovery of contaminants at OU 4		
	Fish Kill	May-79
Initial discovery of problem or contamination		
	IAS by Hartman found several COCs above ARARs in surface water and sediment.	1983
Pre-NPL responses		
	ECT reports several ARARs exceeded in surface water & sediment, and the RA revealed a cancer risk for PCBs.	1993
NPL Listing		Nov-89
FFA signature		1990
Post-NPL responses		n/a
	RI begun for OU 4.	Jul-97
	RI completed for OU 4.	Oct-97
Remedial design start		(1)
Remedial design complete		(1)
MOA signed between USEPA, FDEP, and Navy to ensure land use control compliance		Aug-98
Final RI and RA report submitted		Jun-99
FFS submitted		Nov-99
Proposed Plan for Remedial Action (start of public comment period)		Mar-00
ROD signature for OU 4		Sep-00
Final Close Out Report		Jul-03
Current remedial activities		n/a
Previous five-year reviews		None for OU 4

Notes:
(1) RD/RA process was waived for this site since implementation of the selected remedy was transferred to the SWPPP.
n/a = not applicable.

Groundwater at the site is not used as a potable water supply. Though some COCs did occasionally exceed a TBC criteria, groundwater was determined by AGM (AGM, 1999a) to be discharging to the surface water where those same COCs were not detected. Therefore, groundwater was not considered a medium of concern for OU 4.

Site soils contained various COCs that occasionally exceeded a TBC criteria. For those COCs that exceeded residential risk-based criteria (RBC), they were ruled out since they did not exceed the industrial RBC and the site is considered to be part of an industrial setting. Various potential routes of migration were evaluated (i.e., soil leaching into groundwater, surface run-off to surface water and sediment, and fugitive dust from unvegetated and unpaved areas). These various pathways were ruled out as not occurring or not likely to occur; thus, soil was ruled out as a medium of concern (AGM, 1999a).

Various pesticides and metals were detected in the surface water of Casa Linda Lake. However, since none of the COCs were detected in concentrations above ARARs, the surface water was ruled out as a medium of concern at the site (AGM, 1999a).

5.2 BACKGROUND

5.2.1 Physical Characteristics of OU 4

Casa Linda Lake is located along the northern edge of the NAS Jacksonville Golf Course. A generalized map of NAS Jacksonville showing the location of OU 4 in the eastern portion of the facility is provided on Figure 1-1. A map of OU 4 is provided on Figure 5-1. The area surrounding the lake is relatively flat and consists of grass covered soils. The banks of the lake are steep and lined with grass and trees. There is no significant industrial or residential development around PSC 21. To the north of the site is Birmingham Avenue, across which are industrial buildings and parking areas. However, the areas to the south, east, and west are mostly developed as golf course. Mulberry Cove is approximately 1,500 ft to the east.

5.2.2 Land and Resource Use at OU 4

Past and current land uses at OU 4 remain mostly unchanged since the golf course construction was completed. There have been golf course expansions and changes to the surface water controls associated with Casa Linda Lake over its operational life. Otherwise, there have been no other significant reported land uses at PSC 21. Groundwater and surface water are not used as potable water sources. However, the surface water in Casa Linda Lake is used to irrigate the golf course. The future use of the various resources (e.g., water, fish) is controlled via the LUC in effect for the PSC.

5.3 HISTORY OF CONTAMINATION AT OU 4

Casa Linda Lake was designated a PSC during the IAS because of a fish kill that occurred in 1979. A pesticide application caused the death of between 300 and 1,000 fish and approximately 12 ducks. The COCs previously identified at the site included SVOCs, pesticides, PCBs, and metals in sediment, surface water, and/or fish tissue.

5.3.1 Initial Response for OU 4

As previously indicated, the fish kill in 1979 at Casa Linda Lake resulted in immediate testing that confirmed the source of contamination was the pesticide, Dasanit™. However, given the very short half-life of the product, no other follow-up action was deemed necessary at the time.

5.3.2 Basis for Taking Action at OU 4

Hazardous substances that have been detected at the site and were retained as constituents of interest (COIs) in each media (AGM, 1999a) include:

Surface Soil
Benzo(a)pyrene
Arsenic
Beryllium

Shallow Groundwater
Aluminum
Arsenic
Beryllium
Chromium
Iron
Manganese
Vanadium

Surface Water
No COIs were selected

Sediment
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Indeno(1,2,3-cd)pyrene
Aluminum
Aroclor 1254
Cadmium
Arsenic
Lead
Chromium
Iron
Vanadium
Beryllium

Fish Tissue Samples
4-Methylphenol
Alpha chlordane
4,4'-DCE
Aroclor 1260
Aroclor 1254
Arsenic
Cyanide
Iron
Lead
Mercury
Selenium

The purpose of remedial action at OU 4 was to eliminate the human exposure pathway (fish consumption) and to ensure protection of the St. Johns River from the COIs identified in the environmental media in the lake. Since minimal wildlife and aquatic habitat has evolved at Casa Linda Lake, a secondary RAO is to protect the neighboring wildlife habitat from the constituents of ecological interest (COEIs) detected in the media within and around this retention basin (AGM, 2000).

5.4 REMEDIAL ACTIONS

The RAOs were included in the OU 4 ROD as follows: "The primary remedial action objectives (RAOs) are to eliminate the human exposure pathway (fish consumption) and to ensure protection of the St. Johns River from the COIs identified in the environmental media in the lake. Since minimal wildlife and aquatic habitat has evolved at Casa Linda Lake, a secondary remedial response objective is to protect the neighboring wildlife habitat from the COEIs detected in the media within and around this basin."

5.4.1 Remedy Selections at OU 4

Four remedial alternatives were evaluated in the FFS for OU 4 to address the primary and secondary RAOs. Of the four alternatives evaluated, the selected remedial action for OU 4 was Alternative 2 with Option 1. This alternative involves "monitoring with institutional and habitat controls" (AGM, 2000). The following description for the selected remedy at OU 4 is quoted from the ROD (AGM, 2000):

"Monitoring with institutional and habitat controls assumes that the lake sediments remain in place but the following components will be implemented to address the risks due to exposure to those sediments:

- Institutional controls comprised of use restrictions and advisory signs which are currently enforced by NAS (Jacksonville) for Casa Linda Lake.

- Monitoring of Casa Linda Lake in accordance with NAS (Jacksonville) storm water management programs, including the SWPPP and BMPs.

- Control of the habitats in the vicinity of Casa Linda Lake via Passive Habitat Control, as described below.

Institutional controls will be implemented to reduce potential human and ecological exposure pathways. The existing use restrictions for Casa Linda Lake will continue to be enforced by NAS (Jacksonville). The existing institutional controls include use restriction and advisory signage around the lake, and a catch and release program for all fishing activities around the lake. In addition to these measures, BMPs at NAS (Jacksonville), which are designed to prevent point source discharges (from industrial areas at NAS (Jacksonville)) from entering the storm water management system, will be continued. To ensure these institutional controls for Casa Linda Lake are properly maintained, the controls will be incorporated into the overall Master Plan for NAS (Jacksonville).

NAS (Jacksonville) has outlined specific storm water management and monitoring procedures in its SWPPP. The selected remedy includes monitoring of Casa Linda Lake on a routine basis in accordance with those procedures. The monitoring program will involve visual inspection of the storm water discharging from Casa Linda Lake on a quarterly basis, with observations of sheen, color, odor, and debris duly noted on the applicable report forms per the SWPPP. These inspections will be conducted at the inlet culverts to Casa Linda Lake, at the lake itself, and at the lake's control structure and the outfall (C-3) at Mulberry Cove. NAS (Jacksonville's) SWPPT evaluates the storm water management and monitoring programs on a semi-annual basis. Therefore, the Casa Linda Lake monitoring results will be routinely evaluated, and monitoring procedures will be updated as necessary by the SWPPT to ensure compliance with applicable storm water regulations. Storm water quality summary reports for Casa Linda Lake will be prepared in accordance with the reporting requirements specified in the SWPPP.

Passive habitat controls also will be implemented as part of this selected remedy to reduce human health and ecological risks due to exposure to the COIs/COEIs in lake sediments and the food chain. Control of the wildlife and aquatic habitat at Casa Linda Lake will be maintained through removal of the herbaceous shoreline vegetation from the lake via mowing, and placement of statues of predatory birds and animals around the lake banks to discourage wildlife from seeking refuge there…Periodic visual inspection of the lake banks will be performed to monitor the effectiveness of the passive habitat controls, and identify the frequency of bank maintenance necessary to minimize vegetation along the perimeter of the lake. To ensure these habitat controls for Casa Linda Lake are properly maintained, the controls will be incorporated into the overall Master Plan for NAS (Jacksonville) (as discussed above for institutional controls)."

The selected remedy is implied to remain in place, as part of the Master Plan, as long as the Casa Linda Golf Course is maintained and NAS Jacksonville remains a military base. However, "in the event the base is to be redeveloped or expanded such that the storage volume or capacity of Casa Linda Lake needs to be increased, the Master Plan will specify the proper removal, handling, and disposal procedures for the lake sediments. In the event, NAS (Jacksonville) is to be decommissioned or sold for other uses, the institutional controls would be conveyed to the governmental agency that maintains the closed base, or the new property owner, whichever is applicable, as a condition of the property transfer. The reason for such a conveyance would be to restrict future development in the vicinity of Casa Linda Lake until sediment impacts have been sufficiently addressed" (AGM, 2000).

5.4.2 Remedy Implementation at OU 4

The selected remedy satisfies the statutory requirement for protection of human health and the environment through the use of institutional controls, monitoring, and passive habitat controls. However,

the impacted sediments at Casa Linda Lake will remain in place while relying on NA processes to reduce risks.

Monitoring of institutional and habitat controls is expected to reduce risks to human and wildlife exposure. Routine monitoring of the lake in accordance with the station's Storm Water Pollution Protection Plan (SWPPP) and monitoring of habitat controls are expected to reduce risks to the St. Johns River sediment. NA is expected to protect human health and the environment over time. Also, the use of Best Management Practices (BMPs), now and as better methods are developed, should continue to minimize the potential for impacted sediments to enter and leave Casa Linda Lake and ultimately the St. Johns River.

5.4.3 System Operation/O&M at OU 4

The costs expected from the selected remedy included O&M and capital costs. The administrative actions expected from the Navy included incorporation of institutional controls, habitat controls, and monitoring programs into the NAS Jacksonville Master Plan. As for O&M, the advisory and restriction signs were already in place, no design was required since the predatory animal statues were available locally, lake bank maintenance would be handled by the golf course maintenance personnel, and storm water monitoring was being transferred to the station's SWPPP. Thus, no formal design and action process was required. The Navy's original 2000 present worth cost estimate for implementation and operation of the aforementioned system was approximately $227,297. This figure assumed a discount rate of 5 percent and monitoring for a 30 year period.

5.5 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review since the ROD signing for OU 4. Therefore, there is no progress to report.

5.5.1 Protectiveness Statements from the Last Review

This site was not included in the last five-year review.

5.5.2 Status of Recommendations and Follow-up Actions from Last Review

This OU was not included in the last five-year review.

5.6 FIVE-YEAR REVIEW PROCESS

5.6.1 Administrative Components

The NAS Jacksonville Five-Year Review team consisted of Harold McGill, Phillip McGinnis, and Anthony Robinson (NAVFAC EFD SOUTH); Bill Raspet (NAS Jacksonville); Peter Dao (USEPA); James Cason (FDEP); Hal Davis (USGS); Greg Roof (TtNUS); and Mike Halil (CCI). These organizational representatives have participated in the five-year review. No other potentially interested parties were identified or otherwise notified at the beginning of the review process.

This five-year review consisted of a review of the previous five-year review; evaluation of the issues raised in the previous review, actions taken, and results; site inspections; personnel interviews; and a technical assessment of each site and the remedial actions underway.

This five-year review was funded by NAVFAC EFD SOUTH in February 2004 and will be completed by March 2005. More detailed interview and inspection dates are included in the following sections.

5.6.2 Community Involvement

No public notice identifying that this review was beginning was published. However, at the conclusion of the review, a fact sheet is planned for production and disbursement to a Restoration Advisory Board and others.

5.6.3 Document and Data Review

Since no active monitoring was required by the ROD to track the NA of hazardous sediments remaining in place on the lake bottom, there are no relevant documents to report on the progress of NA that would require a review against applicable cleanup standards or TBCs. The only post-ROD document created for OU 4 during the review period was the, “Final Close Out Report for Casa Linda Lake (PSC 21)”, dated July 2003. This document is intended to provide remedy completion documentation for OU 4.

5.6.4 Site Inspection and Interviews

TtNUS conducted a site inspection of OU 4 on October 27, 2004. Prior to initiating the inspection, the inspector interviewed Mr. Bill Raspet and Ms. Jane Beason. The IR Manager accompanied the inspector for the site inspection, which included visual observations of the lake, signs for catch-and-release-only, and the animal statues for OU 4. It was noted that the southern side of the lake abuts the golf course and no signs were apparent on that side; however, several signs warning that only catch and release fishing is

allowed at the lake were observed in good condition on the northern side. The IR Manager indicated that fisherman would more likely work the northern side for several reasons including easier access from parking areas and less interaction with golfing activities, which provides the reason for the placement of the signs on the north side of the lake. One sign without lettering and shaped differently from the catch-and-release signs was noted on the northern shore of the lake about mid-way between northwestern and southeastern ends. Several animal statues were noted and appeared to be in good condition.

LUC inspections began for OU 4 in December 2004. The land use for the site has remained unchanged.

5.7 TECHNICAL ASSESSMENT

5.7.1 Question A: Is the remedy functioning as intended by the ROD?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the ROD.

- ***HASP/Contingency Plan:*** Since there is no active remediation taking place at OU 4, no HASP is required at this time.

- ***Implementation of Institutional Controls and Other Measures:*** Institutional controls are in place for OU 4 as part of the LUC program at NAS Jacksonville. The site was made part of the quarterly LUC inspection program in December 2004. The implementation appears incomplete, however, due to the lack of preparation of the LUCIP for OU 4.

- ***Remedial Action Performance:*** According to the Final Close Out Report (NAVFAC EFD SOUTH, 2003), the following actions have been performed: vegetation was removed from around the lake, and the bank continues to be maintained by the station to keep vegetation to a minimum around the lake; predatory statues have been emplaced and maintained; and the necessary inspections have been made by the SWPPP.

- ***System Operations/O&M:*** Not applicable.

- ***Cost of System Operations/O&M:*** As noted above in Section 4.3, costs have been within the acceptable range.

- ***Opportunities for Optimization:*** The remedy is functioning as required in the ROD, and there appear to be no opportunities for optimization at this time.

- ***Early Indicators of Potential Remedy Failure:*** None noted.

5.7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standard and TBC Criteria

In accordance with the ROD, the only chemical-specific ARARs identified for the site apply to the COIs and COEIs identified in sediment, fish tissue, and plant tissue. The following standards were identified as chemical-specific ARARs in the ROD. They were reviewed for changes that could affect protectiveness:

- NOAA effects-based sediment quality values
- Florida effects-based Sediment Quality Assessment Guidelines (SQAGs) (MacDonald, 1994)
- NAS Background Screening Concentrations for Sediments (ABB-ES, 1996a)

The Florida SQAGs and NAS Background Screening Concentrations for Sediments have not changed since their inception. Similarly, the latest reference literature from the NOAA (Buchman, 1999) indicates that no change has been issued to the effects-based sediment quality ARARs used in the ROD.

The ROD indicated that no location-specific ARARs were identified for OU 4.

Changes in Exposure Pathways, Toxicity, and other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures (worker exposure to surface soil, diver exposure to sediment and surface water, and fish ingestion by off-site residents) and future exposures (same scenarios). There have been no changes in the toxicity factors for the COCs that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

5.7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would affect the protectiveness of this remedy.

5.8 ISSUES

The only issue identified for OU 4 was the missed LUC inspections. It does not affect protectiveness.

5.9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The recommendation as follow-up action for the missed LUC inspection is to inspect OU 4 quarterly or as required by the LUCIPs.

5.10 PROTECTIVENESS STATEMENT

The selected remedy for OU 4 is protective of human health and the environment for the site.

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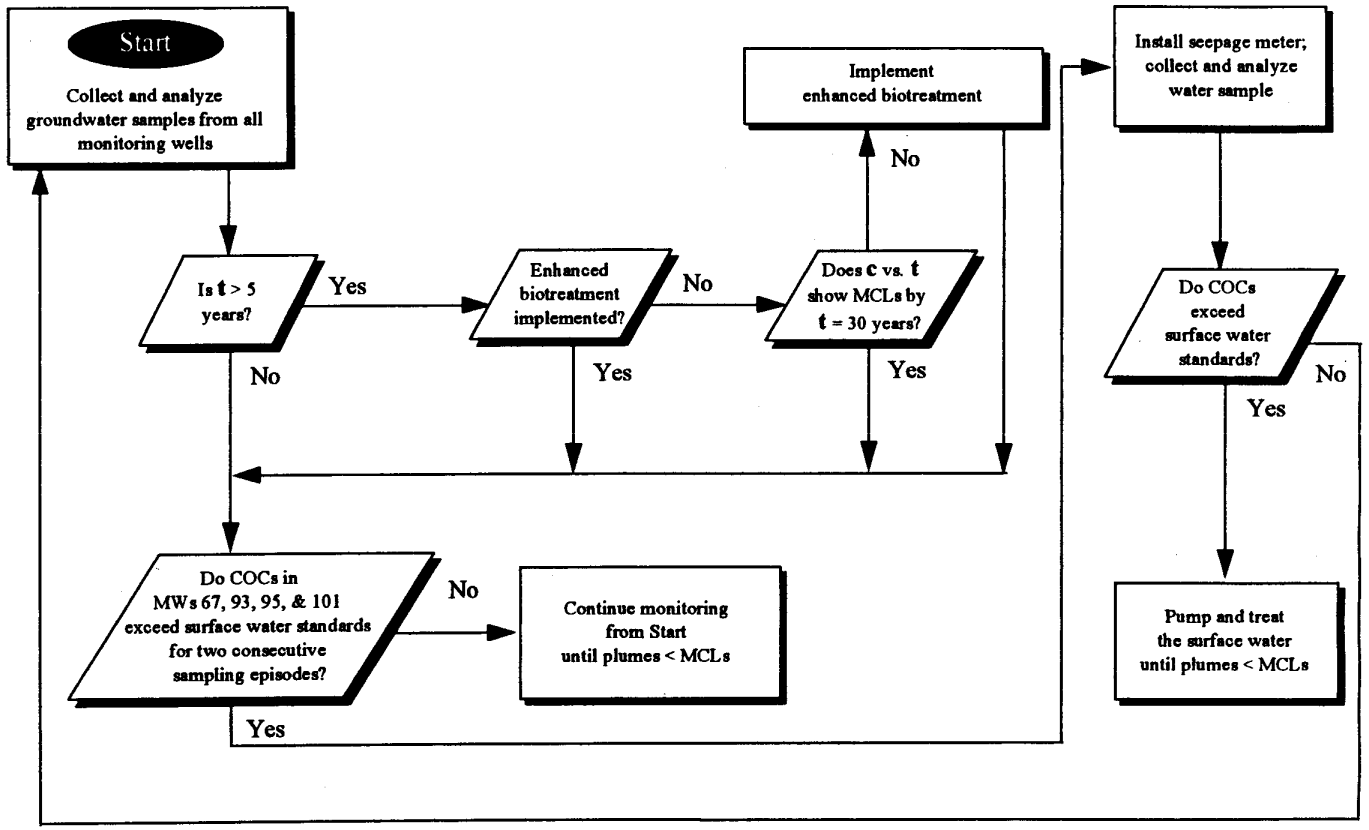
APPENDIX A

OU 1 INFORMATION



NOTES:
NAS = Naval Air Station
MCL = Maximum contaminant level
COC = Contaminant of concern
MW = Monitoring well
< = Less than
> = Greater than
c = Concentration
t = Time since 7/98 (the beginning of long-term monitoring)
vs. = Versus

FIGURE 1-3
CONTINGENCY DECISION-MAKING PROCESS

MONITORING PLAN FOR SELECTED REMEDY OPERABLE UNIT 1

NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

H:\HEIDI\NASJAX\2508-16\FIG1-3.PM5 052798HAS

APPENDIX B

OU 1 LNAPL CALCULATION SPREADSHEET

APPENDIX B
RECOVERED LNAPL FROM NORTH TRENCH - OU 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Date	Drum #	Product Thickness in Inches	Remarks
07/05/95	1	5	* assumed recovered free product
09/08/95	2	5	* assumed recovered free product
10/20/95	3	5	* assumed recovered free product
12/01/95	4	5	* assumed recovered free product
04/10/96	5	5	* assumed recovered free product
03/13/96	6	5	* assumed recovered free product
07/06/96	7	5	* assumed recovered free product
10/08/96	8	5	* assumed recovered free product
10/21/96	9	5	* assumed recovered free product
11/10/96	10	5	* assumed recovered free product
04/01/97	11	5	* assumed recovered free product
05/02/97	12	5	* assumed recovered free product
07/02/97	13	5	* assumed recovered free product
09/19/97	14	5	* assumed recovered free product
11/03/97	15	5	* assumed recovered free product
12/12/97	16	5	* assumed recovered free product
01/15/98	17	5	* assumed recovered free product
01/30/98	18	5	* assumed recovered free product
02/19/98	19	5	* assumed recovered free product
03/02/98	20	5	* assumed recovered free product
03/20/98	21	5	* assumed recovered free product
04/03/98	22	5	* assumed recovered free product
04/13/98	23	5	* assumed recovered free product
04/20/98	24	5	* assumed recovered free product
04/28/98	25	5	* assumed recovered free product
05/20/98	26	5	* assumed recovered free product
06/04/98	27	5	* assumed recovered free product
06/15/98	28	5	* assumed recovered free product
07/19/98	29	5	* assumed recovered free product
07/28/98	30	2	
08/10/98	31	2	
08/25/98	32	2	
09/10/98	33	3	
09/21/98	34	3	
10/08/98	35	3	
10/27/98	36	3	
11/16/98	37	3	
01/11/99	38	3	
01/20/99	39	3	
02/03/99	40	3	
02/10/99	41	2	
03/01/99	42	3	
04/16/99	43	3	
05/12/99	44	5	
07/08/99	45	5	
07/29/99	46	5	
08/19/99	47	5	
09/21/99	48	5	

APPENDIX B
RECOVERED LNAPL FROM NORTH TRENCH - OU 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Date	Drum #	Product Thickness in Inches	Remarks
10/05/99	49	5	
12/21/99	50	5	
02/10/00	51	32	
03/29/00	52	5	
09/17/02	53	3	
12/10/02	54	3	
04/01/03	55	5	* assumed recovered free product

Note: * assumed recovered free product since no notes were made in the remarks on original field data sheets for these entries.

266 Total number of inches of LNAPL recovered.
33 Number of inches of product that can be contained in a 55-gallon drum.
8 Number of drums filled with LNAPL (total inches of LNAPL/33)
443 Number of gallons of LNAPL recovered (number of drums filled * 55 gallons)

APPENDIX B
RECOVERED LNAPL FROM SOUTH TRENCH - OU 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Date	Drum #	Product Thickness in Inches	Remarks
09/01/95	1	5	* assumed recovered free product
12/13/95	2	5	* assumed recovered free product
04/01/96	3	5	* assumed recovered free product
08/12/96	4	5	* assumed recovered free product
12/13/96	5	5	* assumed recovered free product
04/01/97	6	5	* assumed recovered free product
09/08/97	7	5	* assumed recovered free product
12/12/97	8	5	* assumed recovered free product
01/15/98	9	5	* assumed recovered free product
02/03/98	10	5	* assumed recovered free product
03/02/98	11	5	* assumed recovered free product
03/18/98	12	5	* assumed recovered free product
07/24/98	13	5	* assumed recovered free product
09/10/98	14	5	* assumed recovered free product
10/08/98	15	3	
10/28/98	16	3	
11/18/98	17	3	
11/24/98	18	3	
12/22/98	19	3	
01/11/99	20	3	
01/20/99	21	3	
02/03/99	22	3	
02/19/99	23	3	
03/01/99	24	3	
03/22/99	25	3	
04/16/99	26	3	
05/12/99	27	5	
06/21/99	28	5	
08/06/99	29	5	
08/16/99	30	3	
08/30/99	31	3	
09/21/99	32	3	
12/02/99	33	5	
12/22/99	34	4	
02/10/00	35	5	
06/20/00	36	6	
06/26/00	37	6	
07/17/00	38	5	
08/02/00	39	3	
08/21/00	40	3	
08/30/00	41	6	
09/13/00	42	5	
10/04/00	43	3	

APPENDIX B
RECOVERED LNAPL FROM SOUTH TRENCH - OU 1
NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Date	Drum #	Product Thickness in Inches	Remarks
06/21/01	44	5	
01/10/02	45	7	
03/14/02	46	3	
05/06/02	47	2	
04/01/03	48	5	* assumed recovered free product

Note: * assumed recovered free product since no notes were made in the remarks on original field data sheets for these entries.

203 Total number of inches of LNAPL recovered.
33 Number of inches of product that can be contained in a 55-gallon drum.
6 Number of drums filled with LNAPL (total inches of LNAPL/33)
338 Number of gallons of LNAPL recovered (number of drums filled * 55 gallons)

APPENDIX C

OU 2 INFORMATION

Table 2-3
Summary of Groundwater Analytical Results for Listed Constituents (Section 12)

Annual Compliance Monitoring Report
January 2002
Industrial Sludge Drying Bed (ISDB), Polishing Pond (PP), and Domestic Sludge Drying Bed (DSDB)
Naval Air Station Jacksonville
Jacksonville, Florida

			ISDB (PSC 41)			PP (PSC 42)						DSDB (PSC 43)				BKG
Compound	Background Screening Values	GWPS[1]	NAS 4-4	NAS 4-5R	NAS 4-12D	NAS 42-5R	NAS 42-6R	NAS 42-7R DUP	NAS 42-7R	NAS 42-8-2R	MW 017	NAS 41-2	NAS 41-3	NAS 41-4	NAS 41-6	NAS 4-9
			1/9/2002	1/9/2002	1/9/2002	1/11/2002	1/11/2002	1/11/2002	1/11/2002	1/11/2002	1/10/2002	1/10/2002	1/10/2002	1/10/2002	1/10/2002	1/10/2002
Detected Volatile Organics (USEPA Method 8260B)(µg/L)																
1,2-dichlorobenzene	NA	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Detected Semi-Volatile Organics (USEPA Method 8270)(µg/L)																
2-methylphenol	NA	35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3&4-methylphenol	NA	4*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	NA	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Detected Metals (USEPA SW-846 6010B/7000A)(µg/L)																
Arsenic	13.2	50	ND	ND	ND	19.7	24.8	ND	ND	ND	ND	3.8	ND	9.1	ND	ND
Cadmium	8.2	5	**5.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	208	100	0.96	ND	ND	ND	6.9	7.3	8.2	ND	3.1	ND	3.7	56.3	ND	ND
Iron	68292	500	ND	299	**5000**	**14100**	**13300**	**29000**	**29300**	**3770**	**954**	**4480**	**1730**	**10300**	ND	**1160**
Lead	45.8	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**39.3**	ND	ND
Manganese	204	50	6.6	ND	36.8	ND	**126**	**270**	**272**	**166**	ND	**91.5**	**340**	**68.5**	**61.9**	ND
Sodium	24626	160,000	16900	1760	10600	6470	17900	95400	97000	11900	2650	16800	61800	**383000**	15400	2690
Vanadium	294	49	9.1	5.6	ND	ND	ND	28.2	28.8	ND	6.4	ND	6.8	**152**	ND	2.1
Zinc	173.2	5,000	9.8	9.9	26.3	16.7	ND	9.6	11	ND	ND	15.5	10.9	27.5	11.3	10.6
Detected RAD Constituents (USEPA SW-846 6010B/7000A)(pCi/L)																
Gross Alpha	NA	15	ND	1.37	0.768	ND	2.4	**15.0**	14.1	0.982	1.22	2.28	5.91	**38.3**	ND	1.33
Gross Beta	NA	4	3.4	2.41	1.56	3.78	1.34	**8.63**	**7.86**	**5.59**	1.77	2.96	**104**	**19.8**	**10.5**	3.62
Radium-226	NA	5**	ND	0.994	0.718	ND	0.88	1.42	1.78	0.627	0.591	1.13	1.93	4.15	ND	0.754
Radium-228	NA	5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Detected Inorganic Constituents (USEPA SW-846 SW 846-7196A (mg/L)																
Hexavalent chromium	NA	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenols	NA	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

[1]Groundwater Protection Standards in Post-Closure Permit 0072437-005-HF, FAC 62-777, and 40 CFR 264-94.
USEPA = United States Environmental Protection Agency.

J = Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The reported concentration is considered to be an estimate.

*=GWPS for 4-methylphenol

pCi/L=pico

BKG = Background Well

Bolded/highlighted concentrations exceed GWPS.
DUP = Duplicate.
ND = non detect.
µg/L = micrograms per liter.

NA=not applicable
** = GWPS for radium

Table 2-3
Summary of Groundwater Analytical Results for Listed Constituents (Condition 12)

Annual RCRA Groundwater Monitoring Report
January 2003
Domestic Sludge Drying Bed (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Bed (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GWPS[1]	MDL/MDA Range	DSDB (PSC 41)				PP (FSC 42)					ISDB (PSC 43)				BKG	Blanks	
				NAS 41-2	NAS 41-3	NAS 41-4	NAS 41-6	NAS 42-5R	NAS 42-6R	NAS 42-7R	NAS 42-8-2R	MW 017	NAS 4-4	NAS 4-5R	NAS 4-5R DUP	NAS 4-12D	NAS 4-9	01-CB	01-FB
				1/10/2003	1/10/2003	1/10/2003	1/10/2003	1/9/2003	1/9/2003	1/9/2003	1/9/2003	1/9/2003	1/10/2003	1/10/2003	1/10/2003	1/10/2003	1/8/2003	1/10/2003	1/10/2003
Volatile Organics (USEPA Method 8260B) (µg/L)																			
1,2-dichlorobenzene	NA	10	0.3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Semi-Volatile Organics (USEPA Method 8270C) (µg/L)																			
2-methylphenol	NA	35	0.5	U	U	0.89	U	U	U	U	U	U	U	U	U	U	U	U	U
3&4-methylphenol	NA	4****	0.5	U	U	0.95	U	U	U	U	U	U	U	U	U	U	U	U	U
Pyridine	NA	7	0.5	U	U	U	U	U	0.62	0.68	U	0.64	U	0.67	U	U	U	U	U
Metals (USEPA SW-846 6010B/7470A) (µg/L)																			
Arsenic	13.2	50	3.8	U	U	12.4 I	U	36.7	25	U	U	U	U	U	U	U	U	U	U
Cadmium	8.2	5	0.3	U	U	U	U	U	U	U	U	U	2.4 I	U	U	U	U	U	U
Chromium	208	100	3.2	U	9.1	96	7.5	9.4	3.9 I	7.5	4.8 I	U	4.2 I	U	U	U	U	U	U
Iron	68292	500	52	**3330**	**1160**	**13900**	**982**	**13700**	**14300**	**25500**	**2880**	284	U	174	174	**3070**	**930**	U	U
Lead	45.8	15	2.4	U	U	**64.4**	3.6 I	U	U	U	U	U	U	U	U	U	U	U	U
Manganese	204	50	0.2	**102**	**232**	**78.4**	**66.2**	**139**	6.4	**432**	**167**	0.91 I	7.1	2.2 I	2.1 I	38.6	3.2 I	0.52 I	0.24 I
Sodium	24626	160,000	110	18600	41400	**279000**	14600	20800	8160	63900	12700	2900	13800	4130	4130	11900	3090	181 I	175 I
Vanadium	294	49	0.4	0.67 I	8.9 I	**203**	5.7 I	4.9 I	3.5 I	17.4	3.7 I	5.6 I	5.2 I	5.6 I	5.4 I	0.42 I	7.5 I	U	U
Zinc	173.2	5,000	7	8 I	U	30.8	U	U	U	U	U	U	U	U	U	18.3 I	U	U	U
RAD Constituents (USEPA Methods 900, 903, and 904) (pCi/L)																			
Gross Alpha	NA	15	0.292-2.68*	2.07	3.88	**102**	4.38	0.508	3.49	8.63	0.763	0.676	0.379	0.773	1.1	1.08	2.83	NA	NA
Gross Beta	NA	***	0.384-2.22*	**2.41**	**88.7**	**38.3**	**11.5**	**4.62**	**2.48**	**6.87**	**4.67**	**1.21**	**3.4**	**2.36**	**2.47**	**1.84**	**7.06**	NA	NA
Radium-226	NA	5**	0.564-0.918*	1.29	2.24	**19.4**	U	U	1.09	3.15	U	U	0.728	U	U	U	U	NA	NA
Radium-228	NA	5**	3.86-7.66*	U	**6.92**	**113**	U	U	U	U	U	U	U	U	U	U	U	NA	NA
Inorganic Constituents (USEPA E420.1) (mg/L)																			
Phenols (total)	NA	PQL	0.01	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

Notes:

To provide the appropriate qualifiers, TtNUS used the data qualifier codes from the laboratory Form 1's to create this summary table. Chapter 62-160, FAC, does not provide validation specifications or protocols. Since no Florida requirements for validation exists, TtNUS used standard USEPA protocols and qualifiers in the validation tables. The qualifiers and some of the values in the validation packages do not match this summary table for this reason.

[1]GWPS in Post-closure Permit 0072437-005-HF; Chapter 62-777, FAC; and 40 CFR 264-94.

I = The reported value is between the laboratory method detection limit and the laboratory PQL.
* = Expressed as MDA values
** = GWPS for radium
*** = GWPS established at PQL/RL
**** = GWPS for 4-methylphenol

pCi/L=picocuries per liter
DUP = duplicate
U = non detect
µg/L = micrograms per liter
NA = not applicable
BKG = background well

PQL = practical quantitation limit
RL = reporting limit
CB = pre-cleaned blank
FB = field cleaned blank
Bold/highlighted concentrations exceed GWPS/MDAs.

Table 2-3
Summary of Groundwater Analytical Results for Listed Constituents (Condition 12)

Annual RCRA Groundwater Monitoring Report
January 2004
Domestic Sludge Drying Beds (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Beds (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GWPS[1]	MDL (no dilution factor)/MDA Range	DSDB (PSC 41)					PP (PSC 42)				
				NAS 41-2	NAS 41-2 DUP	NAS 41-3	NAS 41-4[2]	NAS 41-6	NAS 42-5R[3]	NAS 42-6R	NAS 42-7R[3]	NAS 42-8-2R[3]	MW 017R
				1/14/2004	1/14/2004	1/14/2003	1/14/2004	1/13/2004	1/15/2004	1/13/2004	1/15/2004	1/15/2004	1/29/2004
Volatile Organics (USEPA Method 8260B) (µg/L)													
1,2-Dichlorobenzene	NA	10	0.15	0.15 U	0.15 U	0.15 U	1.5 U	0.15 U	0.75 U	0.15 U	0.75 U	0.75 U	0.15 U
Semi-Volatile Organics (USEPA Method 8270C) (µg/L)													
2-Methylphenol	NA	35	0.9	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U
3&4-Methylphenol	NA	4****	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Pyridine	NA	7	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Metals (USEPA SW-846 6010B/7470A) (µg/L)													
Arsenic	13.2	50	2.6	4.4 I	4.1 I	4.0 I	10.4	3.5 I	66.5	28	5.3	3.1 I	3.4 I
Cadmium	8.2	5	0.2	0.2 U	0.2 I	0.22 I	0.62 I	0.21 I	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chromium	208	100	0.85	0.85 U	0.85 U	3.7 I	70	2.2 I	6.7	2.2 I	31.3	5.4	21.1
Iron	68292	500	13.1	4280	4600	1350	14600	148	22500	16500	31400	7570	5890
Lead	45.8	15	1.1	1.1 U	1.1 U	1.1 U	35.9	1.1 U	1.1 U	1.1 U	6.7	1.1 U	7.2
Manganese	204	50	0.094	116	127	234	68.2	59.7	195	6.7 I	245	135	18.1
Sodium	24626	160,000	182	21000	23000	41900	217000	14400	35500	8590	48600	17700	2340
Vanadium	294	49	0.64	0.64 U	0.64 U	5.9 I	136	1.7 I	5.3 I	4.3 I	57.2	4.6 I	25.5
Zinc	173.2	5,000	4	9.3 I	32.3	4.0 U	29.3	6.2 B I	4.0 U	4.2 I	16.5 I	4.0 U	14.5 I
RAD Constituents (USEPA Methods 900, 903, and 904) (pCi/L)													
Gross Alpha	NA	15	0.292-2.68*	2.79	2.0	3.2	32.3	0.96	0.372 U	3.39	13.5	1.17	7.59
Gross Beta	NA	***	0.384-2.22*	3.34	3.3	68.8	28.2	6.88	3.81	1.78	7.61	6	6.14
Radium-226	NA	5**	0.564-0.918*	2.54	1.42	2.42	7.94	1.09	0.562 U	1.33	4.96	0.915 U	2.17
Radium-228	NA	5**	3.86-7.66*	1.54	14.1 U	1.45	1.07 U	20.5	0.968 U	1.25	2.42	1.09	0.943
Inorganic Constituents (USEPA E420.1) (mg/L)													
Phenols (total)	NA	PQL	9.2	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U

See notes at end of table.

Table 2-3 (Continued)
Summary of Groundwater Analytical Results for Listed Constituents (Condition 12)

Annual RCRA Groundwater Monitoring Report
January 2004
Domestic Sludge Drying Beds (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Beds (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GWPS[1]	MDL (no dilution factor)/MDA Range	ISDB (PSC 43)			BKG	Blanks	
				NAS 4-4	NAS 4-5R	NAS 4-12D	NAS 4-9	NAS-EB01	NAS-FB01
				1/15/2004	1/13/2004	1/15/2004	1/15/2004	1/15/2004	1/14/2004
Volatile Organics (USEPA Method 8260B) (µg/L)									
1,2-Dichlorobenzene	NA	10	0.15	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Semi-Volatile Organics (USEPA Method 8270C) (µg/L)									
2-Methylphenol	NA	35	0.9	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U
3&4-Methylphenol	NA	4****	1.3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Pyridine	NA	7	1.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Metals (USEPA SW-846 6010B/7470A) (µg/L)									
Arsenic	13.2	50	2.6	2.6 U	3.3 I	2.6 U	2.6 U	2.6 U	2.6 U
Cadmium	8.2	5	0.2	2.8	0.21 I	0.3 I	0.25 I	0.2 U	0.38 I
Chromium	208	100	0.85	1.9 I	4.7 I	0.85 U	0.85 U	0.85 U	0.85 U
Iron	68292	500	13.1	48.2	**1040**	**1530**	**1020**	26.1 I	13.1 U
Lead	45.8	15	1.1	1.1 U	1.4 I	1.1 U	1.1 U	1.1 U	1.1 U
Manganese	204	50	0.094	9.9 I	5.3 I	41.4	7.1 I	0.21 I	0.094 U
Sodium	24626	160,000	182	23300	1670 I	12700	2690 I	182 U	182 U
Vanadium	294	49	0.64	8.8	9.9	0.64 U	4.2 I	0.64 U	0.64 U
Zinc	173.2	5,000	4	4.3 I	5.5 I	26.6	4.0 U	4.0 U	4.0 U
RAD Constituents (USEPA Methods 900, 903, and 904) (pCi/L)									
Gross Alpha	NA	15	0.292-2.68*	3.13	0.657 U	0.714	1.68	0.165 U	0.0997 U
Gross Beta	NA	***	0.384-2.22*	**3.64**	**6.34**	**1.88**	**3.18**	0.428 U	0.416 U
Radium-226	NA	5**	0.564-0.918*	1.71	1.27	1.13	1.25	0.517	0.330 U
Radium-228	NA	5**	3.86-7.66*	1.53	1.57	1.38	1.12 U	0.903 U	14.7 U
Inorganic Constituents (USEPA E420.1) (mg/L)									
Phenols (total)	NA	PQL	9.2	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U	9.2 U

Notes:

To provide the appropriate qualifiers, TtNUS used the data qualifier codes from the laboratory Form 1's to create this summary table. Chapter 62-160, FAC, does not provide validation specifications or protocols. Since no Florida requirements for validation exists, TtNUS used standard USEPA protocols and qualifiers in the validation tables. The qualifiers and some of the values in the validation packages do not match this summary table for this reason.

[1]GWPS in Post-closure Permit 0072437-005-HF; Chapter 62-777, FAC; and 40 CFR 264-94.
[2]Dilution factor = 10 for volatile organics
[3]Dilution factor = 5 for volatile organics
* = Expressed as MDA values
** = GWPS for radium
*** = GWPS established at PQL/RL
**** = GWPS for 4-methylphenol

pCi/L=picocuries per liter
DUP = duplicate
U = non detect
µg/L = micrograms per liter
NA = not applicable
BKG = background well

PQL = practical quantitation limit
MDA = minimum detectable activity
Bold/shaded concentrations exceed GWPS/MDAs.
RL = reporting limit

I = The reported value is between the laboratory method detection limit and the laboratory PQL.

Table 2-4
Summary of Groundwater Analytical Results for Appendix IX Constituents (Section 14)

Annual Compliance Monitoring Report
January 2002
Industrial Sludge Drying Bed (ISDB), Polishing Pond (PP), and Domestic Sludge Drying Bed (DSDB)
Naval Air Station Jacksonville
Jacksonville, Florida

			ISDB (PSC 41)			PP (PSC 42)					DSDB (PSC 43)				BKG
Compound	**Background Screening Values**	**GCTLs/GWPS[1]**	**NAS 4-4**	**NAS 4-5R**	**NAS 4-12D**	**NAS 42-5R**	**NAS 42-6R**	**NAS 42-7R**	**NAS 42-8-2R**	**MW 017**	**NAS 41-2**	**NAS 41-3**	**NAS 41-4**	**NAS 41-6**	**NAS 4-9**
			1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002	1/28/2002
Detected Appendix IX Volatile Organics (USEPA Method 8260B)(µg/L)															
Benzene	NA	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.5**
1,1-Dichloroethane	NA	70	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4J	1.0J	ND	ND
1,2-Dichloroethene (Total)	NA	63	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.51J	ND	ND	ND
Ethylbenzene	NA	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3
p-Isopropyltoluene	NA	0.8*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.5	ND	ND
Methyl tertiary butyl ether	NA	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27.8	ND	ND
Detected Appendix IX Semi-Volatile Organics (USEPA Method 8270)(µg/L)															
Benzaldehyde	NA	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.7J	ND	ND
1,4-Dioxane	NA	5	ND	ND	ND	ND	ND	**11.3**	ND	ND	ND	**12.1**	**19.6**	ND	ND
Phenol	NA	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.6	ND	ND
Detected Appendix IX Metals (USEPA SW-846 6010B/7000A)(µg/L)															
Arsenic	13.2	50	ND	ND	ND	33.6	21.2	ND	ND	ND	ND	ND	ND	ND	ND
Barium	616	2000	ND	ND	ND	ND	ND	ND	ND	ND	ND	226	ND	ND	ND
Cadmium	8.2	5	**5.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	208	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	47.8	ND	ND
Lead	45.8	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**34.3**	ND	ND
Nickel	74.8	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	45	ND	ND
Vanadium	294	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**157**	ND	ND

Notes:
[1]Groundwater Protection Standards in Post-Closure Permit 0072437-005-HF, FAC 62-777, and 40 CFR 264-94.
USEPA = United States Environmental Protection Agency.
J = Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The reported concentration is considered to be an estimate.
*=GCTL/GWPS for cumene (or isopropyl benzene)
GCTL=Groundwater Concetration Target Level

Bolded/highlighted concentrations exceed GCTL/GWPS.
DUP = Duplicate.
ND = non detect.
µg/L = micrograms per liter.

NA=not applicable
BKG = Background Well

Table 2-4
Summary of Detected Groundwater Analytical Results for Appendix IX Constituents (Condition 14)
Not Otherwise Reported Under Part III Condition 12

Annual RCRA Groundwater Monitoring Report
January 2003
Domestic Sludge Drying Bed (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Bed (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GCTLs	MDL	DSDB (PSC 41)				PP (PSC 42)					ISDB (PSC 43)				BKG	Blanks	
				NAS 41-2	NAS 41-3	NAS 41-4	NAS 41-6	NAS 42-5R	NAS 42-6R	NAS 42-7R	NAS 42-8-2R	MW-017	NAS 4-4	NAS 4-5R	NAS 4-5R DUP	NAS 4-12D	NAS 4-9	01-CB	01-FB
				1/8/2003	1/8/2003	1/8/2003	1/8/2003	1/9/2003	1/9/2003	1/9/2003	1/9/2003	1/9/2003	1/10/2003	1/10/2003	1/10/2003	1/10/2003	1/8/2003	1/10/2003	1/10/2003
Dectected Appendix IX Volatile Organics (USEPA Method 8260B) (µg/L)																			
Acetone	NA	700	1.1	2.2 I,V	4.0 I,V	9.2 V	2.6 I,V	2.3 I,V	U	4.3 I,V	3.2 I,V	2.4 I,V	U	3.6 I,V	2.5 I,V	2.5 I,V	2.7 I,V	13 V	13 V
2-Butanone	NA	4200	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	3.8 I,V	3.9 I,V
Carbon Disulfide	NA	700	0.2	0.94 I	U	2.6	U	1.2	1.4	0.69 I	U	U	U	0.71 I	0.74 I	1.3	0.57 I	U	0.62 I
1,1-Dichloroethane	NA	70	0.2	U	U	0.54 I	U	U	U	U	U	U	U	U	U	U	U	U	U
Methylene Chloride	NA	5	0.8	0.81 I,V	1.0 V	0.94	0.81 I,V	1.0 V	1.3 V	1.1 V	1.1 V	0.95 I,V	1.2 V	0.84 I,V	0.88 I,V	0.83 I,V	0.81 I,V	2.3 V	2.2 V
Dectected Appendix IX Semi-Volatile Organics (USEPA Method 8270) (µg/L)																			
Bis(2-Ethylhexyl)Phthalate	NA	10	1.6	U	U	U	3.4 J	U	U	6.5 J	U	1.8 J	10	U	U	U	U	U	U
Di-N-Butyl Phthalate	NA	10	1.3	6.8 J	3.7 J	1.5 J	6.8 J	12	10	5.2 J	15	6.2 J	6.9 J	U	1.9 J	3 J	8.3 J	1.4 J	3.6 J
Naphthalene	NA	20	0.1	U	U	U	U	U	U	U	U	U	U	U	U	U	0.38	0.1 J	0.11
Dectected Appendix IX Metals (USEPA SW-846 6010B/7000A) (µg/L)																			
Barium	616	2000	0.3	79.6	175	271	61.2	50.2	13.4	113	23	7.2	7.1	9.8	9.7	71	36.1	0.31 I	0.5 I
Beryllium	8.2	3	0.1	U	U	1.7 I	U	U	U	0.15 I	U	U	U	U	U	U	U	U	U
Cobalt	22.6	420	0.8	4.7 I	3.4 I	3.3 I	U	U	U	U	U	U	U	U	U	6.4	U	U	U
Copper	40.4	1000	0.8	0.94 I	1.1 I	18.2	1.3 I	U	U	U	U	U	U	0.85 I	U	3.9 I	U	2.2 I	0.93 I
Mercury	0.98	2	0.1	U	U	0.24	U	U	U	U	U	U	U	U	U	U	U	U	U
Nickel	74.8	100	1.3	1.6 I	9.9 I	54.4	U	U	U	U	1.4 I	U	U	U	U	1.6 I	U	U	U
Selenium	13.8	50	4.1	U	U	6.4 I	U	U	U	U	U	U	U	U	U	U	U	U	U

Notes:

To provide the appropriate qualifiers, TtNUS used the data qualifier codes from the laboratory Form 1's to create this summary table. Chapter 62-160, FAC, does not provide validation specifications or protocols. Since no Florida requirements for validation exists, TtNUS used standard USEPA protocols and qualifiers in the validation tables. The qualifiers and some of the values in the validation packages do not match this summary table for this reason.

V = Indicates that the analyte was detected in both the sample and the associated method blank. Note: The value in the blank shall not be subtracted from associated samples.
I = The reported value is between the laboratory MDL and the laboratory PQL.
GCTLs derived from Chapter 62-777, FAC.
Bold/highlighted concentrations exceed GCTLs.
J = Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The reported concentration is considered to be an estimate.

DUP = duplicate
U = non detect
NA = not applicable
BKG = background well
CB = pre-cleaned blank
FB = field cleaned blank

Table 2-4
Summary of Detected Groundwater Analytical Results for Appendix IX Constituents (Condition 14)
Not Otherwise Reported Under Part III Condition 12

Annual RCRA Groundwater Monitoring Report
January 2004
Domestic Sludge Drying Beds (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Beds (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GCTLs	MDL (no dilution factor)	DSDB (PSC 41)					PP (PSC 42)				
				NAS 41-2	NAS 41-2 DUP	NAS 41-3	NAS 41-4[1]	NAS 41-6	NAS 42-5R[2]	NAS 42-6R	NAS 42-7R[2]	NAS 42-8-2R[2]	MW-017R
				1/14/2004	1/14/2004	1/14/2004	1/14/2004	1/13/2004	1/15/2004	1/13/2004	1/15/2004	1/15/2004	1/9/2003
Dectected Appendix IX Volatile Organics (USEPA Method 8260B) (µg/L)													
Acetone	NA	700	0.66	0.96 I	0.66 U	1.1 I	6.6 I	0.88 I	3.3 U	0.79 I	3.3 U	3.3 U	2.7 I
2-Butanone	NA	4200	0.36	0.36 U	0.36 U	0.36 U	3.6 U	0.36 U	1.8 U	0.36 U	1.8 U	1.8 U	10 I
Bromomethane	NA	9.8	0.16	0.16 U	0.16 U	0.16 U	1.6 U	0.16 U	0.8 U	0.16 U	0.8 U	0.8 U	0.16 U
1,1-Dichloroethane	NA	70	0.26	0.29 I	0.26 U	0.58 I	2.6 U	0.26 U	1.3 U	0.26 U	1.3 U	1.3 U	0.26 U
Benzene	NL	1	0.2	0.2 U	0.2 U	0.2 U	2.0 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	0.2 U
Ethylbenzene	NA	5	0.19	0.19 U	0.19 U	0.19 U	1.9 U	0.19 U	0.95 U	0.19 U	0.95 U	0.95 U	0.19 U
Dectected Appendix IX Semi-Volatile Organics (USEPA Method 8270) (µg/L)													
Bis(2-Ethylhexyl)Phthalate	NA	10	0.2	8 I	0.45 I	1.5 I	0.46 I	0.2 U	0.63 I	0.2 U	1.0 U	0.62 I	0.54 I
Di-N-Butyl Phthalate	NA	10	0.37	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Diethyl phthalate	NL	5600	0.25	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Acetophenone	NL	700	0.65	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.25 U	0.65 U	0.25 U	0.25 U	0.65 U
Caprolactam	NA	20	0.45	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.67 I	0.45 U	0.51 I	2.25 U	0.45 U
Dectected Appendix IX Metals (USEPA SW-846 6010B/7000A) (µg/L)													
Antimony	NL	6	2.2	2.2 I	2.2 U	2.2 U	2.2 U	2.2 U	2.2 I	2.2 U	2.2 U	2.2 U	2.2 U
Barium	616	2000	0.15	88.1 I	96.5 I	142 I	177 I	37 I	47.5 I	14.2 I	149	48.5 I	92.1 I
Beryllium	8.2	3	0.035	0.087 I	0.11 I	0.035 U	0.86 I	0.035 U	0.052 I	0.14 I	0.59 I	0.035 U	0.035 U
Cobalt	22.6	420	0.4	5.8 I	6.2 I	5.1 I	4.3 I	0.4 U	1.3 I	0.58 I	2.1 I	0.4 U	1.9 I
Copper	40.4	1000	0.56	0.56 U	0.56 U	0.56 U	13.3 I	0.85 I	0.56 U	0.77 I	3.1 I	0.56 U	5.7 I
Mercury	0.98	2	0.1	0.1 U	0.1 U	0.1 U	0.26	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	74.8	100	1	5.1 I	5.4 I	15.9 I	40.7	1.1 I	4.2 I	1 I	7.9 I	4.3 I	4.4 I
Selenium	13.8	50	3.4	3.4 U	3.4 U	3.4 U	4.1 I	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.5 I
Thallium	NL	NL	3.5	3.5 U	3.5 U	3.5 U	3.5 U	4.1 I	3.5 U	3.5 U	3.5 U	3.5 U	4.8 I

See notes at end of table.

Table 2-4 (Continued)
Summary of Detected Groundwater Analytical Results for Appendix IX Constituents (Condition 14)
Not Otherwise Reported Under Part III Condition 12

Annual RCRA Groundwater Monitoring Report
January 2004
Domestic Sludge Drying Beds (DSDB), Polishing Pond (PP), and Industrial Sludge Drying Beds (ISDB)
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Background Screening Values	GCTLs	MDL (no dilution factor)	ISDB (PSC 43)			BKG	Blanks	
				NAS 4-4	NAS 4-5R	NAS 4-12D	NAS 4-9	NAS-EB01	NAS-FB01
				1/15/2004	1/13/2004	1/15/2004	1/15/2004	1/15/2004	1/14/2004
Dectected Appendix IX Volatile Organics (USEPA Method 8260B) (µg/L)									
Acetone	NA	700	0.66	0.66 U	1.2 I	0.66 U	16 V	NA	11 V
2-Butanone	NA	4200	0.36	0.36 U	10 U	0.36 U	10 U	NA	7 I
Bromomethane	NA	9.8	0.16	0.16 U	0.23 I	0.16 U	0.16 U	NA	1 U
1,1-Dichloroethane	NA	70	0.26	0.26 U	0.26 U	0.26 U	0.26 U	NA	0.26 U
Benzene	NL	1	0.2	0.2 U	0.2 U	0.2 U	1.7	NA	0.2 U
Ethylbenzene	NA	5	0.19	0.19 U	0.19 U	0.19 U	0.52I	NA	0.19 U
Dectected Appendix IX Semi-Volatile Organics (USEPA Method 8270) (µg/L)									
Bis(2-Ethylhexyl)Phthalate	NA	10	0.2	0.2 U	1.1 I	10 I	0.2 U	0.55 I	0.61 I
Di-N-Butyl Phthalate	NA	10	0.37	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.46 I
Diethyl phthalate	NL	5600	0.25	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.53 I
Acetophenone	NL	700	0.65	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.77 I
Caprolactam	NA	20	0.45	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
Dectected Appendix IX Metals (USEPA SW-846 6010B/7000A) (µg/L)									
Antimony	NL	6	2.2	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Barium	616	2000	0.15	10.6 I	21.2 I	74.6 I	64.1 I	0.15 U	0.15 U
Beryllium	8.2	3	0.035	0.035 U	0.037 I	0.075 I	0.25 I	0.035 U	0.035 U
Cobalt	22.6	420	0.4	0.4 U	0.4 I	7.1	0.4 U	0.4 U	0.4 U
Copper	40.4	1000	0.56	1.3 I	2.1 I	0.89 I	0.56 U	0.56 U	0.98 I
Mercury	0.98	2	0.1	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	74.8	100	1	4.5 I	2.2 I	5.7 I	1.2 I	1 U	1 U
Selenium	13.8	50	3.4	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Thallium	NL	NL	3.5	3.5 U	4.9 I	3.9 I	3.5 U	3.5 U	3.5 U

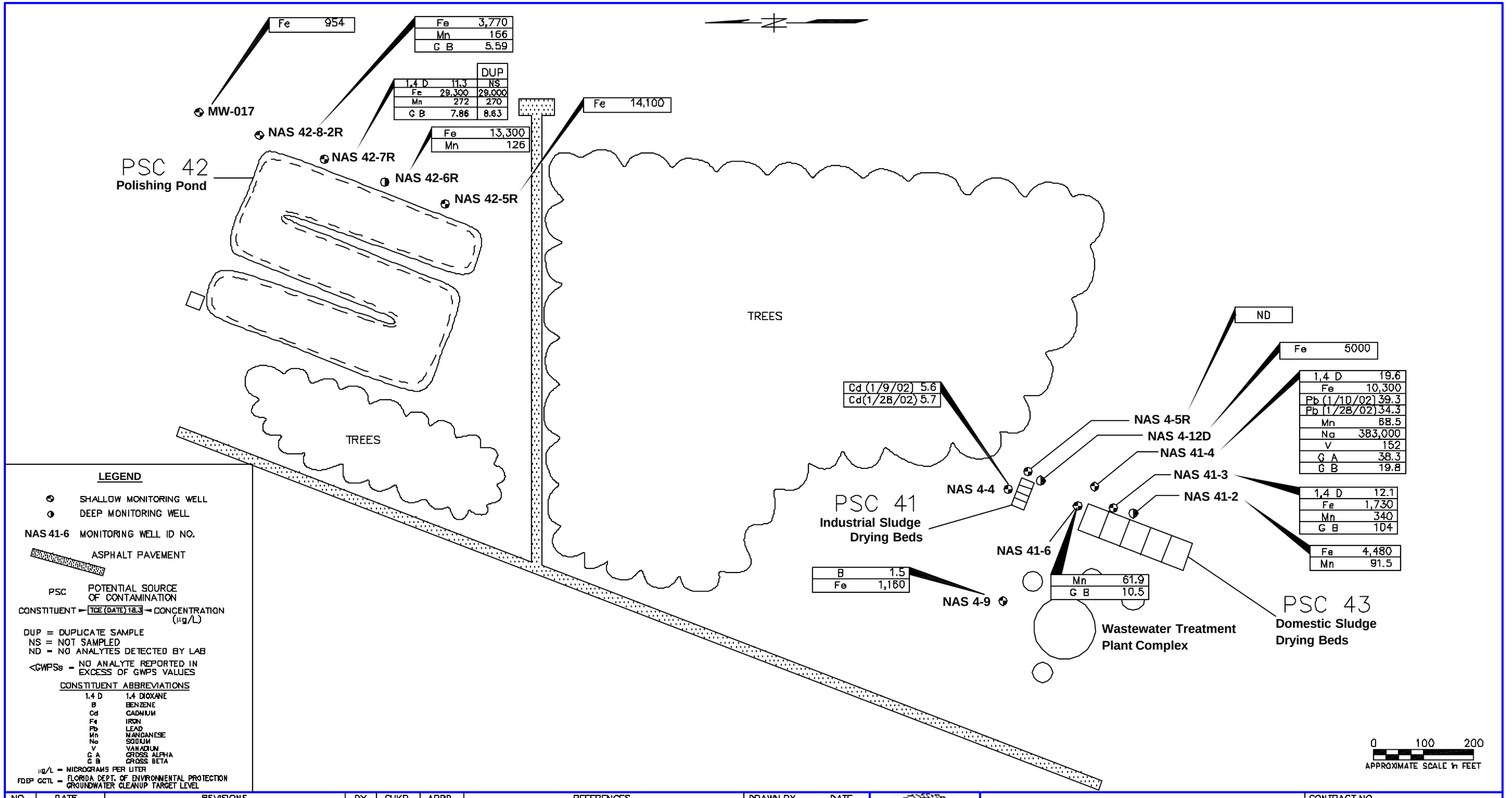
Notes:

To provide the appropriate qualifiers, TtNUS used the data qualifier codes from the laboratory Form 1's to create this summary table. Chapter 62-160, FAC, does not provide validation specifications or protocols. Since no Florida requirements for validation exists, TtNUS used standard USEPA protocols and qualifiers in the validation tables. The qualifiers and some of the values in the validation packages do not match this summary table for this reason.

[1]Dilution factor = 10 for volatile organics
[2]Dilution factor = 5 for volatile organics
Bold/shaded concentrations exceed GCTLs.
DUP = duplicate
BKG = background well
GCTLs derived from Chapter 62-777, FAC.
U = non detect
NA = not applicable
CB = pre-cleaned blank
FB = field cleaned blank
NL = not listed

V = Indicates that the analyte was detected in both the sample and the associated method blank. Note: The value in the blank shall not be subtracted from associated samples.
I = The reported value is between the laboratory MDL and the laboratory PQL.

S:\PROJECTS\NASJAX\CTD216\CAD\4146_PSC41-43



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- NAS 41-6 MONITORING WELL ID NO.
- ASPHALT PAVEMENT
- PSC POTENTIAL SOURCE OF CONTAMINATION
- CONSTITUENT — TCE (DATE) 18.3 — CONCENTRATION (µg/L)
- DUP = DUPLICATE SAMPLE
- NS = NOT SAMPLED
- ND = NO ANALYTES DETECTED BY LAB
- <GWPSs = NO ANALYTE REPORTED IN EXCESS OF GWPS VALUES

CONSTITUENT ABBREVIATIONS

1,4 D	1,4 DIOXANE
B	BENZENE
Cd	CADMIUM
Fe	IRON
Pb	LEAD
Mn	MANGANESE
Na	SODIUM
V	VANADIUM
G A	GROSS ALPHA
G B	GROSS BETA

µg/L = MICROGRAMS PER LITER
FDEP GCTL = FLORIDA DEPT. OF ENVIRONMENTAL PROTECTION GROUNDWATER CLEANUP TARGET LEVEL

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY LLK DATE 3/16/01
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

GROUNDWATER ANALYTICAL VALUES EXCEEDING CURRENT REGULATORY CRITERIA
JANUARY 2002
PSC 41, 42, and 43
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. 4145
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 3–1
REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98

NASJAX\CTO265\AnnualMonReport\Figures\4285GAD103IPD

NOTE: Groundwater samples Collected January 8–10, 2003

LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL

NAS 41–6 MONITORING WELL ID NO.

CONSTITUENT – GB 3.4 – CONCENTRATION (µg/L)

CONSTITUENT ABBREVIATIONS		GWPS (µg/L)
Fe	IRON	500
Pb	LEAD	15
Mn	MANGANESE	50
Na	SODIUM	160000
V	VANADIUM	49
		GWPS/MDA (pCi/L)
GA	GROSS ALPHA	15/0.292–2.68
GB	GROSS BETA	NL/0.384–2.22
R226	RADIUM–226	5/0.564–0.918
R228	RADIUM–228	5/3.86–7.65

GWPS = GROUNDWATER PROTECTION STANDARDS (IN POST–CLOSURE PERMIT)
MDA = MINIMAL DETECTABLE ACTIVITY
µg/L = MICROGRAMS PER LITER
pCi/L = PICOCURIES PER LITER

PSC – POTENTIAL SOURCE OF CONTAMINATION

MW–017
GB 1.21

NAS 42–8–2R
Fe 2880
Mn 167
GB 4.67

NAS 42–7R
Fe 25500
Mn 432
GB 5.87

NAS 42–6R
Fe 14300
GB 2.48

NAS 42–5R
Fe 13700
Mn 139
GB 4.62

PSC 42
POLISHING POND

TREES

TREES

NAS 4–4
GB 3.4

DUPLICATE
GB 2.36 2.47

Fe 3070
GB 1.84

NAS 4–5R
NAS 4–12D
NAS 41–4
NAS 41–3
NAS 41–2

Fe 13900
Pb 64.4
Mn 78.4
Na 279000
V 203
GA 102
GB 38.3
R226 19.4
R228 113

Fe 1160
Mn 232
GB 88.7
R228 6.92

Fe 3330
Mn 102
GB 2.41

PSC 43
INDUSTRIAL SLUDGE DRYING BEDS

NAS 41–6
Fe 982
Mn 66.2
GB 11.5

NAS 4–9
Fe 930
GB 7.06

PSC 41
DOMESTIC SLUDGE DRYING BEDS

WASTEWATER TREATMENT PLANT COMPLEX

0 100 200
APPROXIMATE SCALE in FEET

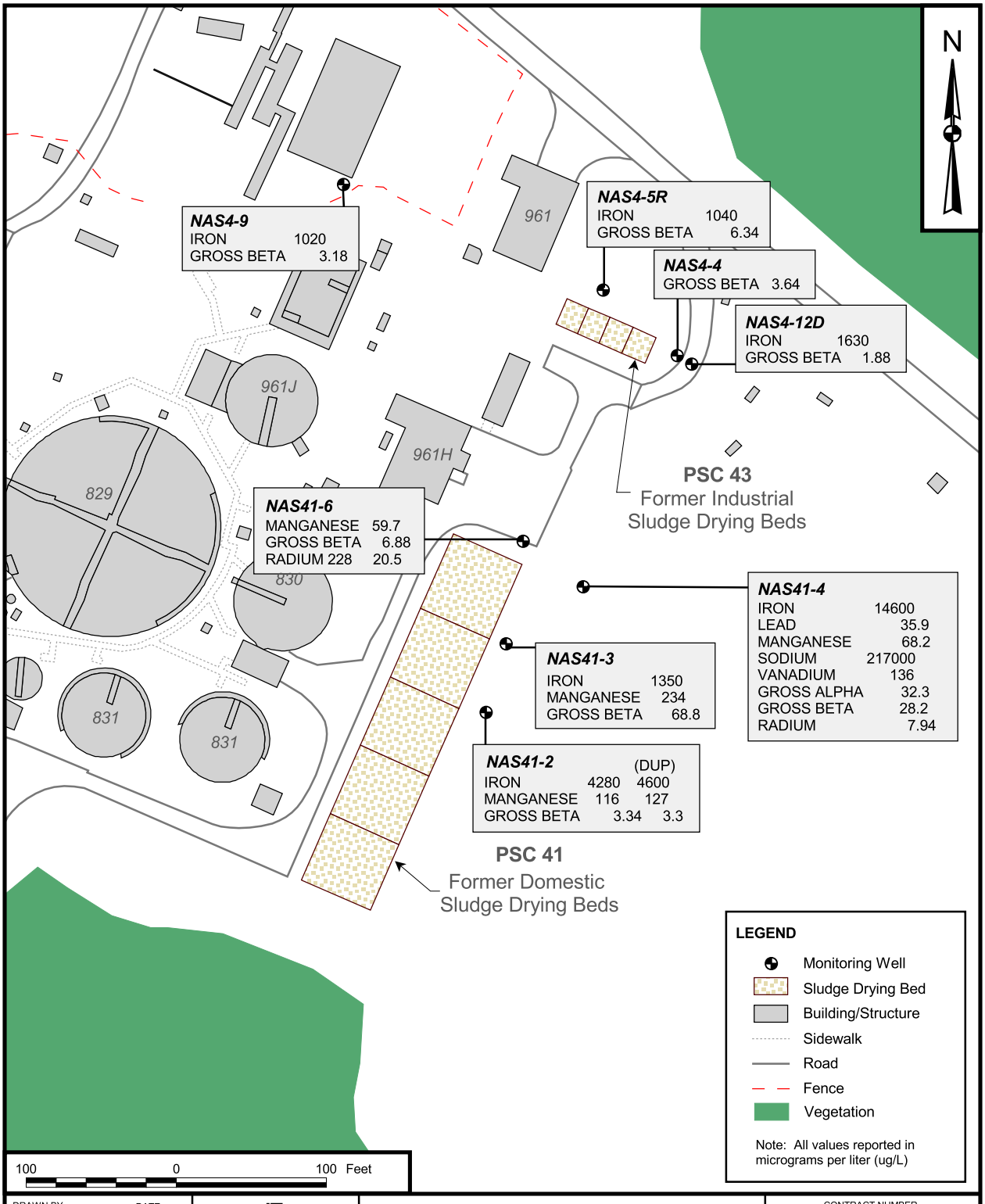
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY LLK DATE 3/14/03
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

PART III, CONDITION 12 CONSTITUENTS EXCEEDING GWPS
JANUARY 2003
ANNUAL RCRA GROUNDWATER MONITORING REPORT
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

CONTRACT NO. 4285
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 3–1
REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98



DRAWN BY J. LAMEY	DATE 2/23/04	PSCs 41 AND 43	CONTRACT NUMBER 6287
CHECKED BY	DATE	PART III, CONDITION 12 CONSTITUENTS EXCEEDING GWPS	APPROVED BY — DATE —
COST/SCHEDULE-AREA		JANUARY 2004	APPROVED BY — DATE —
SCALE AS NOTED		ANNUAL RCRA GROUNDWATER MONITORING REPORT NAS JACKSONVILLE JACKSONVILLE, FLORIDA	DRAWING NO. FIGURE 3-1 REV 0

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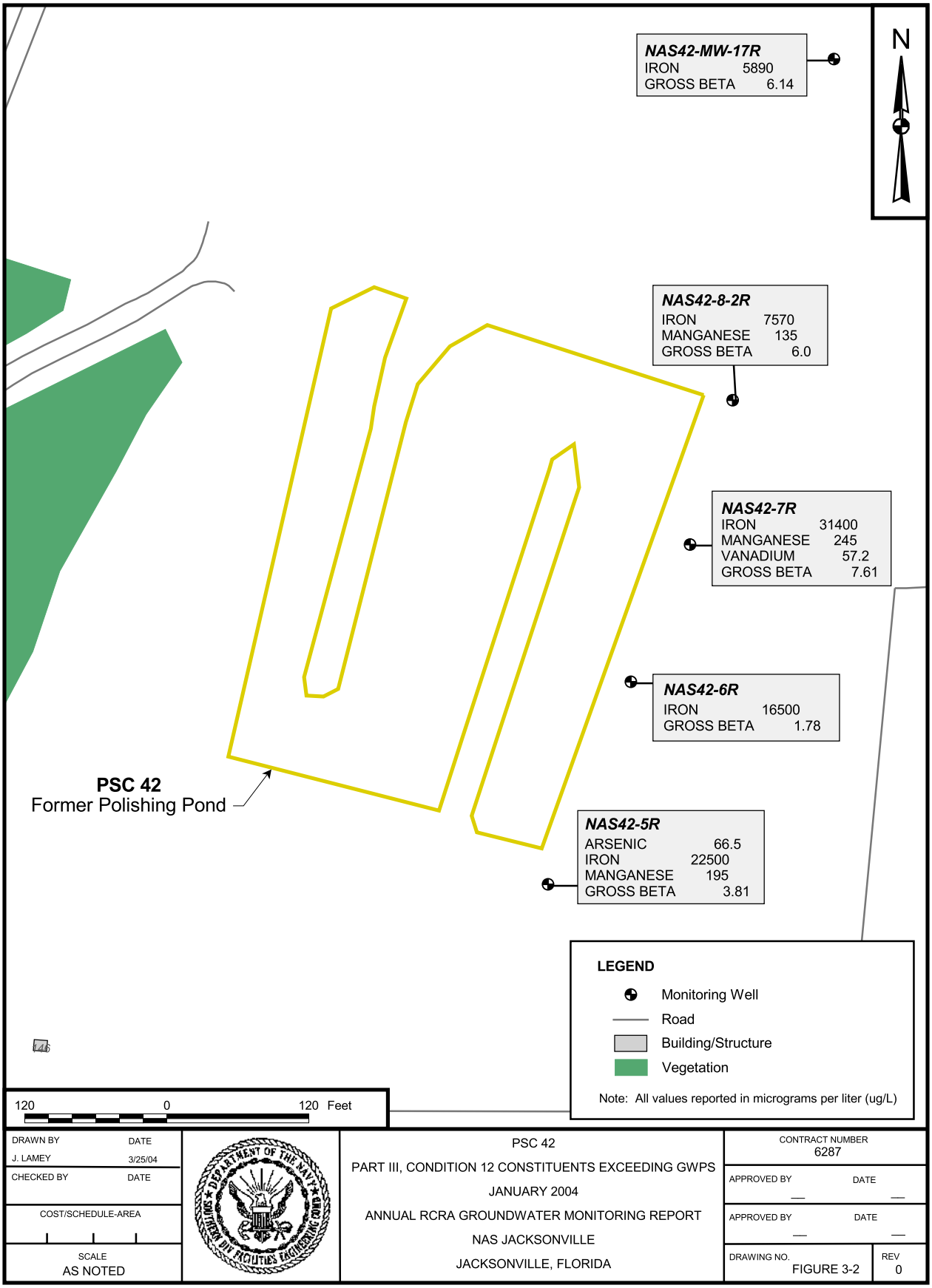

DRAWN BY: J. LAMEY DATE: 3/25/04		PSC 42	CONTRACT NUMBER: 6287
CHECKED BY: DATE:		PART III, CONDITION 12 CONSTITUENTS EXCEEDING GWPS	APPROVED BY: — DATE: —
COST/SCHEDULE-AREA		JANUARY 2004	APPROVED BY: — DATE: —
SCALE: AS NOTED		ANNUAL RCRA GROUNDWATER MONITORING REPORT NAS JACKSONVILLE JACKSONVILLE, FLORIDA	DRAWING NO.: FIGURE 3-2 REV: 0

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APPENDIX D

OU 3 RI/FS INFORMATION

Table 4-6
Summary of Detections in Surface Water

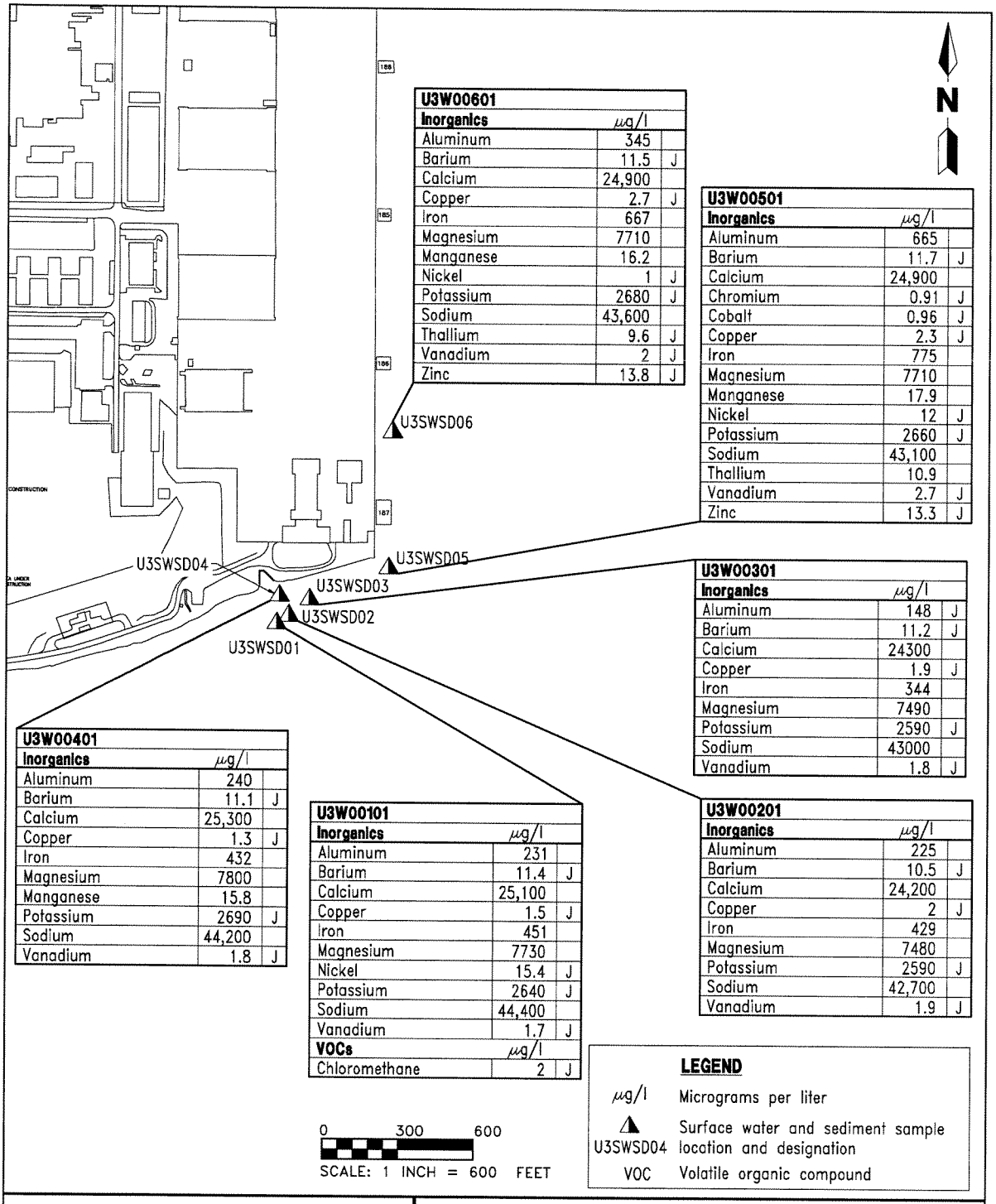
Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Volatile Organic Compounds (F g/ℓ)			
Chloromethane	1/10	2 to 2	2
Methylene Chloride	2/10	0.5 to 0.6	0.55
Inorganic Analytes (F g/ℓ)			
Aluminum	10/10	148 to 665	353
Barium	10/10	10.5 to 12.2	11.4
Calcium	10/10	23,900 to 25,300	24,775
Chromium	1/10	0.91 to 0.91	0.91
Cobalt	2/10	0.89 to 0.96	0.93
Copper	10/10	1.3 to 3.6	2.1
Iron	10/10	344 to 775	577
Magnesium	10/10	7,400 to 7,900	7,683
Manganese	7/10	11.9* to 25.1	16.9
Nickel	5/10	1 to 15.4	6.2
Potassium	10/10	2,580 to 2,840	2,671
Sodium	10/10	41,900 to 45,800	43,730
Thallium	2/10	9.6 to 10.9	10.3
Vanadium	10/10	1.7 to 2.7	2
Zinc	6/10	8 to 18.9	13.3
General Chemistry (mg/ℓ)			
Hardness, as $CaCO_3$	2/2	91 to 110	101

[1] Frequency of detection is the number of surface water samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: Analytical results summarized include the following samples: U3W00101, U3W00201, U3W00301, U3W00401, U3W00501, U3W00601, U3W00701, U3W00801 (and field duplicate), U3W00901, and U3W01001.

Fg/ℓ= micrograms per liter.
* = average of both sample and field duplicate.
mg/ℓ = milligrams per liter.
$CaCO_3$ = calcium carbonate.



U3W00601		
Inorganics	µg/l	
Aluminum	345	
Barium	11.5	J
Calcium	24,900	
Copper	2.7	J
Iron	667	
Magnesium	7710	
Manganese	16.2	
Nickel	1	J
Potassium	2680	J
Sodium	43,600	
Thallium	9.6	J
Vanadium	2	J
Zinc	13.8	J

U3W00501		
Inorganics	µg/l	
Aluminum	665	
Barium	11.7	J
Calcium	24,900	
Chromium	0.91	J
Cobalt	0.96	J
Copper	2.3	J
Iron	775	
Magnesium	7710	
Manganese	17.9	
Nickel	12	J
Potassium	2660	J
Sodium	43,100	
Thallium	10.9	
Vanadium	2.7	J
Zinc	13.3	J

U3W00301		
Inorganics	µg/l	
Aluminum	148	J
Barium	11.2	J
Calcium	24300	
Copper	1.9	J
Iron	344	
Magnesium	7490	
Potassium	2590	J
Sodium	43000	
Vanadium	1.8	J

U3W00401		
Inorganics	µg/l	
Aluminum	240	
Barium	11.1	J
Calcium	25,300	
Copper	1.3	J
Iron	432	
Magnesium	7800	
Manganese	15.8	
Potassium	2690	J
Sodium	44,200	
Vanadium	1.8	J

U3W00101		
Inorganics	µg/l	
Aluminum	231	
Barium	11.4	J
Calcium	25,100	
Copper	1.5	J
Iron	451	
Magnesium	7730	
Nickel	15.4	J
Potassium	2640	J
Sodium	44,400	
Vanadium	1.7	J
VOCs	µg/l	
Chloromethane	2	J

U3W00201		
Inorganics	µg/l	
Aluminum	225	
Barium	10.5	J
Calcium	24,200	
Copper	2	J
Iron	429	
Magnesium	7480	
Potassium	2590	J
Sodium	42,700	
Vanadium	1.9	J

LEGEND

µg/l	Micrograms per liter
U3SWSD04	Surface water and sediment sample location and designation
VOC	Volatile organic compound

FIGURE 4-5A

ANALYTICAL DETECTIONS IN SURFACE WATER AT LOCATIONS SOUTHEAST OF OPERABLE UNIT 3

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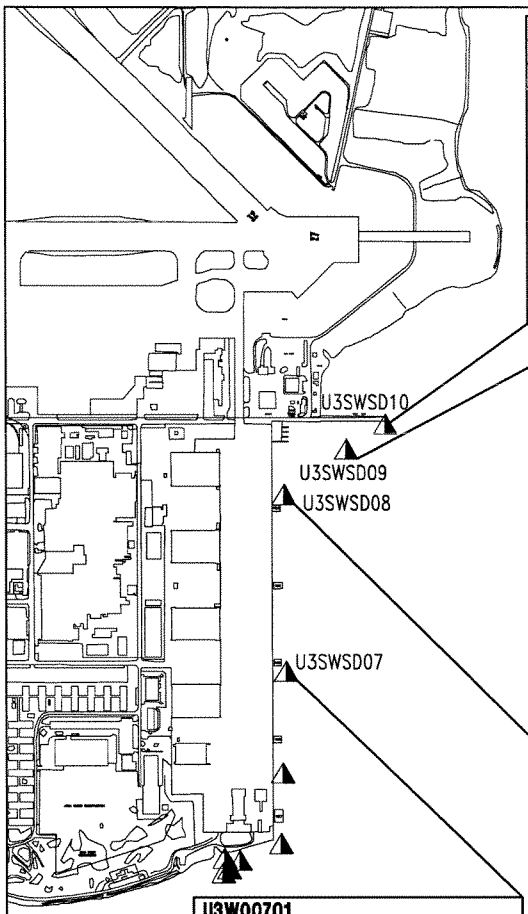
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE JACKSONVILLE, FLORIDA



U3W01001		
Inorganics	µg/l	
Aluminum	511	
Barium	11.9	J
Calcium	24,800	
Copper	2	J
Iron	745	
Magnesium	7,900	
Manganese	18	
Potassium	2,840	J
Sodium	45,800	
Vanadium	1.9	J
Zinc	17.1	J

U3W00901		
Inorganics	µg/l	
Aluminum	413	
Barium	12.2	J
Calcium	25,200	
Cobalt	0.89	J
Copper	3.6	J
Iron	745	
Magnesium	7,790	
Manganese	25.1	
Nickel	1.4	J
Potassium	2,730	J
Sodium	44,200	J
Vanadium	2.4	J
Zinc	18.9	J
VOCs	µg/l	
Methylene chloride	0.5	J

	U3W00801		U3W00801D	
Inorganics	µg/l		µg/l	
Aluminum	334		279	
Barium	11.7	J	10.7	J
Calcium	26,200		24,100	
Copper	2.3	J	1.7	J
Iron	502		482	
Magnesium	8,140		7,490	
Manganese	12	J	11.8	J
Potassium	2,800	J	2,620	J
Sodium	45,500		43,300	
Vanadium	2.1	J	1.7	J
Zinc	10.3	J	7.5	J
VOCs	µg/l		µg/l	
Methylene chloride	0.6	J		

U3W00701		
Inorganics	µg/l	
Aluminum	441	
Barium	11	J
Calcium	23,900	
Copper	2.1	J
Iron	694	
Magnesium	7,400	
Nickel	13.2	J
Potassium	1.4	J
Sodium	2,580	J
Vanadium	41,900	

LEGEND

▲ U3SWSD07	Surface water and sediment sample location and designation
U3W00701	Surface water sample identifier
VOC	Volatile organic compound
µg/l	Micrograms per liter
J	Estimated value
D	Duplicate

0 700 1400

SCALE: 1 INCH = 1400 FEET

FIGURE 4-5B

ANALYTICAL DETECTIONS IN SURFACE WATER AT LOCATIONS NORTHEAST OF OPERABLE UNIT 3

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE JACKSONVILLE, FLORIDA

Table 4-7
Summary of Detections in Sediment

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Volatile Organic Compounds (F g/kg)			
2-Butanone	3/10	81 to 130	110
Acetone	6/10	41 to 625*	279
Carbon disulfide	1/10	14 to 14	14
Polyaromatic Hydrocarbons (F g/kg)			
2-Methylnaphthalene	1/3	617.5* to 617.5*	618
Benzo(a)anthracene	6/13	9.1 to 1,800	395
Benzo(a)pyrene	10/13	11 to 3,000	449
Benzo(b)fluoranthene	9/13	28 to 2,300	442
Benzo(g,h,i)perylene	4/13	35 to 1,300	457
Benzo(k)fluoranthene	4/13	15 to 1,500	457
Chrysene	2/13	615* to 1,200	908
Dibenzo(a,h)anthracene	9/13	19 to 740	193
Fluoranthene	11/13	14 to 2,100	416
Indeno(1,2,3-cd)pyrene	5/13	24 to 1,600	420
Naphthalene	1/13	572.5* to 572.5*	573
Phenanthrene	1/13	337.75* to 337.75*	338
Pyrene	11/13	14 to 3,000	561
Inorganic Analytes (mg/kg)			
Aluminum	13/13	407 to 14,100	4,543
Arsenic	4/13	9 to 12.85*	11
Barium	10/13	4.2 to 45.5	20.2
Beryllium	2/13	0.61 to 0.645*	0.63
Cadmium	14/16	0.46 to 4.2	1.5
Calcium	12/13	459 to 68,700	13,210
Chromium	13/13	5.3 to 101	27.8
Cobalt	8/13	0.25 to 4.1	2.1
Copper	13/13	2 to 57.2	15.4
Iron	13/13	771 to 23,950*	7,630
Lead	13/13	11.9 to 185	54.6
Magnesium	10/13	119 to 6,105*	2,489
Manganese	13/13	12.5 to 377	115
Mercury	10/16	0.08 to 0.62*	0.27
Nickel	13/13	1.3 to 21	11.2
Potassium	6/13	132 to 1,520*	962

See notes at end of table.

Table 4-7 (Continued)
Summary of Detections in Sediment

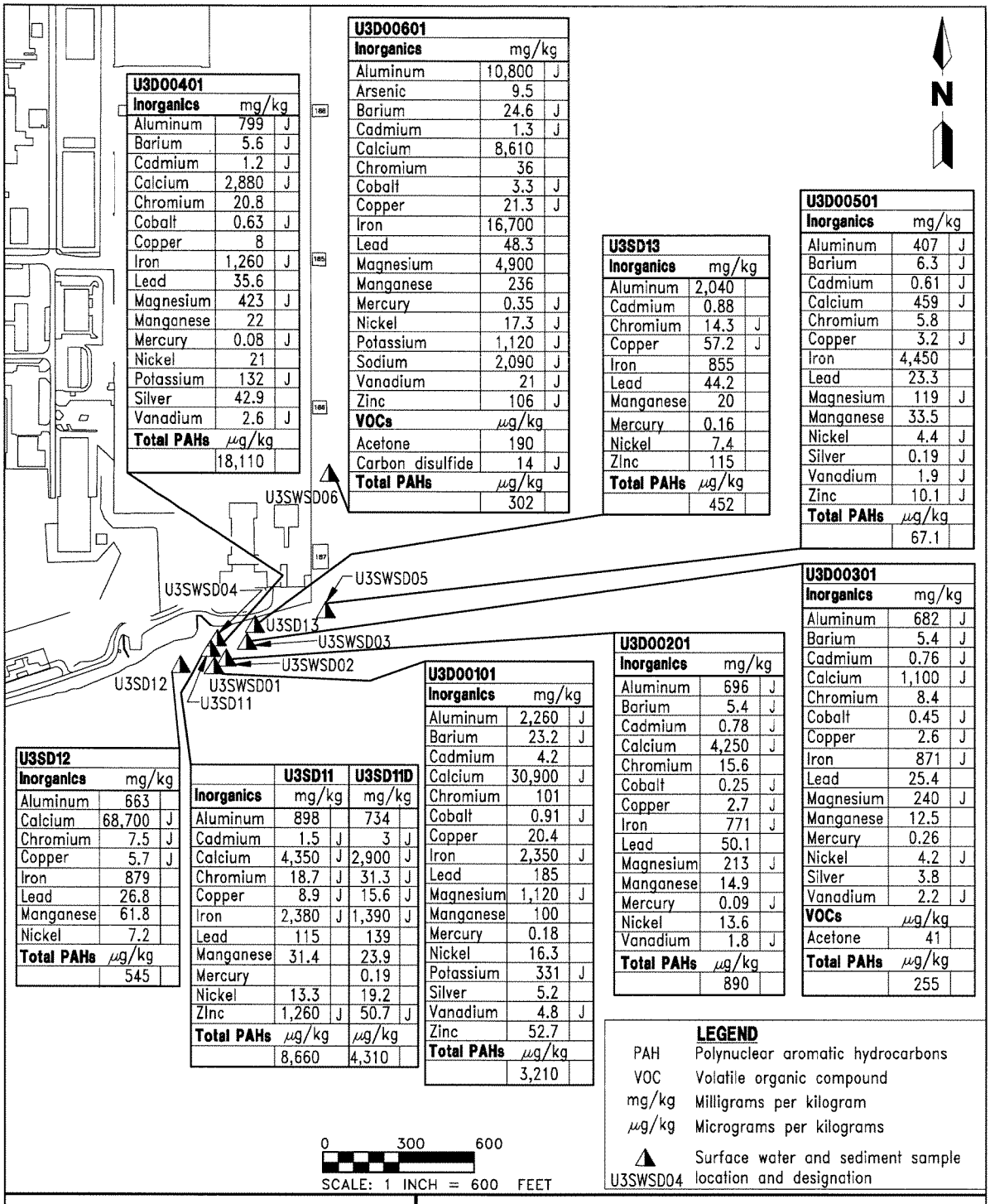
Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Inorganic Analytes (mg/kg) (Continued)			
Selenium	1/13	5.1 to 5.1	5.1
Silver	4/13	0.19 to 42.9	13
Sodium	4/13	2,090 to 3,250	2,789
Vanadium	10/13	1.8 to 31.9*	12.2
Zinc	9/13	10.1 to 655.35*	148
General Chemistry (mg/kg)			
Total Organic Carbon	16/16	2,000 to 160,000	58,844

[1] Frequency of detection is the number of sediment samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: Analytical results summarized include the following samples: U3D00101, U3D00201, U3D00301, U3D00401, U3D00501, U3D00601, U3D00701, U3D00801 (and field duplicate), U3D00901, and U3D01001, U3SD11, U3SD12, U3SD13, U3SD14, U3SD15 and U3SD16.

Fg/kg = micrograms per kilogram.
* = average of both sample and field duplicate.
mg/kg = milligrams per kilogram.



U3D00401		
Inorganics	mg/kg	
Aluminum	799	J
Barium	5.6	J
Cadmium	1.2	J
Calcium	2,880	J
Chromium	20.8	
Cobalt	0.63	J
Copper	8	
Iron	1,260	J
Lead	35.6	
Magnesium	423	J
Manganese	22	
Mercury	0.08	J
Nickel	21	
Potassium	132	J
Silver	42.9	
Vanadium	2.6	J
Total PAHs	µg/kg	
	18,110	

U3D00601		
Inorganics	mg/kg	
Aluminum	10,800	J
Arsenic	9.5	
Barium	24.6	J
Cadmium	1.3	J
Calcium	8,610	
Chromium	36	
Cobalt	3.3	J
Copper	21.3	J
Iron	16,700	
Lead	48.3	
Magnesium	4,900	
Manganese	236	
Mercury	0.35	J
Nickel	17.3	J
Potassium	1,120	J
Sodium	2,090	J
Vanadium	21	J
Zinc	106	J
VOCs	µg/kg	
Acetone	190	
Carbon disulfide	14	J
Total PAHs	µg/kg	
	302	

U3SD13		
Inorganics	mg/kg	
Aluminum	2,040	
Cadmium	0.88	
Chromium	14.3	J
Copper	57.2	J
Iron	855	
Lead	44.2	
Manganese	20	
Mercury	0.16	
Nickel	7.4	
Zinc	115	
Total PAHs	µg/kg	
	452	

U3D00501		
Inorganics	mg/kg	
Aluminum	407	J
Barium	6.3	J
Cadmium	0.61	J
Calcium	459	J
Chromium	5.8	
Copper	3.2	J
Iron	4,450	
Lead	23.3	
Magnesium	119	J
Manganese	33.5	
Nickel	4.4	J
Silver	0.19	J
Vanadium	1.9	J
Zinc	10.1	J
Total PAHs	µg/kg	
	67.1	

U3D00301		
Inorganics	mg/kg	
Aluminum	682	J
Barium	5.4	J
Cadmium	0.76	J
Calcium	1,100	J
Chromium	8.4	
Cobalt	0.45	J
Copper	2.6	J
Iron	871	J
Lead	25.4	
Magnesium	240	J
Manganese	12.5	
Mercury	0.26	
Nickel	4.2	J
Silver	3.8	
Vanadium	2.2	J
VOCs	µg/kg	
Acetone	41	
Total PAHs	µg/kg	
	255	

U3D00201		
Inorganics	mg/kg	
Aluminum	696	J
Barium	5.4	J
Cadmium	0.78	J
Calcium	4,250	J
Chromium	15.6	
Cobalt	0.25	J
Copper	2.7	J
Iron	771	J
Lead	50.1	
Magnesium	213	J
Manganese	14.9	
Mercury	0.09	J
Nickel	13.6	
Vanadium	1.8	J
Total PAHs	µg/kg	
	890	

U3D00101		
Inorganics	mg/kg	
Aluminum	2,260	J
Barium	23.2	J
Cadmium	4.2	
Calcium	30,900	J
Chromium	101	
Cobalt	0.91	J
Copper	20.4	
Iron	2,350	J
Lead	185	
Magnesium	1,120	J
Manganese	100	
Mercury	0.18	
Nickel	16.3	
Potassium	331	J
Silver	5.2	
Vanadium	4.8	J
Zinc	52.7	
Total PAHs	µg/kg	
	3,210	

U3SD12		
Inorganics	mg/kg	
Aluminum	663	
Calcium	68,700	J
Chromium	7.5	J
Copper	5.7	J
Iron	879	
Lead	26.8	
Manganese	61.8	
Nickel	7.2	
Total PAHs	µg/kg	
	545	

	U3SD11		U3SD11D	
Inorganics	mg/kg		mg/kg	
Aluminum	898		734	
Cadmium	1.5	J	3	J
Calcium	4,350	J	2,900	J
Chromium	18.7	J	31.3	J
Copper	8.9	J	15.6	J
Iron	2,380	J	1,390	J
Lead	115		139	
Manganese	31.4		23.9	
Mercury			0.19	
Nickel	13.3		19.2	
Zinc	1,260	J	50.7	J
Total PAHs	µg/kg		µg/kg	
	8,660		4,310	

LEGEND

PAH	Polynuclear aromatic hydrocarbons
VOC	Volatile organic compound
mg/kg	Milligrams per kilogram
µg/kg	Micrograms per kilograms
▲ U3SWSD04	Surface water and sediment sample location and designation

FIGURE 4-6A

ANALYTICAL DETECTIONS IN SEDIMENT SAMPLES AT LOCATIONS SOUTHEAST OF OPERABLE UNIT 3

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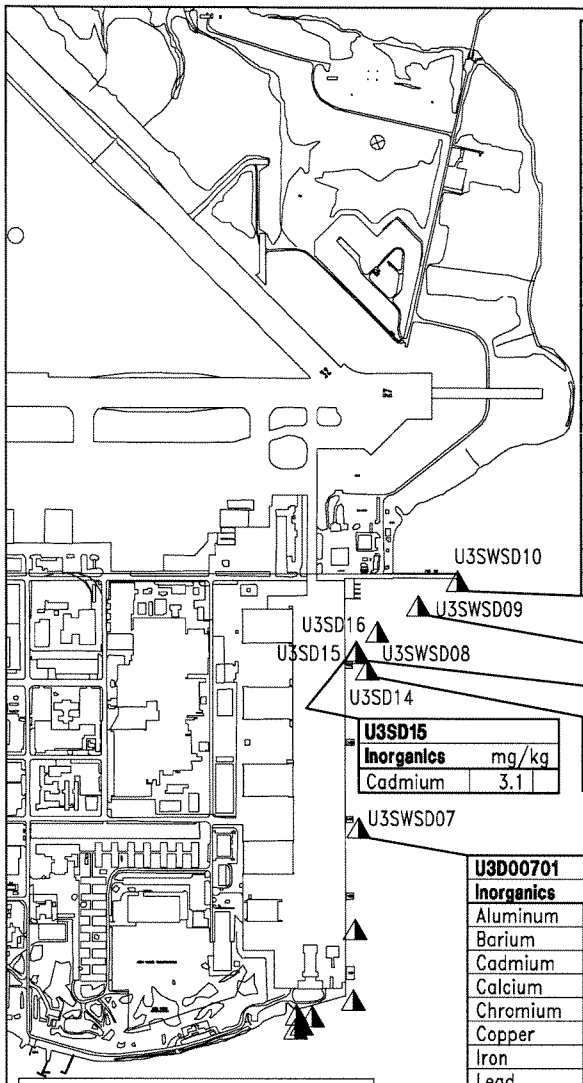
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE JACKSONVILLE, FLORIDA



U3D01001		
Inorganics	mg/kg	
Aluminum	14,100	J
Arsenic	12.6	J
Barium	45.5	J
Beryllium	0.61	J
Cadmium	1.1	J
Calcium	12,400	
Chromium	40.2	
Cobalt	4.1	J
Copper	21.7	J
Iron	23,600	
Lead	42.7	
Magnesium	5,900	J
Manganese	377	
Mercury	0.44	J
Nickel	12.2	J
Potassium	1,470	J
Sodium	3,250	J
Vanadium	31.3	J
Zinc	122	J
VOCs	µg/kg	
2-Butanone	130	
Acetone	390	

U3D00901		
Inorganics	mg/kg	
Aluminum	11,200	J
Arsenic	9	J
Barium	39	J
Cadmium	1	J
Calcium	11,500	
Chromium	34.2	
Cobalt	3.2	J
Copper	18.2	J
Iron	20,300	
Lead	33.8	
Magnesium	5,640	J
Manganese	276	
Mercury	0.39	J
Nickel	11.3	J
Potassium	1,200	J
Selenium	5.1	J
Sodium	3,130	J
Vanadium	22.6	J
Zinc	102	J
VOCs	µg/kg	
2-Butanone	81	
Acetone	320	
Total PAHs	µg/kg	
	183	

U3SD15		
Inorganics	mg/kg	
Cadmium	3.1	

U3SD14		
Inorganics	mg/kg	
Cadmium	1.6	

	U3D00801		U3D00801D	
Inorganics	mg/kg		mg/kg	
Aluminum	13,600	J	14,100	J
Arsenic	13.7	J	12	J
Barium	41.4	J	44.9	J
Beryllium	0.59	J	0.7	J
Cadmium	2	J	2.4	J
Calcium	11,700		12,100	
Chromium	44.2		49.2	
Cobalt	3.8	J	3.9	J
Copper	26.4	J	24.7	J
Iron	23,200		24,700	
Lead	52.6		58.3	
Magnesium	5,960	J	6,250	J
Manganese	290		305	
Mercury	0.6	J	0.64	J
Nickel	12.9	J	14	J
Potassium	1,450	J	1,590	J
Sodium	2,770	J	2,600	J
Vanadium	30.3	J	33.5	J
Zinc	131	J	142	J
VOCs	µg/kg		µg/kg	
2-Butanone	160		75	J
Acetone	640		610	

U3D00701		
Inorganics	mg/kg	
Aluminum	747	J
Barium	4.2	J
Cadmium	0.46	J
Calcium	2,200	
Chromium	5.3	
Copper	2	J
Iron	1,320	
Lead	11.9	
Magnesium	231	J
Manganese	12.8	
Nickel	1.3	J
Vanadium	2	J
Zinc	33.4	J
VOCs	µg/kg	
Acetone	110	
Total PAHs	µg/kg	
	152	

LEGEND

▲ U3SWSD07	Surface water and sediment sample location and designation
U3D00701	Sediment sample identifier
mg/kg	Milligrams per kilogram
µg/kg	Micrograms per kilogram
VOC	Volatile organic compound
PAH	Polynuclear aromatic hydrocarbons
J	Estimated value
D	Duplicate

0 700 1400

SCALE: 1 INCH = 1400 FEET

FIGURE 4-6B

ANALYTICAL DETECTIONS IN SEDIMENT SAMPLES AT LOCATIONS NORTHEAST OF OPERABLE UNIT 3

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE JACKSONVILLE, FLORIDA

Table 4-8
Summary of Detections in Groundwater

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Area A			
Volatile Organic Compounds (F g/ℓ)			
1,1,2-Trichloroethane	4/7	0.67 to 9.3	4.5
1,1-Dichloroethene	6/7	1.1 to 31	14.6
1,2-Dichloroethene (total)	7/7	140 to 6,200	2,526
Benzene	1/7	1.5 to 1.5	1.5
Carbon Disulfide	5/7	1 to 3.3	2.3
Chloroform	3/7	1 to 4.1	2.7
Tetrachloroethene	1/7	1.1 to 1.1	1.1
Toluene	3/7	17 to 21	18.3
Trichloroethene	7/7	2.9 to 31,000	13,173
Vinyl Chloride	7/7	110 to 1,600	580
Inorganic Analytes (F g/ℓ):			
Aluminum	1/1	197	197
Barium	1/1	104	104
Calcium	1/1	63,600	63,600
Cobalt	1/1	4.5	4.5
Copper	1/1	1.7	1.7
Iron	1/1	2,170	2,170
Magnesium	1/1	9,670	9,670
Manganese	1/1	82.8	82.8
Nickel	1/1	4.5	4.5
Potassium	1/1	1,860	1,860
Sodium	1/1	75,800	75,800
Zinc	1/1	52.3	52.3
Data set summarized above include hydrocone samples U3QA0101, U3QA0201, U3QA0301, U3QA0401, U3QA0501, U3QA0601 and monitoring well samples U3GA0701 (VOC) and U3GA0704 (metals).			
Area B			
Volatile Organic Compounds (F g/ℓ)			
1,1,2-Trichloroethane	1/7	2 to 2	2
1,1-Dichloroethene	1/7	3 to 3	3
1,2-Dichloroethene (total)	1/7	2 to 2	2
Acetone	1/7	26 to 26	26
Carbon Disulfide	2/7	1.9 to 97	49.5
Chloroform	2/7	0.88 to 3	1.9
Chloromethane	2/7	1.1 to 14	7.6
Tetrachloroethene	1/7	40 to 40	40
Trichloroethene	3/7	2.3 to 9,800	3,274
Data set summarized above include hydrocone samples U3QB0101, U3QB0201, U3QB0301, U3QB0401, U3QB0501, U3CW31A02, and monitoring well sample U3G01801.			
See notes at end of table.			

Table 4-8 (Continued)
Summary of Detections in Groundwater

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Area C			
Volatile Organic Compounds (F g/ℓ)			
1,2-Dichloroethene (total)	2/10	1.5 to 27	14.3
Acetone	2/10	26 to 310	168
Methylene Chloride	1/10	27 to 27	27
Trichloroethene	6/11	10 to 5,000	1,407
Data set summarized above include hydrocone samples U3QC0101, U3QC0201, U3QC0301, U3QC0401, U3QC0501, U3CW02A02 U3CW16A02 and monitoring well samples U3G00201, U3G00301, U3G01301, and U3G03101.			
Area D			
Volatile Organic Compounds (F g/ℓ)			
1,1,2-Trichloroethane	1/9	0.56 to 0.56	0.56
1,1-Dichloroethene	2/9	2 to 4.1	3.1
1,2-Dichloroethene (total)	8/9	0.63 to 190	42.9
2-Butanone	1/9	2.3 to 2.3	2.3
Acetone	1/9	98 to 98	98
Bromoform	1/9	8.8 to 8.8	8.8
Carbon Disulfide	1/9	1.5 to 1.5	1.5
Methylene Chloride	5/9	0.4 to 11.25	4.2
Tetrachloroethene	7/9	0.55 to 34	7.8
Trichloroethene	9/9	92 to 6,800	3,531
Inorganic Analytes (F g/ℓ)			
Aluminum	1/2	406 to 406	406
Arsenic	2/2	10.1 to 23	16.6
Barium	2/2	58.2 to 96.7	77.5
Calcium	2/2	17,300 to 35,800	26,550
Cobalt	1/2	1.6 to 1.6	1.6
Iron	2/2	14,800 to 32,300	23,550
Magnesium	2/2	2,360 to 8,330	5,345
Manganese	2/2	207 to 662	435
Nickel	1/2	1.3 to 1.3	1.3
Potassium	2/2	1,610 to 1,760	1,685
Sodium	2/2	46,500 to 104,000	75,250
Zinc	2/2	15.3 to 86.4	50.9
Data set summarized above include hydrocone samples U3QD0101, U3QD0201, U3QD0302, U3QD0401, U3QD0501 monitoring well samples U3GTP0902 (VOC), U3GTP0903 (metals), U3GTP1201, U3GTP1301, U3WD0601 (except VOC), U3WD0603 and U3WD0603D.			
See notes at end of table.			

Table 4-8 (Continued)
Summary of Detections in Groundwater

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Area E			
Volatile Organic Compounds (F g/ℓ)			
1,1,2-Trichloroethane	1/7	0.95 to 0.95	0.95
1,1-Dichloroethene	1/7	7.9 to 7.9	7.9
1,2-Dichloroethene (total)	3/7	7.5 to 610	369
Acetone	2/7	10 to 70	40
Carbon Disulfide	1/7	0.84 to 0.84	0.84
Chloroform	1/7	5.9 to 5.9	5.9
Tetrachloroethene	2/7	9,200 to 16,000	12,600
Trichloroethene	2/7	420 to 670	545
Vinyl Chloride	3/7	1.7 to 43	22.9
Data set summarized above include hydrocone samples U3QE0602, U3QE0101, U3QE0201, U3QE0301, U3QE0401, U3QE0501 and monitoring well sample U3G01601.			
Area F			
Volatile Organic Compounds (F g/ℓ)			
1,1,1-Trichloroethane	1/8	2.9 to 2.9	2.9
1,1,2-Trichloroethane	2/8	0.9 to 6.5	3.7
1,1-Dichloroethane	1/8	2.4 to 2.4	2.4
1,1-Dichloroethene	3/8	1 to 270	94.7
1,2-Dichloroethene (total)	5/8	1.7 to 61	21.7
Acetone	1/8	16 to 16	16
Carbon Disulfide	1/8	1.7 to 1.7	1.7
Chloroform	3/8	0.5 to 1.2	0.74
Methylene Chloride	1/8	0.3 to 0.3	0.3
Tetrachloroethene	3/8	1.4 to 7.3	3.7
Toluene	1/8	1.4 to 1.4	1.4
Trichloroethene	7/8	12 to 27,000	4,550
Vinyl Chloride	2/8	2.8 to 3.4	3.1
Inorganic Analytes (F g/ℓ)			
Aluminum	1/1	428	428
Barium	1/1	124	145
Beryllium	1/1	0.77	0.77
Calcium	1/1	11,500	11,500
Cobalt	1/1	2.1	2.1
Iron	1/1	32.6	32.6
Magnesium	1/1	10,700	10,700
Manganese	1/1	9.3	9.3

See notes at end of table.

Table 4-8 (Continued)
Summary of Detections in Groundwater

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Inorganic Analytes (F g/ℓ) (Continued)			
Nickel	1/1	2.3	2.3
Potassium	1/1	4,760	4,760
Sodium	1/1	23,900	23,900
Vanadium	1/1	0.82	0.82
Zinc	1/1	20.4	20.4
Data set summarized above include hydrocone samples U3QF0102, U3QF0201, U3QF0301, U3QF0401, U3QF0501, and monitoring well samples U3G00701, U3G00701D, U3G03201, U3GF0603 (VOC), and U3GF0604 (metals).			
Area G			
Volatile Organic Compounds (F g/ℓ)			
1,1,1-Trichloroethane	2/8	11 to 570	291
1,1,2-Trichloroethane	1/8	5.1 to 5.1	5.1
1,1-Dichloroethane	2/8	11 to 18	14.5
1,1-Dichloroethene	3/8	0.77 to 760	380
1,2-Dichloroethene (total)	3/8	25 to 1,600	605
Benzene	1/8	1.1 to 1.1	1.1
Carbon Disulfide	2/8	1 to 5.6	3.3
Chloroform	2/8	0.53 to 0.63	0.58
Methylene Chloride	2/8	0.9 to 2.4	1.7
Tetrachloroethene	2/8	0.71 to 0.94	0.83
Trichloroethene	7/8	1.5 to 3,800	1,123
Vinyl Chloride	3/8	1.6 to 66	26.9
Inorganic Analytes (F g/ℓ)			
Aluminum	1/1	800	800
Arsenic	1/1	4.9	4.9
Barium	1/1	46.8	46.8
Calcium	1/1	42,200	42,200
Iron	1/1	8,790	8,790
Magnesium	1/1	5,220	5,220
Manganese	1/1	45.6	45.6
Potassium	1/1	1,620	1,620
Sodium	1/1	3,350	3,350
Data set summarized above include hydrocone samples U3QG0102, U3QG0201, U3QG0302, U3QG0402, U3QG0501, and monitoring well samples U3G03301, U3G03401, U3NARFB103.			
See notes at end of table.			

Table 4-8 (Continued)
Summary of Detections in Groundwater

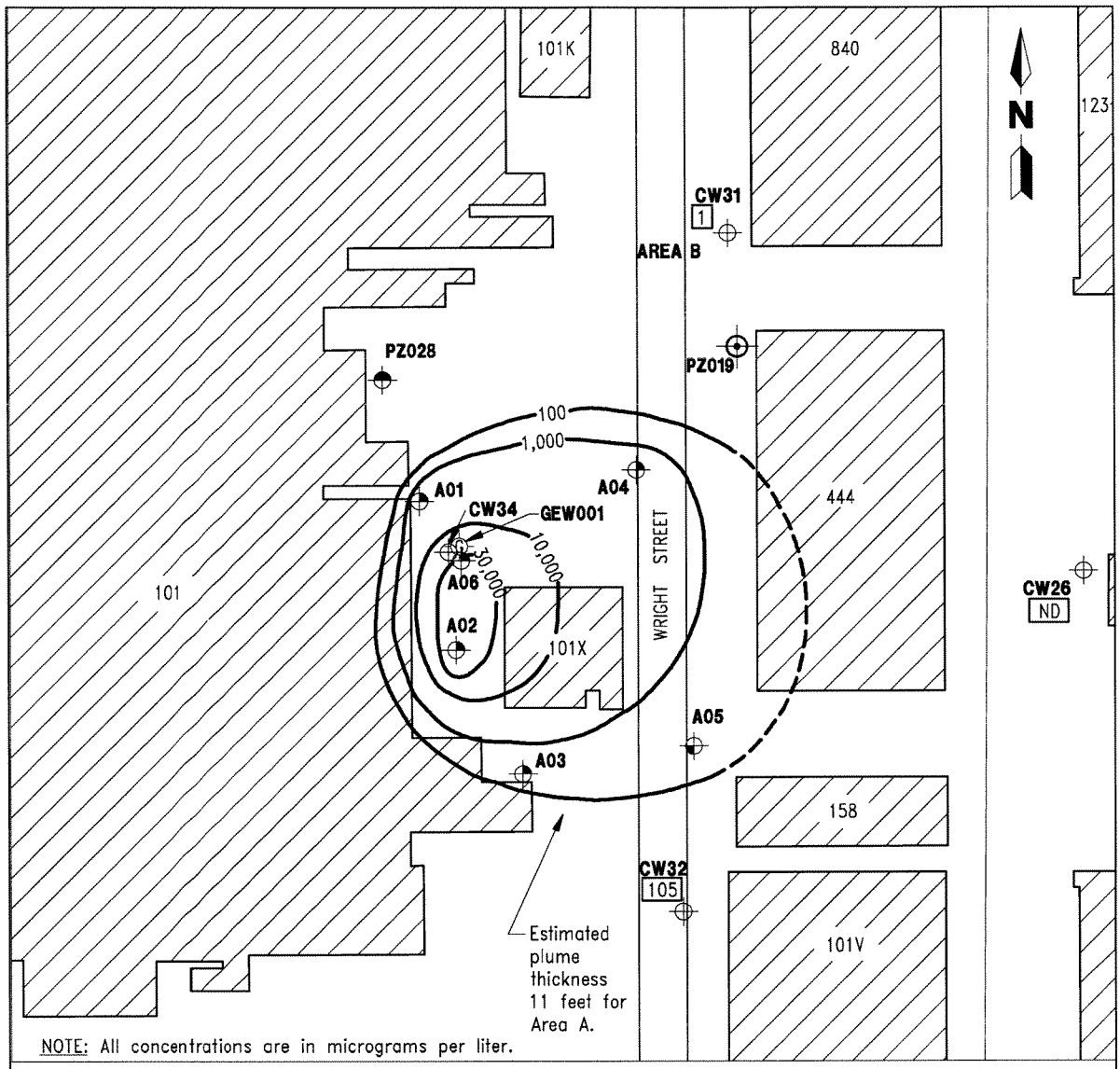
Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]
Areas Outside of Areas A to G			
Volatile Organic Compounds (F g/ℓ)			
1,1,1-Trichloroethane	1/76	1 to 1	1
1,1,2-Trichloroethane	1/76	1 to 1	1
1,1-Dichloroethane	3/76	1 to 3.8	2.2
1,2-Dichloroethane	1/76	1 to 1	1
Acetone	7/11	7 to 92	34.7
Benzene	3/76	1 to 64	24.8
Carbon Disulfide	5/11	5 to 260	96.6
Chloroform	2/76	1 to 1	1
Chloromethane	5/11	3 to 30	14
Methylene Chloride	6/11	1 to 35	7.7
Tetrachloroethene	4/76	1 to 10	3.3
Toluene	1/76	8.3 to 8.3	8.3
Trichloroethene	24/76	1 to 580	54.5
cis-1,2-Dichloroethene	15/65	1.6 to 1,300	99.1
trans-1,2-Dichloroethene	5/65	1.1 to 520	106
Semivolatile Organic Compounds (F g/ℓ)			
Di-n-butylphthalate	1/11	4 to 4	4
Diethylphthalate	2/11	3 to 7	5
Phenol	4/11	2 to 35	10.8
Pesticides (F g/ℓ)			
gamma-BHC (Lindane)	1/76	0.018 to 0.018	0.018

Data set summarized above include 1993 SSFP samples from three levels taken at hydrocone sampling locations CW01, CW03, CW04, CW10, CW14, CW17, CW19, CW21, CW22, CW25, CW29, CW30, CW35, CW37, CW38, CW47, CW48, CW49, CW50, CW52, CW53, CW55, CW57, CW62, and CW63.

[1] Frequency of detection is the number of groundwater samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: Fg/ℓ = micrograms per liter.
BHC = hexachlorobenzene.



NOTE: All concentrations are in micrograms per liter.

LEGEND

- **CW32** — Cone penetrometer test sample location and designation (conducted during the SSFP in 1993)
- **PZ028** — Piezometer installed during the engineering studies in 1996 (not sampled)
- 100 — Total chlorinated solvent contour in groundwater (dashed where inferred)
- **A05** — Piezocone and hydrocone location and designation
- **A04** — Hydrocone sample location and designation
- **PZ018** — Piezometer location and designation (installed during the SSFP in 1993)
- **GEW001** — Groundwater extraction/air injection well location and designation
- 105 — Total chlorinated solvent concentration in shallow zone of the surficial aquifer
- Building
- SSFP — Scoping study field program
- ND — Not detected

0 50 100

SCALE: 1 INCH = 100 FEET

FIGURE 4-7

CONTAMINATION CONTOURS
AREA A - OLD ENGINE CLEANING AREA

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Table 4-9
Estimated Dimensions of Elevated Groundwater Contamination Areas

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station
Jacksonville, Florida

Area	Predominant VOC present	Estimated Total Area (ft^2)	Estimated Plume Thickness (feet)	Estimated Upper Boundary (ft bls)	Estimated Lower Boundary (ft bls)	Estimated Total Volume of Contaminated Groundwater (ft^3)	Estimated Total Contaminant Mass (kg)	Figure Reference
Area A	TCE	48,250	11	7	18	132,700	32.8	Figure 4-7
Area B	TCE	10,150	10	35	45	23,375	1.7	Figure 4-8
Area C (eastern plume)	TCE	8,950	10	30	40	51,125	1.9	Figure 4-9
(western plume)	TCE	20,450	10	30	40	19,875	1.6	
Area D	TCE	134,050	25	27	52	837,125	51.0	Figure 4-10
Area E	PCE	11,950	10	6	16	29,875	4.7	Figure 4-11
Area F	TCE	28,900	10	15	25	72,250	4.0	Figure 4-12
Area G	TCE	23,900	10	10 to 30*	20 to 40*	59,750	3.9	Figure 4-13

Notes: Total contaminant mass calculations based on the mass of the predominant chlorinated solvent compound in the plume (TCE except Area E which is based on PCE). All calculations, including assumptions used, can be found in Appendix C-8.

VOC = Volatile Organic Compound.
ft^2 = square feet.
ft bls = feet below land surface.
ft^3 = cubic feet.
kg = kilogram.
TCE = trichloroethene.
PCE= tetrachloroethene.
* = A range of depths is provided because the plume dips towards the east.

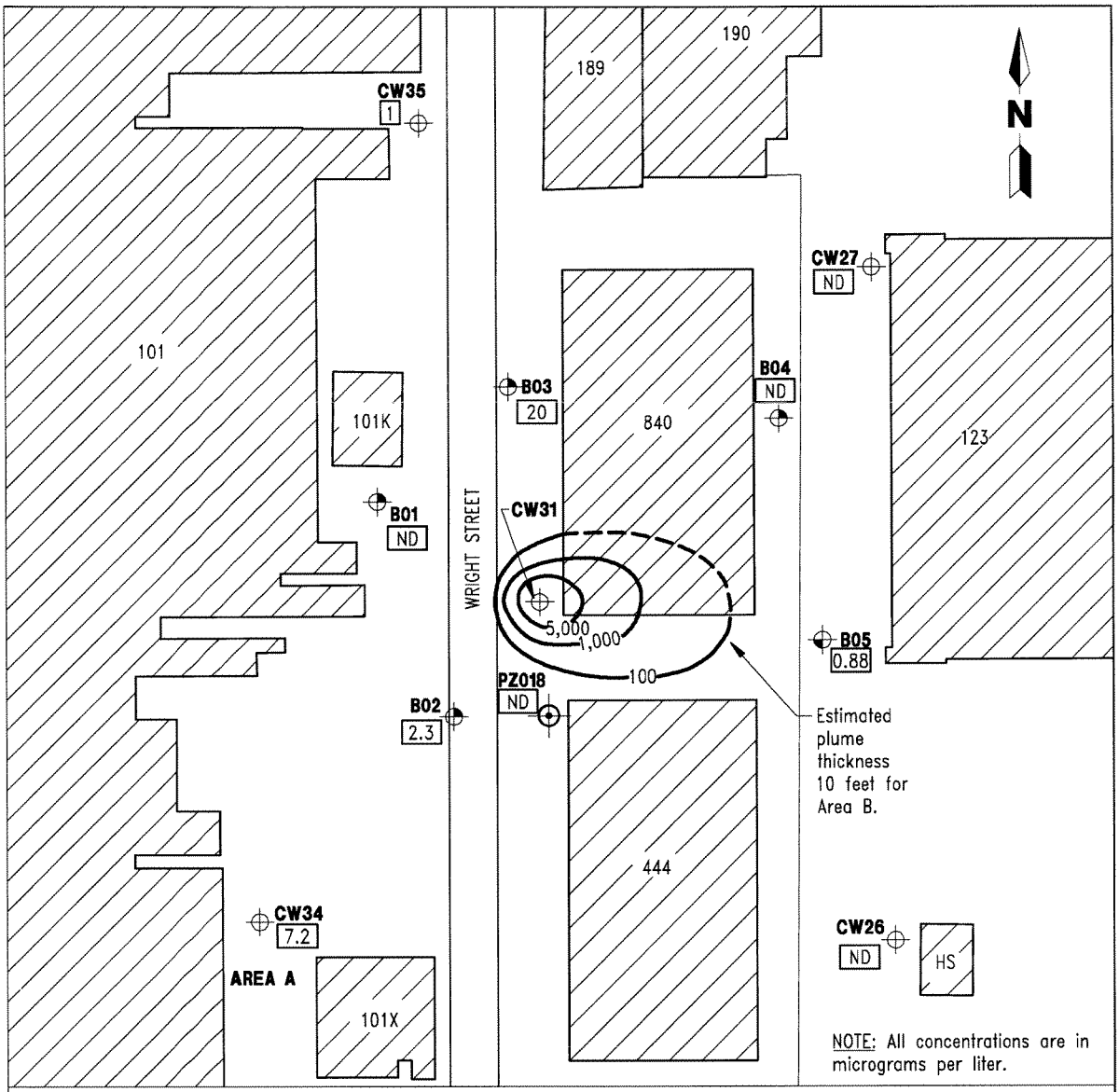

FIGURE 4-8

CONTAMINATION CONTOURS
AREA B - SOUTHWEST OF BUILDING 840

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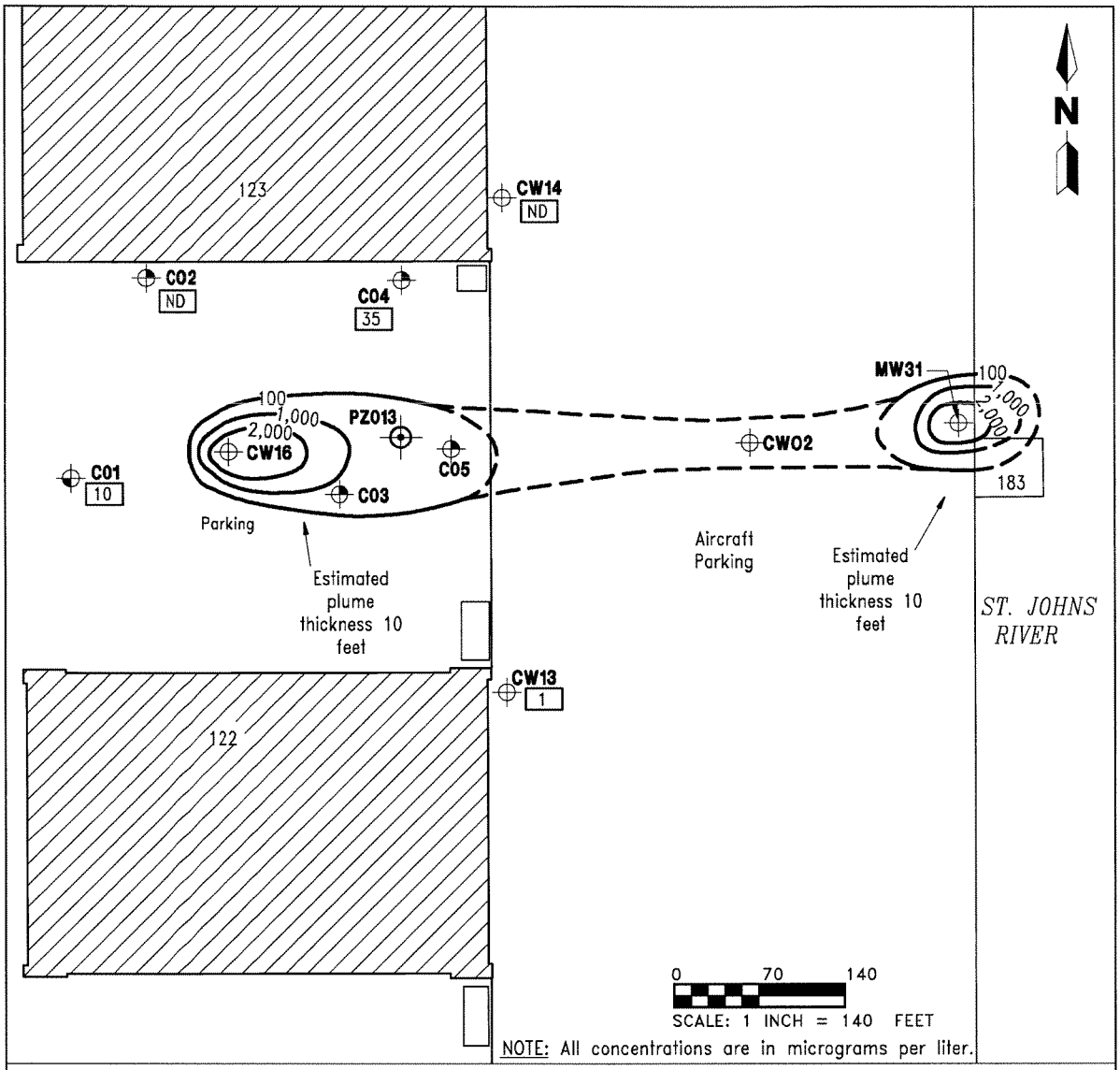
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA



LEGEND

- **CW16** — Cone penetrometer test sample location and designation (conducted during the SSFP in 1993)
- **C04** — Hydrocone sample location and designation
- SSFP — Scoping study field program
- Building
- **C01** — Piezocone and hydrocone location and designation
- **PZ013** — Piezometer location and designation (installed during the SSFP in 1993)
- 100 — Total chlorinated solvent contour in groundwater (dashed where inferred)
- 35 — Total chlorinated solvent concentration in intermediate zone of the surficial aquifer
- ND — Not detected

FIGURE 4-9

CONTAMINATION CONTOURS
AREA C - BETWEEN HANGARS 122 AND 123

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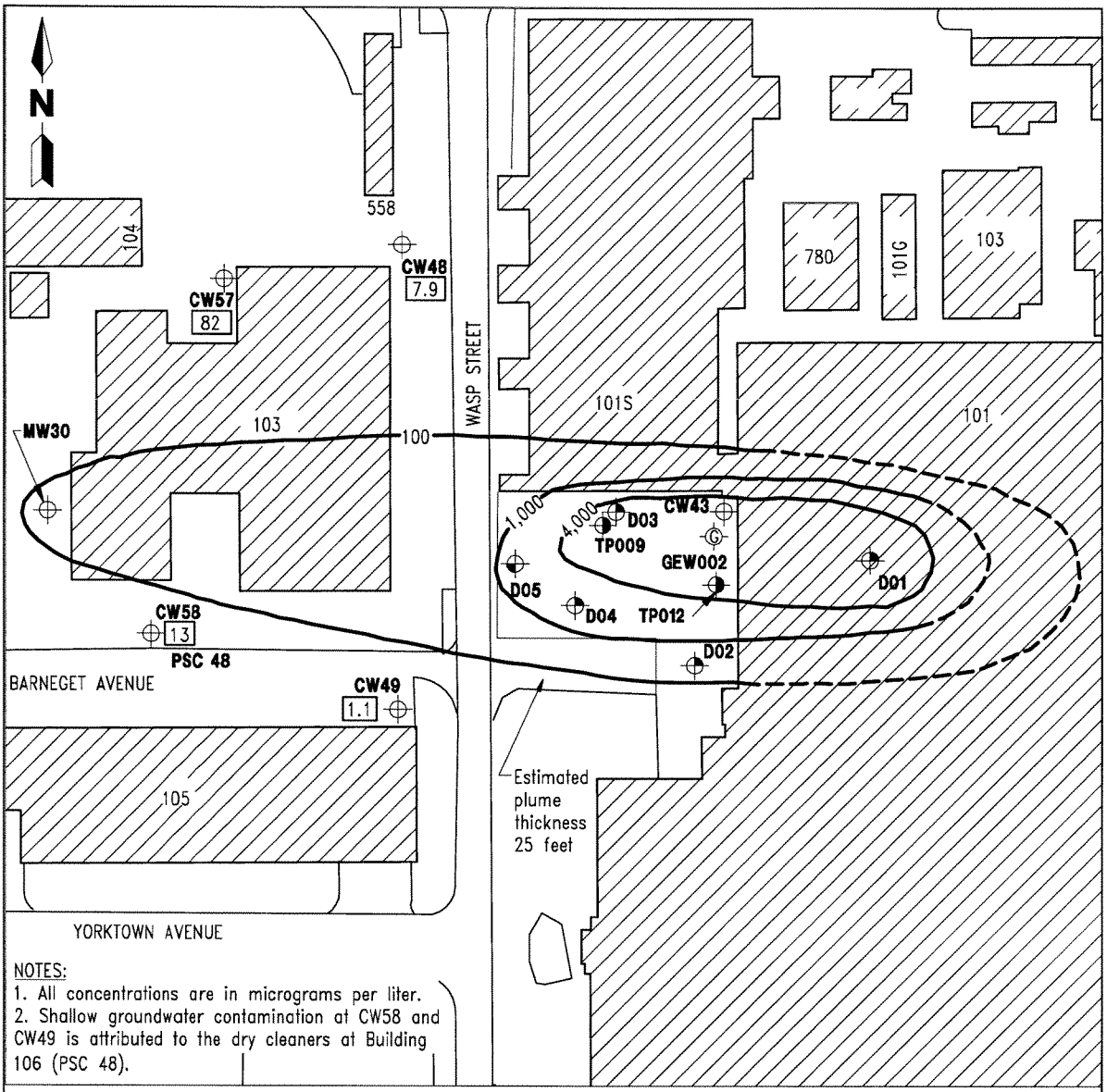
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA



NOTES:
1. All concentrations are in micrograms per liter.
2. Shallow groundwater contamination at CW58 and CW49 is attributed to the dry cleaners at Building 106 (PSC 48).

LEGEND

- CW58 — Cone penetrometer test sample location and designation (conducted during the SSFP in 1993)
- D02 — Hydrocone sample location and designation
- GEW002 — Groundwater extraction well location and designation
- D05 — Piezocone and hydrocone location and designation
- 100 — Total chlorinated solvent contour in groundwater (dashed where inferred)
- TP009 — Temporary piezometer installed for groundwater pumping test in 1996
- PSC — Potential source of contamination
- SSFP — Scoping study field program
- 13 — Total chlorinated solvent concentration in intermediate zone of the shallow aquifer
- Building

0 70 140

SCALE: 1 INCH = 140 FEET

FIGURE 4-10
CONTAMINATION CONTOURS
AREA D - WEST END OF JETLINE HANGAR

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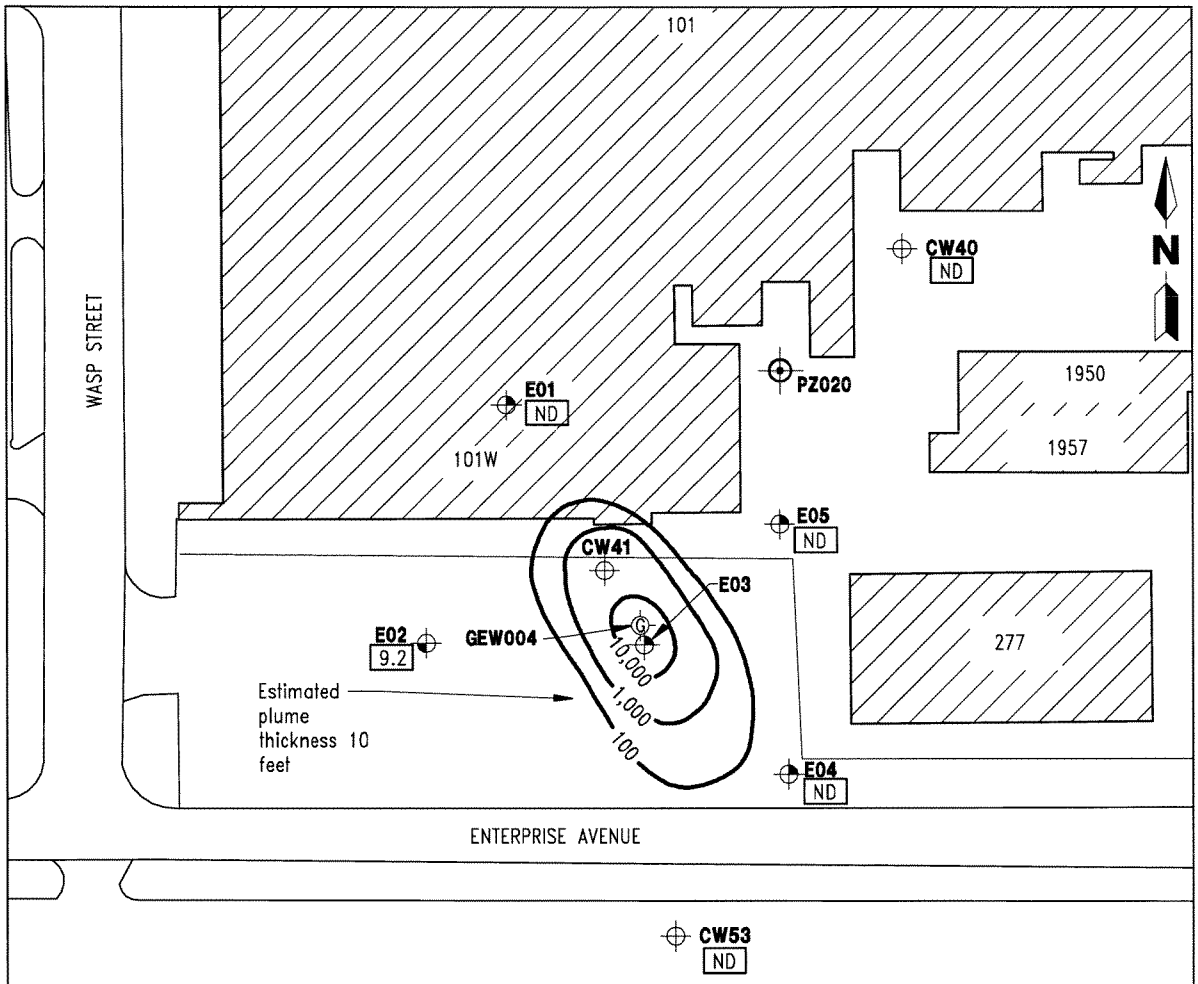
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA



NOTE: All concentrations are in micrograms per liter.

LEGEND

- CW41 — Cone penetrometer test sample location and designation (conducted during the SSFP in 1993)
- E01 — Hydrocone sample location and designation
- E02 — Piezocone and hydrocone location and designation
- 100 — Total chlorinated solvent contour in groundwater
- PZ020 — Piezometer location and designation (installed during the SSFP in 1993)[not sampled]
- GEW004 — Groundwater extraction well location and designation
- ND — Not detected
- SSFP — Scoping study field program
- 9.2 — Total chlorinated solvent concentration in shallow zone of the surficial aquifer
- Building

FIGURE 4-11
CONTAMINATION CONTOURS
AREA E - SOUTHERN END OF P3 HANGAR

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

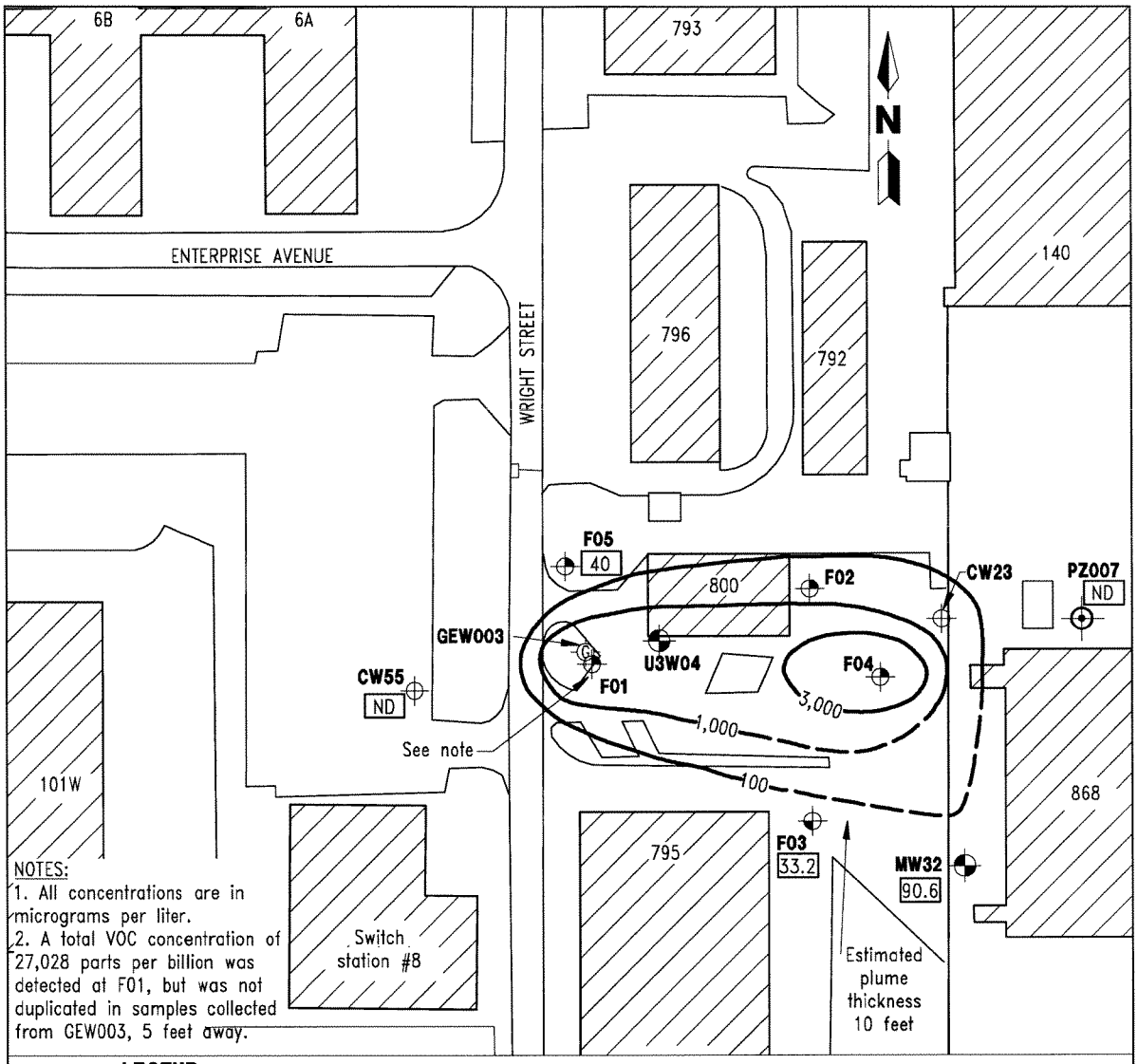

FIGURE 4-12
CONTAMINATION CONTOURS
AREA F - P-615 AREA

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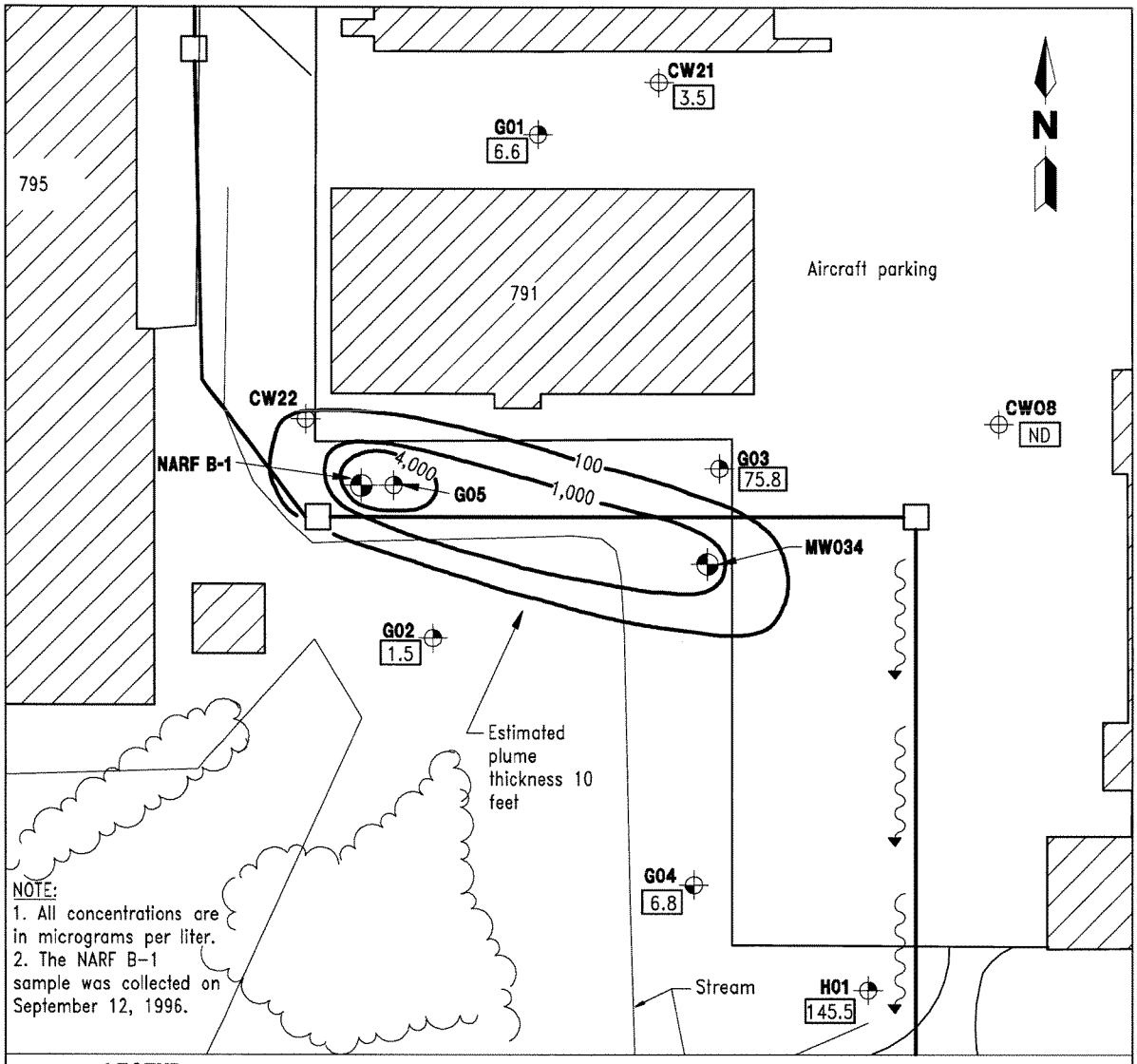
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA



LEGEND

- **CW22** — Cone penetrometer test sample location and designation (conducted during the SSFP in 1993)
- **G03** — Hydrocone sample location and designation
- **G04** — Piezocone and hydrocone location and designation
- **NARF B-1** — Monitoring well location and designation (installed by Geraghty & Miller)
- **MW034** — Monitoring well location and designation
- Storm sewer line (consists of 2 60-inch diameter pipes)
- Potential groundwater pathway
- 100 — Total chlorinated solvent contour in groundwater
- SSFP — Scoping study field program
- PSC — Potential source of contamination
- NARF — Naval Air Rework Facility
- ND — Not detected
- 6.8 — Total chlorinated solvent concentration in shallow zone of the surficial aquifer
- Manhole
- Tree line
- Building

0 50 100
SCALE: 1 INCH = 100 FEET

FIGURE 4-13
CONTAMINATION CONTOURS
AREA G - PSC 15

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

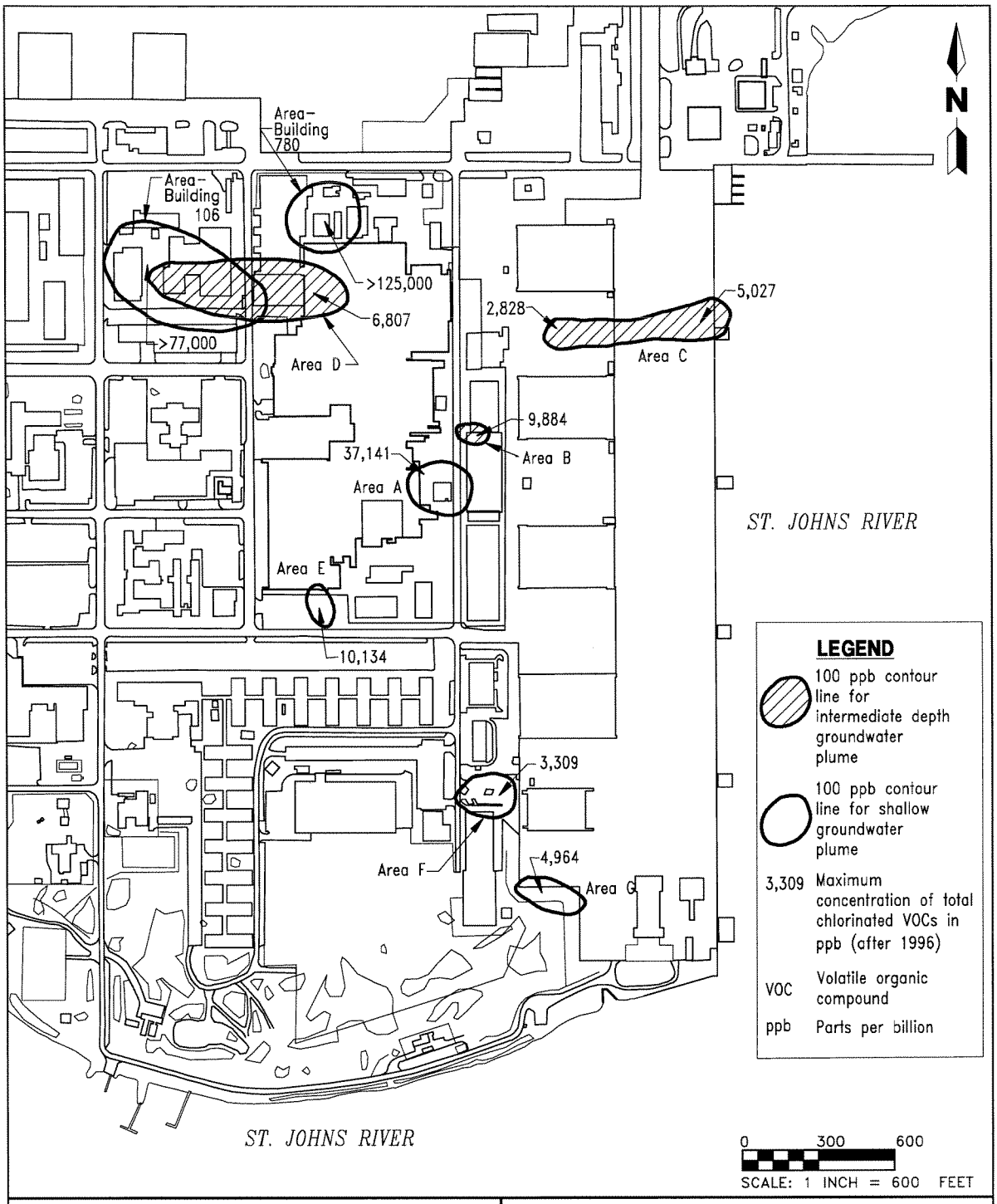

FIGURE 4-14
CHLORINATED VOC GROUNDWATER PLUME LOCATION AREAS

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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Table 4-10
Summary of Detections in Storm Sewer Water Samples
Target Compound List Volatile Organics

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Compound	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]	Maximum Detected Concentration
Volatile Organic Compounds (F g/ℓ)				
1,1,1-Trichloroethane	2/19	0.9 to 1	0.95	1
1,1-Dichloroethane	3/19	0.7 to 6.5	2.7	6.5
1,1-Dichloroethene	4/19	0.8 to 2	1.2	2
1,2-Dichlorobenzene	1/13	2.5 to 2.5	2.5	2.5
1,2-Dichloroethene (total)	13/19	1 to 98	13.3	98
Acetone	2/6	6 to 7	6.5	7
Bromodichloromethane	1/19	3 to 3	3	3
Chlorobenzene	1/19	1.2 to 1.2	1.2	1.2
Chloroform	5/19	1.3 to 8.5	3	8.5
Ethylbenzene	1/19	0.6 to 0.6	0.6	0.6
Methylene Chloride	7/19	0.7 to 8	3.1	8
Tetrachloroethene	3/19	0.7 to 3	1.6	3
Toluene	1/19	0.9* to 0.9*	0.9	0.9
Trichloroethene	8/19	1.5 to 170*	70.5	170
Vinyl chloride	7/19	0.9 to 13	3.4	13

[1] Frequency of detection is the number of storm sewer water samples in which the analyte was detected divided by the total number of samples analyzed. While Appendix C-1.2 lists 21 samples, two of these samples, U3ZMH202 and U3ZMH302, are resampling of U3ZMHZ01 and U3ZMH301, respectively. Only the newer data set was used for these two samples with the older data disregarded in the calculations. Acetone was reported only in the eight samples collected in January 1998. Because two of these samples were disregarded as noted above, the denominator for acetone is six.

[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: Fg/ℓ = micrograms per liter.
* = average of both sample and field duplicate.

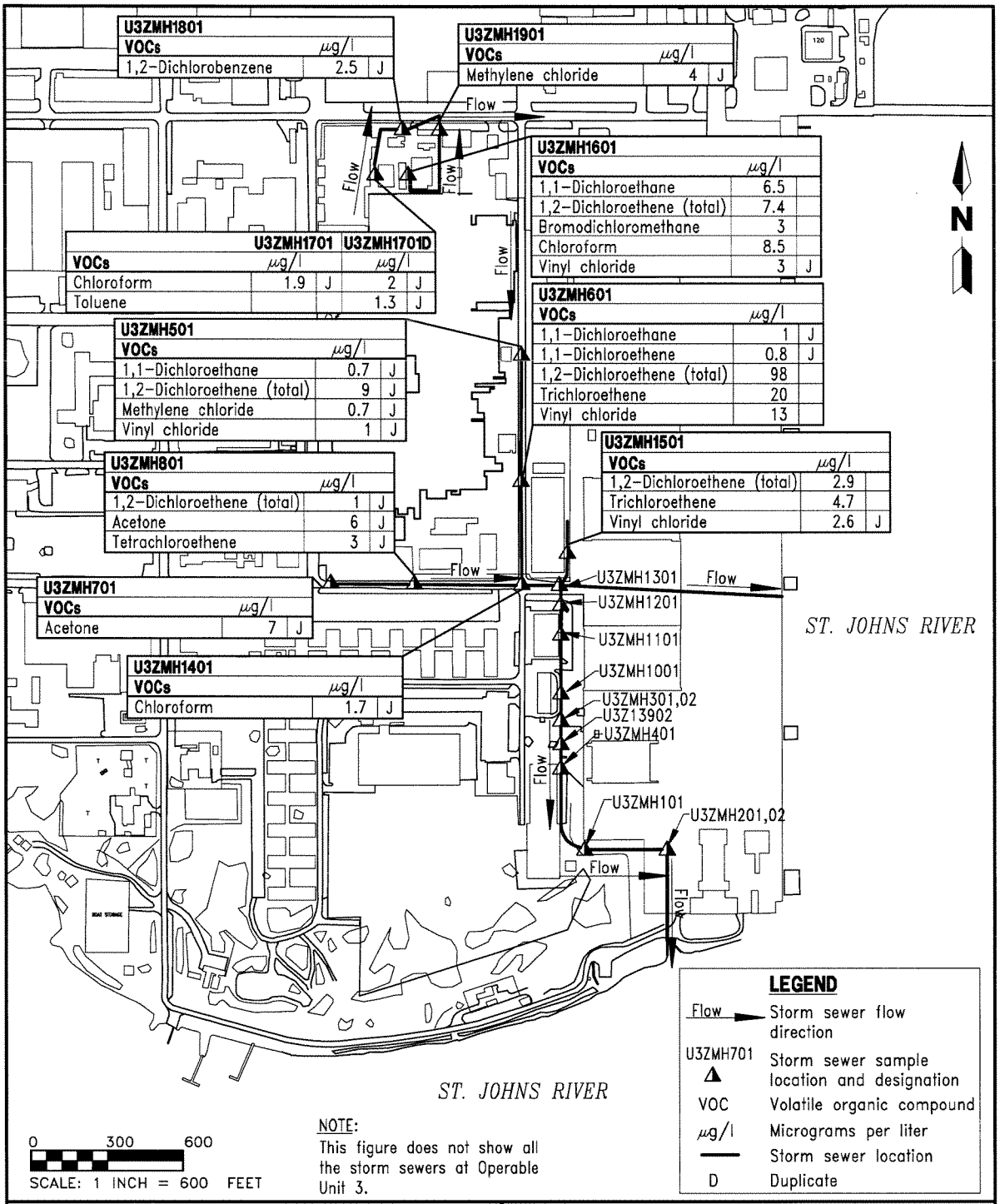

FIGURE 4-15A
ANALYTICAL DETECTIONS IN STORM SEWER SAMPLES

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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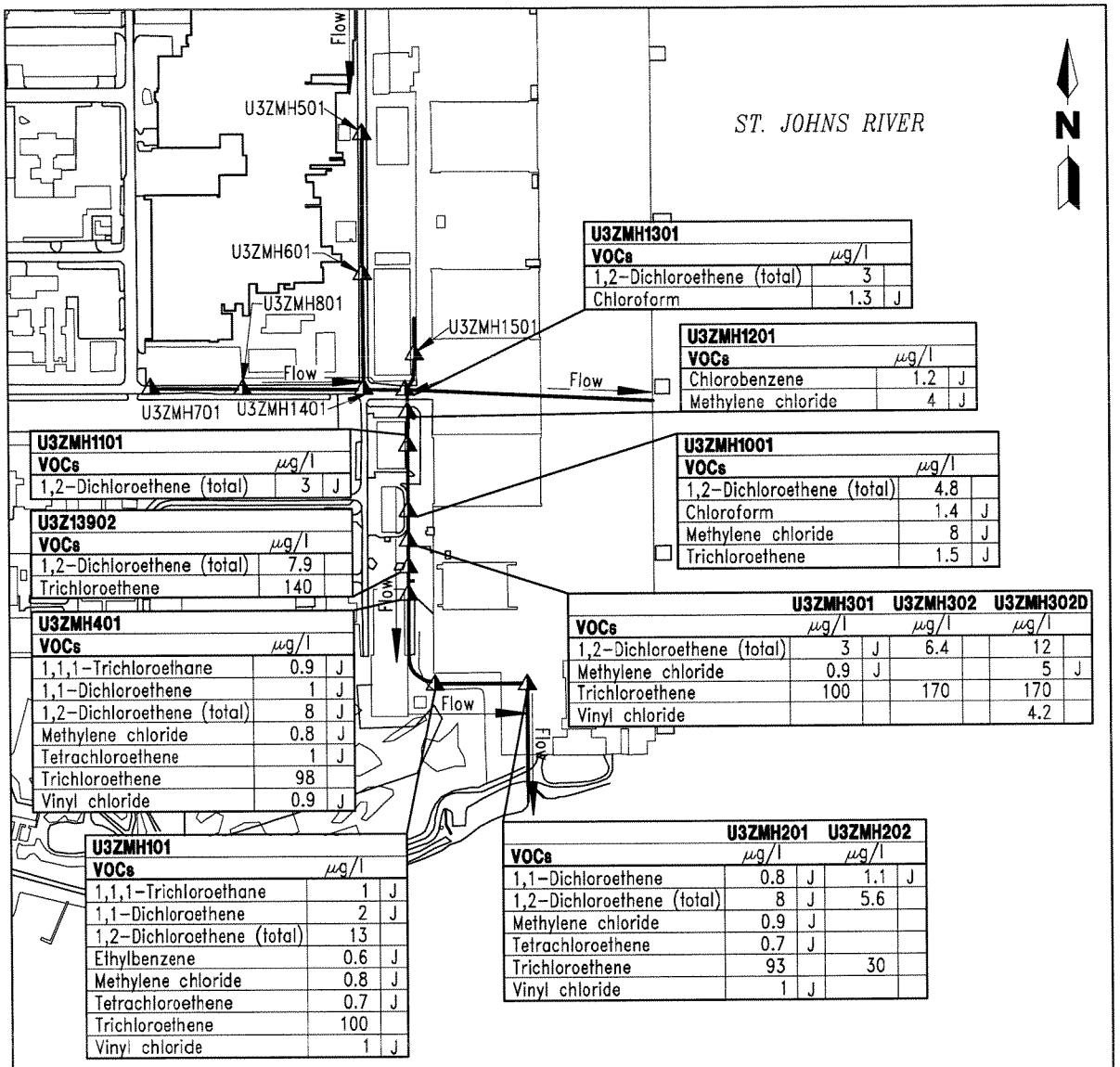

FIGURE 4-15B
ANALYTICAL DETECTIONS IN STORM SEWER SAMPLES

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

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Table 4-11
Summary of Sediment Sampling Results (Detections)
Obtained By Other Contractors

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Brown & Root Sampling Event (PSC 16) December, 1995 3 Samples[1]	Burns & McDonnell Sampling Event (Storm Sewers/PSC 16) May, 1996 2 Samples[2]	Bechtel Environmental Sampling Event (Storm Sewers/PSC 16) March, 1999 1 Sample[3]
Volatile Organic Compounds (µg/kg)			
Acetone	180, 220, 120		
2-Butanone	18		
n-Butylbenzene			1,100
s-Butylbenzene			580
Carbon disulfide	3		
Chloroethane	25		
1,4-Dichlorobenzene			1,200
1,2-Dichlorobenzene			320
1,3-Dichlorobenzene			900
1,2-Dichloroethene (total)	7	109, >10,000	
1,1-Dichloroethylene		27.8, >10,000	
Ethylbenzene	6	11.9, >10,000	
p-Isopropyltoluene			340
Methylene Chloride	3		
Tetrachloroethylene		56.1, >10,000	
Toluene	130, 7	108, >10,000	
1,1,1-Trichloroethane		1,050, >10,000	
Trichloroethylene		632, >10,000	
1,2,4-Trimethylbenzene			540
1,3,5-Trimethylbenzene			680
Vinyl chloride		70.2, >10,000	
Xylenes (total)	18		
Semivolatile Organic Compounds (F g/kg)			
alpha-Chlordane	24, 16, 2.1		
Benzo(a)anthracene	400		
Benzo(a)pyrene	300		
Benzo(b)fluoranthene	500		
Benzo(k)fluoranthene	200		

See notes at end of table.

Table 4-11 (Continued)
Summary of Sediment Sampling Results (Detections)
Obtained By Other Contractors

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Brown & Root Sampling Event (PSC 16) December, 1995 3 Samples[1]	Burns & McDonnell Sampling Event (Storm Sewers/PSC 16) May, 1996 2 Samples[2]	Bechtel Environmental Sampling Event (Storm Sewers/PSC 16) March, 1999 1 Sample[3]
Semivolatile Organic Compounds (F g/kg) (Continued)			
bis(2-Ethylhexyl)phthalate	800, 1,200, 400		
Butyl-benzyl-phthalate		37, 400	
Chrysene	400		
4,4'-DDE	10		
Di-n-butylphthalate	5,000		
Fluoranthene	900, 200		
gamma-Chlordane	5.3, 2.7		
Heptachlor epoxide	7.3		
Indeno(1,2,3-cd)pyrene	200		
Phenanthrene	700	1,110	
Pyrene	800, 190	1,380	
Diesel Range Organics (C10-C24) (mg/kg)			11,000
Inorganic Analytes (mg/kg)			
Aluminum	755, 1,660, 806		
Antimony	5.6, 1.9		
Arsenic	1		4.0
Barium	9.9, 10.3, 3.9		490
Beryllium	0.59, 0.6		
Cadmium	3.2	2.23, 2.11	69
Calcium	13,400, 14,200, 4,810		
Chromium	12.6, 29.2, 11.4	20.6, 40.8	410
Cobalt	2.4		
Copper	7.8, 11.2, 5.4	36.5, 21.4	
Iron	1,230, 2,020, 1,610		
Lead	38.2, 53.2, 20.5	238, 140	2,500
Magnesium	339, 960, 330		
Manganese	17.1, 53.5, 14.1		
Mercury	0.11, 0.16		2.8
Nickel	14.2	21.7, 16.6	
Potassium	69.4, 25.7		

See notes at end of table.

Table 4-11 (Continued)
Summary of Sediment Sampling Results (Detections)
Obtained By Other Contractors

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte/Compound	Brown & Root Sampling Event (PSC 16) December, 1995 3 Samples[1]	Burns & McDonnell Sampling Event (Storm Sewers/PSC 16) May, 1996 2 Samples[2]	Bechtel Environmental Sampling Event (Storm Sewers/PSC 16) March, 1999 1 Sample[3]
Inorganic Analytes (mg/kg)			
Selenium	0.33		
Silver			25
Vanadium	2.7, 5.9, 3.3		
Zinc	47.2, 54.7, 26.6	57.7, 88.2	

[1] Samples collected from the St. Johns River at distances of 10, 50 and 100 feet from the outfall at PSC 16.
[2] Samples taken from the sediment cleaned out of the 300-ft segment of storm sewer immediately upgradient from the outfall at PSC 16 prior to installation of the Cured-in-Place Pipe.
[3] Sample taken from sediment removed from segment of storm sewer from MH10 (just north of Area F) to MH1 (at Area G) prior to a video survey of the sewer.

Notes: PSC = potential source of contamination.
Fg/kg = micrograms per kilogram.
> = greater than.
DDE = dichlorodiphenyldichloroethene.
mg/kg = milligrams per kilogram.

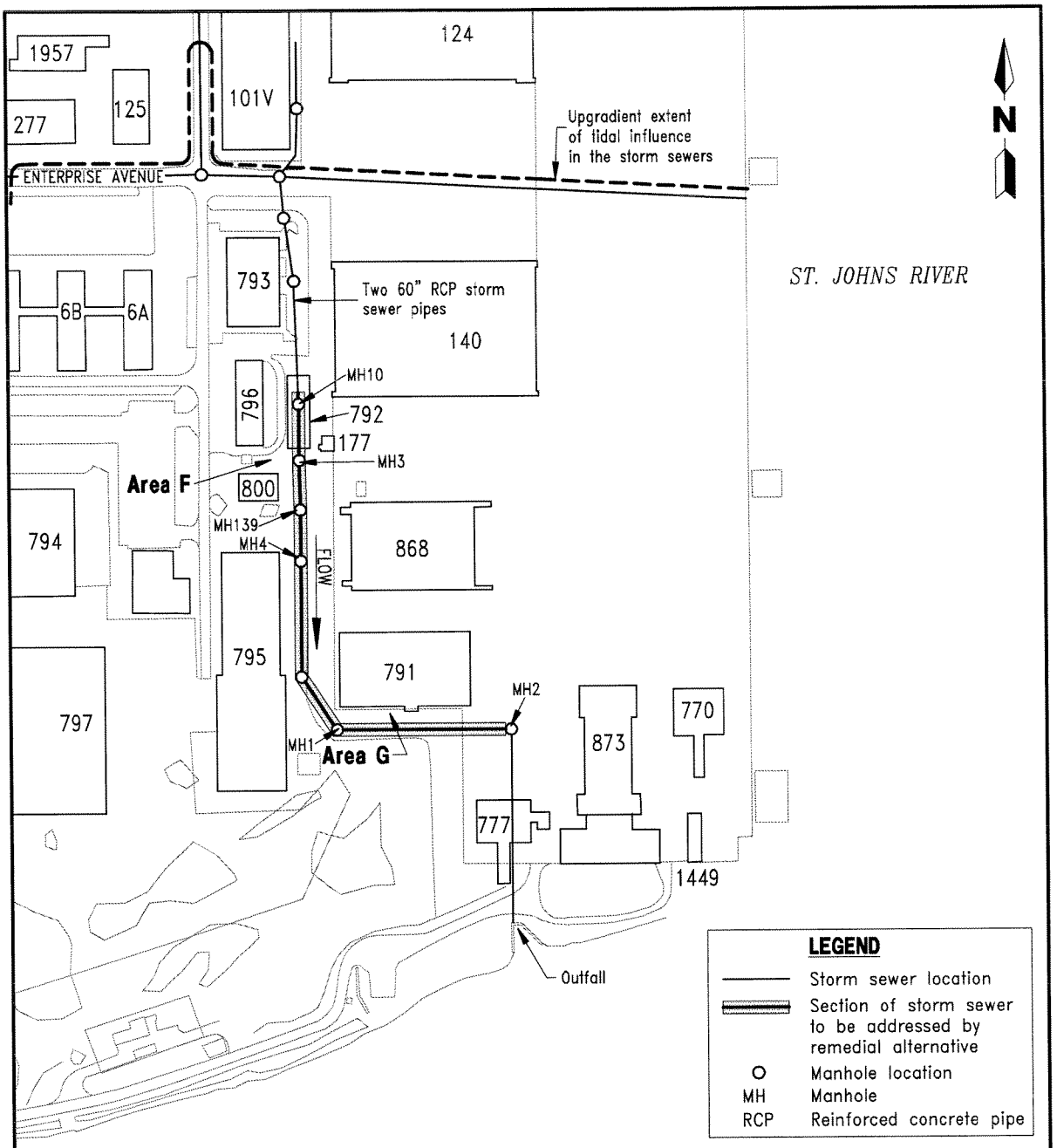

FIGURE 10-1
PORTION OF STORM SEWERS TO BE ADDRESSED BY REMEDIAL ALTERNATIVE

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

receptor exposure to ECPCs in surface water at the site (refer to Paragraph 7.1.6.2).

No RAOs will be established for surface water at OU 3 because no risks were predicted for human or ecological receptors based on exposure to this medium.

9.2.3 RAOs for Storm Sewer Water Several water samples were collected from the storm sewers at OU 3 during two different sampling events conducted for the RI. These data were summarized and discussed in Chapters 4.0 and 5.0 of this report.

Chemical-specific ARARs for the storm sewer water were considered to be the same as those identified for surface water, which are the FSWSs for Class III fresh waters. This is because the storm sewers discharge to the St. Johns River, where surface water standards will need to be achieved. A comparison of the storm sewer data to the surface water standards was completed, and the concentration of one organic chemical, TCE, exceeded its respective standard (Table 9-3). TCE was detected in samples collected from the storm sewer in the vicinity of groundwater hot spot Areas F and G (see Figure 4-15B).

Table 9-3
Summary of Exceedances of ARARs/TBCs for Storm Sewer Water

Remedial Investigation and Feasibility Study
Operable Unit 3
Naval Air Station Jacksonville
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detected Concentrations	Mean of Detected Concentrations[2]	Maximum Detected Concentration	Florida Surface Water Standard[3]
Volatile Organic Compounds (µg/l)					
Trichloroethene	8/19	1.5 to 170	70.5	170	80.7

[1] Frequency of detection is the number of confirmatory samples in which the analyte was detected versus the total number of confirmatory samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all confirmatory samples in which the analyte was detected. It does not include those confirmatory samples in which the analyte was not detected.
[3] Values are for Class III Fresh water, at average annual flow conditions (Section 200, Chapter 62-302, Florida Administrative Code).

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = to be considered.
Fg/l = micrograms per liter.

An HHRA was completed for human exposure to storm sewer water. The exposure scenario evaluated for this assessment included limited dermal contact for a utility worker (i.e., someone repairing or performing maintenance activities in the sewer line). The ELCR predicted for this exposure scenario was estimated to be $3x10^{-7}$, which is less than the USEPA target risk range of $1x10^{-4}$ to $1x10^{-6}$, and less than the FDEP target risk level of $1x10^{-6}$. The noncancer HI predicted for the same exposure scenario was less than 1, which is acceptable to the USEPA and FDEP.

An ERA was not conducted for ecological exposure to storm sewer water at OU 3. This is because a viable exposure pathway for ecological receptors was not identified, in that the storm sewers are located underground (beneath thick pavement and buildings) thereby severely limiting routes of exposure for ecological receptors to storm sewer water.

APPENDIX E

OU 3 AREAS C AND D PRESENTATION – CH2MHILL

Post-HRC Injection Monitoring Update
Areas C and D, NAS Jacksonville
Jacksonville, FL

Presented to
NAS Jacksonville Partnering Team

March 30, 2004

HRC Injection and Monitoring Summary - Area C

- HRC Injection Groundwater Monitoring Program includes Monitoring Wells U3C-MW31, U3C-MW35, U3C-MW36, U3C-MW37, U3C-MW38, U3C-MW39, U3C-MW40, U3C-MW41, and U3C-MW42
- Baseline Groundwater Monitoring Event performed November 5 - 13, 2001
- HRC Injection completed from December 16, 2002 - February 26, 2003 with approximately 3,710 gallons of HRC injected into 262 injection points
- 1st Post-HRC Injection Monitoring Event performed July 15-30, 2003. The results were presented to the NAS Jacksonville Partnering Team at the October 28, 2003 meeting
- 2nd Post-HRC Injection Monitoring Event performed December 15-20, 2003 approximately 10 months following HRC injection completion

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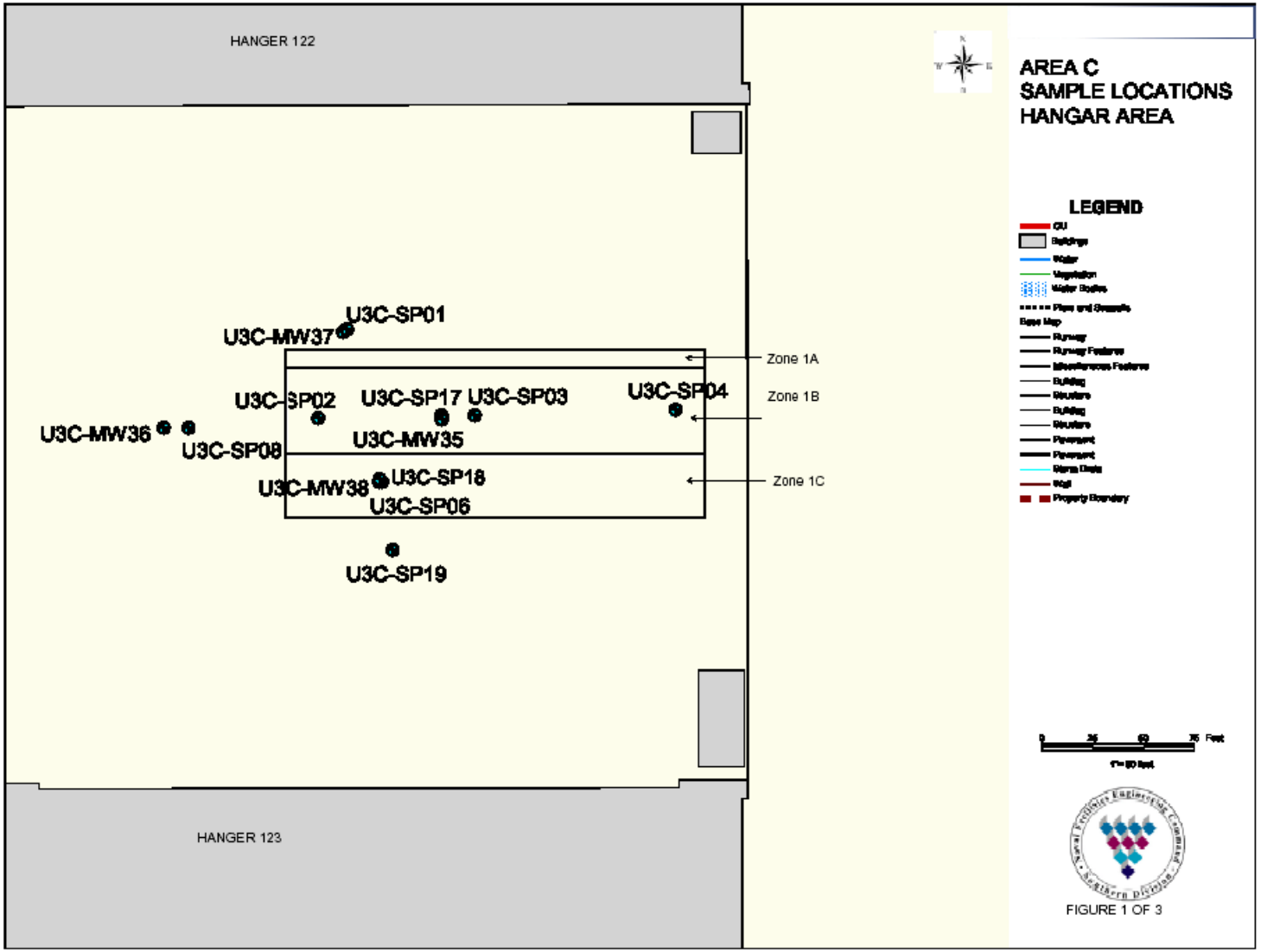
HRC Injection Plan - Hangar Area



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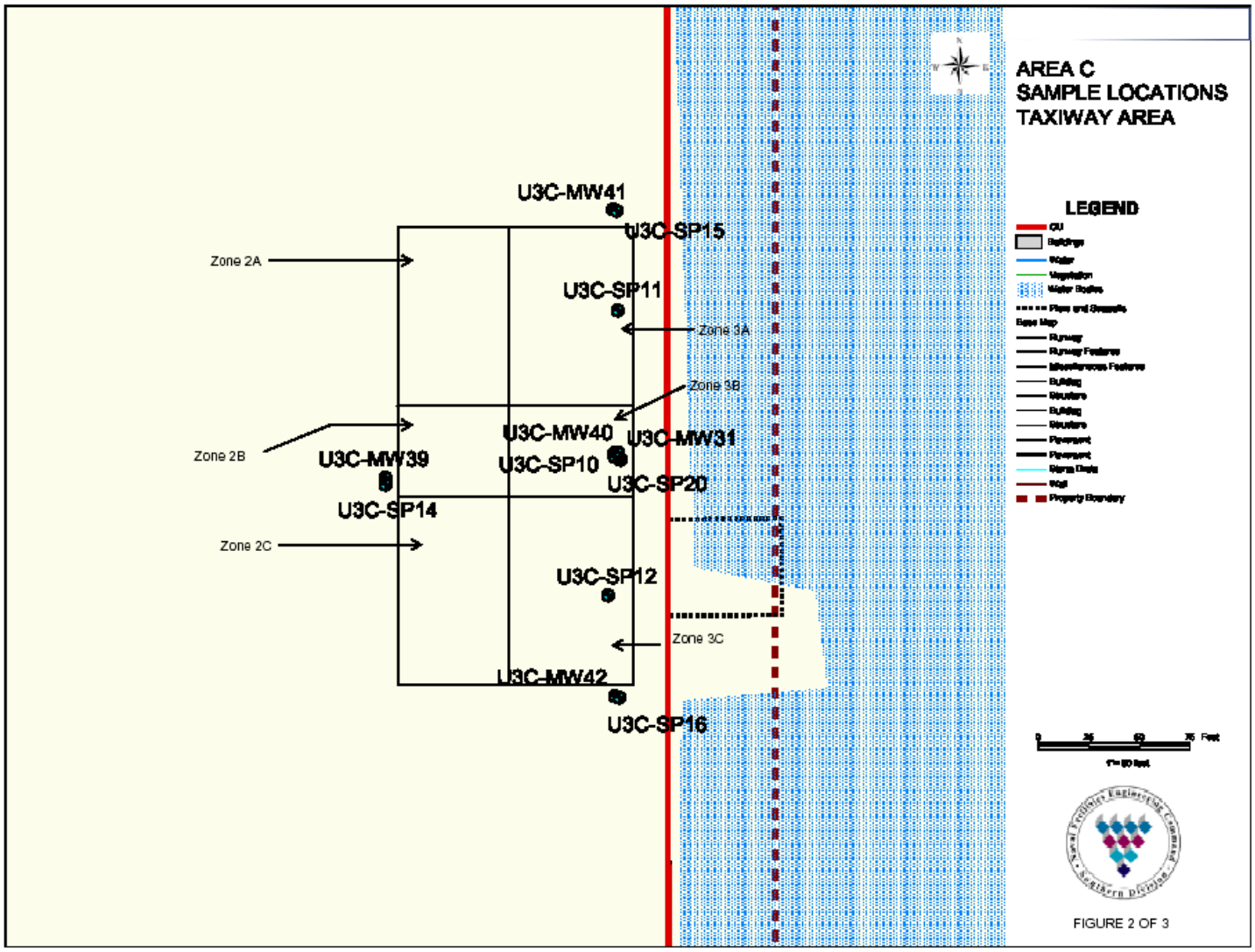
HRC Injection Plan - Taxiway Area



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POST-HRC INJECTION GROUNDWATER MONITORING RESULTS - TCLE

AREA C, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3C-MW31	U3C-MW35	U3C-MW36	U3C-MW37	U3C-MW38	U3C-MW39	U3C-MW40	U3C-MW41	U3C-MW42
Interval No.		--	1	1	1	1	1	3	3	2
Screen Interval (ft bls)		35 to 40	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50
Vinyl Chloride (ug/L)	Nov-01	27.0	<1	<1	<1	<1	<1	100	<1	<1
	Jul-03	<25	<100	<1	<5	<1	<20	<50	<1	<1
	Dec-03	73.7	<100	<1	<1	<10	<1	57.5	<1	<1
1,1-DCE (ug/L)	Nov-01	1.7	1.2	<1	<1	12.0	<1	3.8	<1	<1
	Jul-03	<125	<50	<5	26.9	<5	<100	<250	<5	<5
	Dec-03	<250	<500	<5	<5	23.2	<5	<100	<5	<5
cis-1,2-DCE (ug/L)	Nov-01	260	29.0	0.88	0.38	1.6	0.69	850	<1	<1
	Jul-03	2,870	<500	<5	<25	<5	3,750.00	4,070	<5	<5
	Dec-03	4,210	130	1.34	<5	15	3.08	2,890	0.798	<5
trans-1,2-DCE (ug/L)	Nov-01	3.6	0.81	<1	<1	<1	<1	5.5	<1	<1
	Jul-03	<125	<500	<5	<25	<5	<100	<250	<5	<5
	Dec-03	<250	<500	<5	<5	<50	<5	20.9	<5	<5
TCE (ug/L)	Nov-01	5,000	9,100	40	28	780	23	2,700	1.40	2.0
	Jul-03	2,570	9,190	46	654	23.5	316	298	1.11	<3
	Dec-03	131	10,500	44.7	26.7	839	27.8	39.5	1.21	<3
PCE (ug/L)	Nov-01	<1	1.1	<1	<1	<1	<1	<1	<1	<1
	Jul-03	<75	<300	<3	<15	<3	<60	<150	<3	<3
	Dec-03	<150	<300	<3	<3	<30	<3	<60	<3	<3
TCLE (ug/L)	Nov-01	5,292.3	9,132.1	40.9	28.4	793.6	23.7	3,659.3	1.4	2.0
	Jul-03	5,440	9,190	46	681	24	4,066	4,368	1	0
	Dec-03	4,414.7	10,630	46.0	26.7	877.2	30.88	3,007.9	2	0

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Hangar 122

U3C-MW37□
TCLE (ug/L): 28.4 (11/01); □
681 (07/03); 26.7 (12/03)□

U3C-MW35□
TCLE (ug/L): 9,132.1 (11/01); □
9,190 (07/03); 10,630 (12/03)□
□
D. ethenogenes (soil): 777 cells/g□
D. ethenogenes (gw): Yes / 1050 □
cells/mL

U3C-MW36□
TCLE (ug/L): 40.9 (11/01); □
46 (07/03); 46 (12/03)□
□
D. ethenogenes (soil): <500 cells/g□
D. ethenogenes (gw): Yes / <500 □
cells/mL

U3C-MW38□
TCLE (ug/L): 793.6 (11/01); □
24 (07/03); 877.2 (12/03)□

Hangar 123

U3C-MW41□
TCLE (ug/L): 1.4 (11/01); □
1.0 (07/03); 2.0 (12/03)□

U3C-MW40□
TCLE (ug/L): 3,659.3 (11/01); □
4,398 (07/03); 3,007.9 (12/03)□
□
D. ethenogenes (soil): <500 cells/g□
D. ethenogenes (gw): No / <500 cells/mL

U3C-MW39□
TCLE (ug/L): 23.7 (11/01); □
4,066 (07/03); 30.88 (12/03)□
□
D. ethenogenes (soil): <500 cells/g□
D. ethenogenes (gw): Yes / <500 cells/mL

U3C-MW31□
TCLE (ug/L): 5,292.3 (11/01); □
5,440 (07/03); 4,414.7 (12/03)

U3C-MW42□
TCLE (ug/L): 2.0 (11/01); □
ND (07/03); ND (12/03)□

TETRA TECH, INC.

Area C Site Plan

LEGEND

- Buildings
- Water
- Water Bodies
- Piers and Seawalls

Base Map

- Runway
- Runway Features
- Miscellaneous Features
- Building
- Structure
- Building
- Structure
- Pavement
- Pavement
- Storm Drain
- Wall
- Property Boundary

0 25 50 75 100 125 Feet

1"= 60 feet

Naval Facilities Engineering Command • Southern Division •

FIGURE 1 of 1

This graphic was generated using the TtNUS EGIS module

Plot date: Oct 23, 2003; c:\copy of egis\egis_jacksonville_nas_r3.apr

Monitoring Well U3C-MW36

- Upgradient well for “upgradient plume”
- Multiport well with screened sections from 30-35, 35-40, 40-45, and 45-50 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has remained consistent in the 40-46 ug/L range from the baseline through post-injection monitoring events
- ORP has increased and DO fluctuated since the baseline event
- Soil sample collected from the 45-50 foot bls depth interval during the 1st post-injection monitoring event showed “non detect” TCLE concentrations
- *D. ethenogenes* not measurably present in soil and possibly present in groundwater based on 1st post-injection monitoring event

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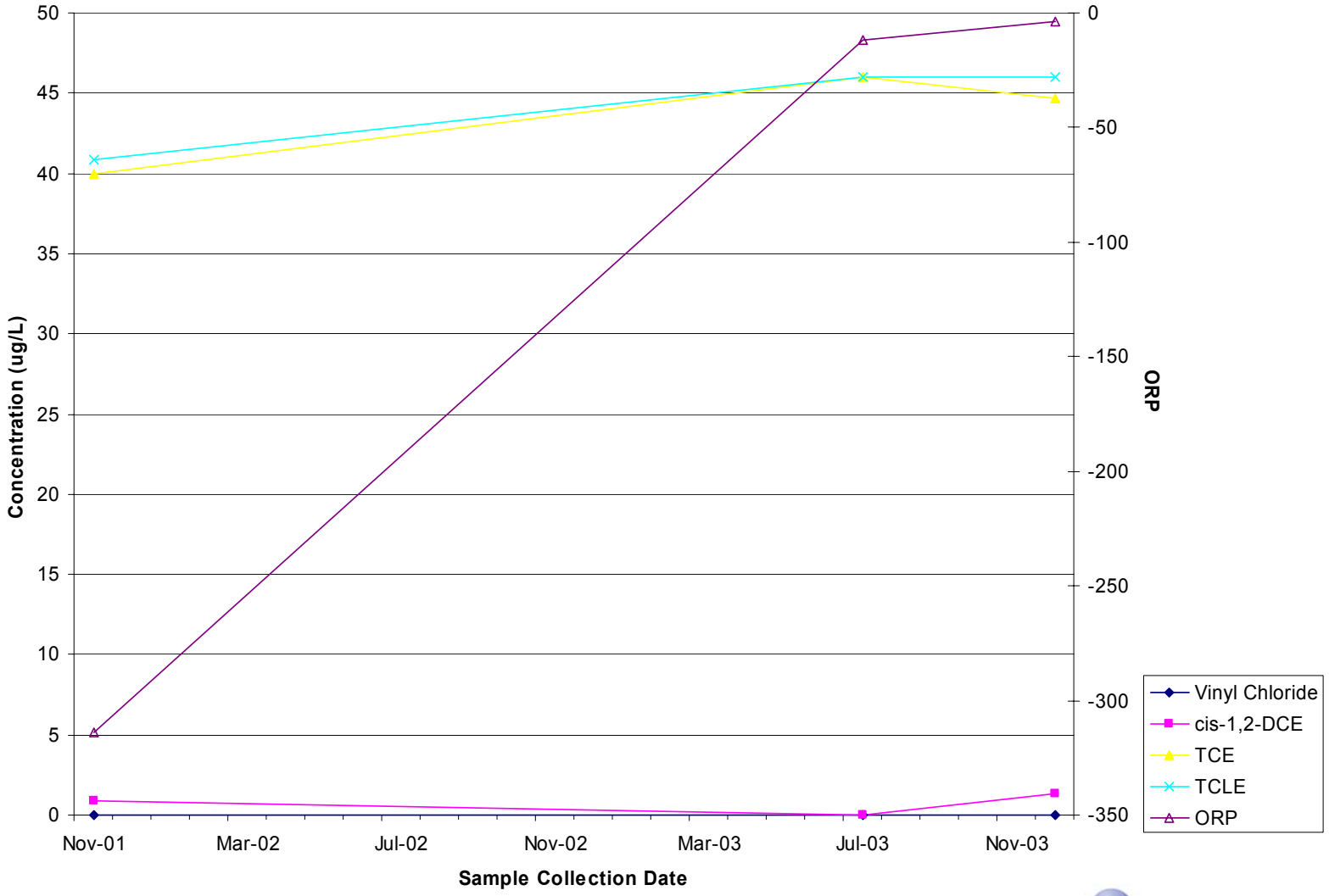
Monitoring Well U3C-MW36



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Monitoring Wells U3C-MW37 and U3C-MW38

- Sidegradient wells for “upgradient plume”
- Multiport wells with screened sections from 30-35, 35-40, 40-45, and 45-50 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- Major fluctuations in TCLE (primarily TCE) concentrations from the baseline through post-injection sampling events; Concentrations returned to baseline conditions for the 2nd post-injection monitoring event
- U3C-MW37: ORP has increased, but remains reductive, and DO has fluctuated since the baseline event
- U3C-MW38: ORP has decreased and DO has fluctuated since the baseline event

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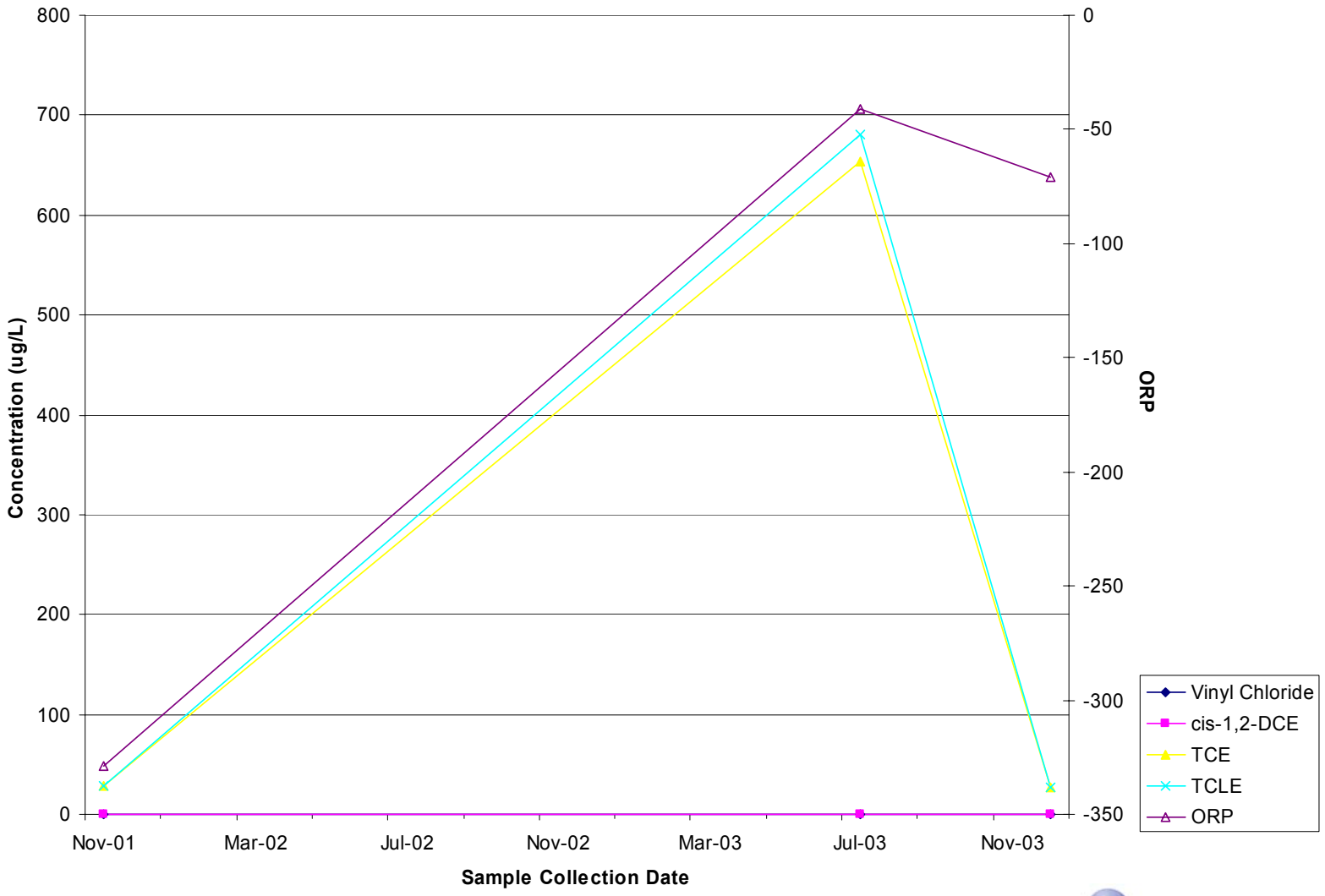
Monitoring Well U3C-MW37



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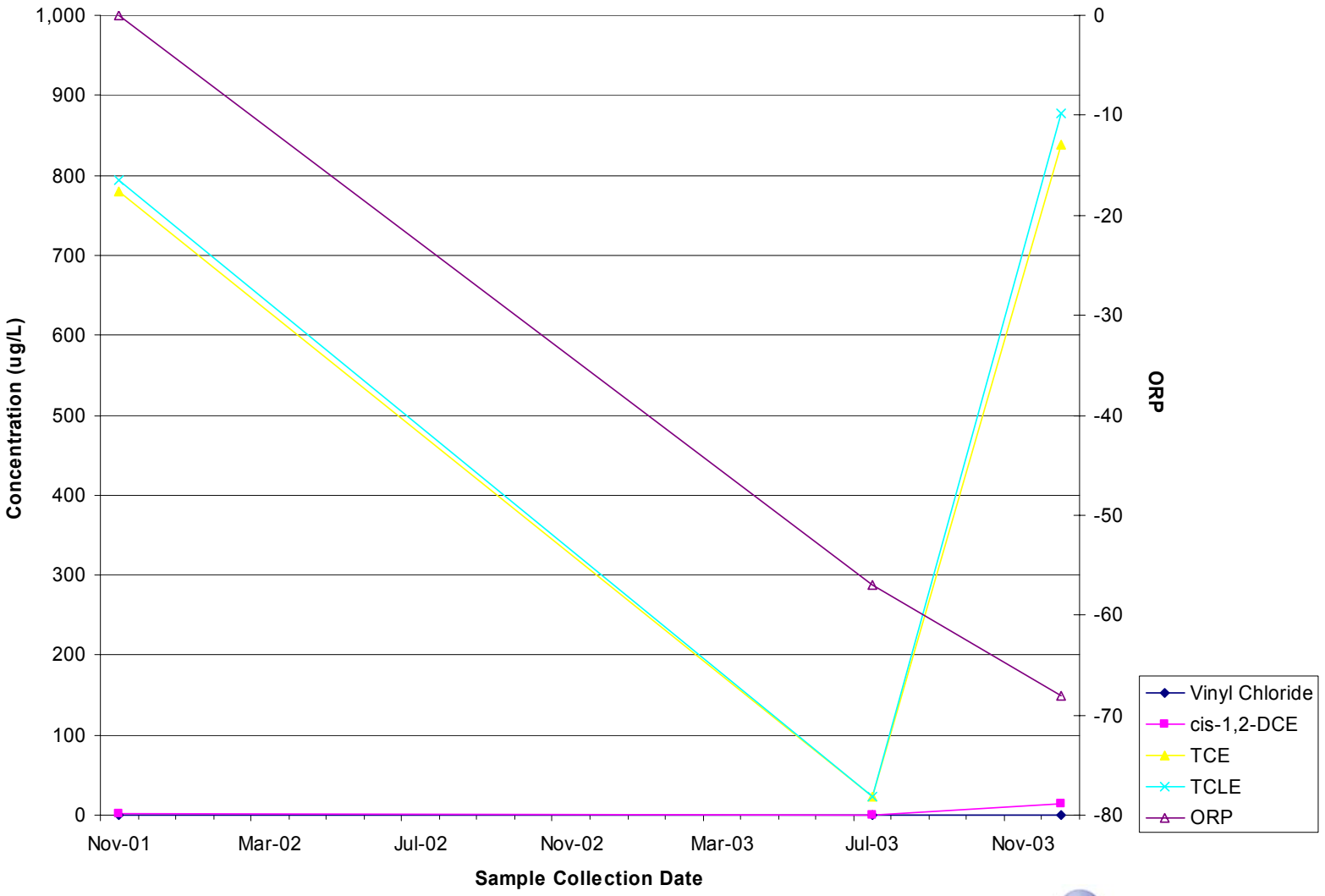
Monitoring Well U3C-MW38



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Monitoring Well U3C-MW35

- Source well for “upgradient plume”
- Multiport well with screened sections from 30-35, 35-40, 40-45, and 45-50 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has increased from 9,100 to 10,500 ug/L and cis-1,2-DCE concentration has increased from 29 to 130 ug/L from the baseline through post-injection monitoring events
- ORP has decreased and DO fluctuated since the baseline event
- Soil sample collected from the 45-50 foot bls depth interval during the 1st post-injection monitoring event showed minimal concentrations of TCE and cis-1,2-DCE
- *D. ethenogenes* measurably present in soil and groundwater based on 1st post-injection monitoring event

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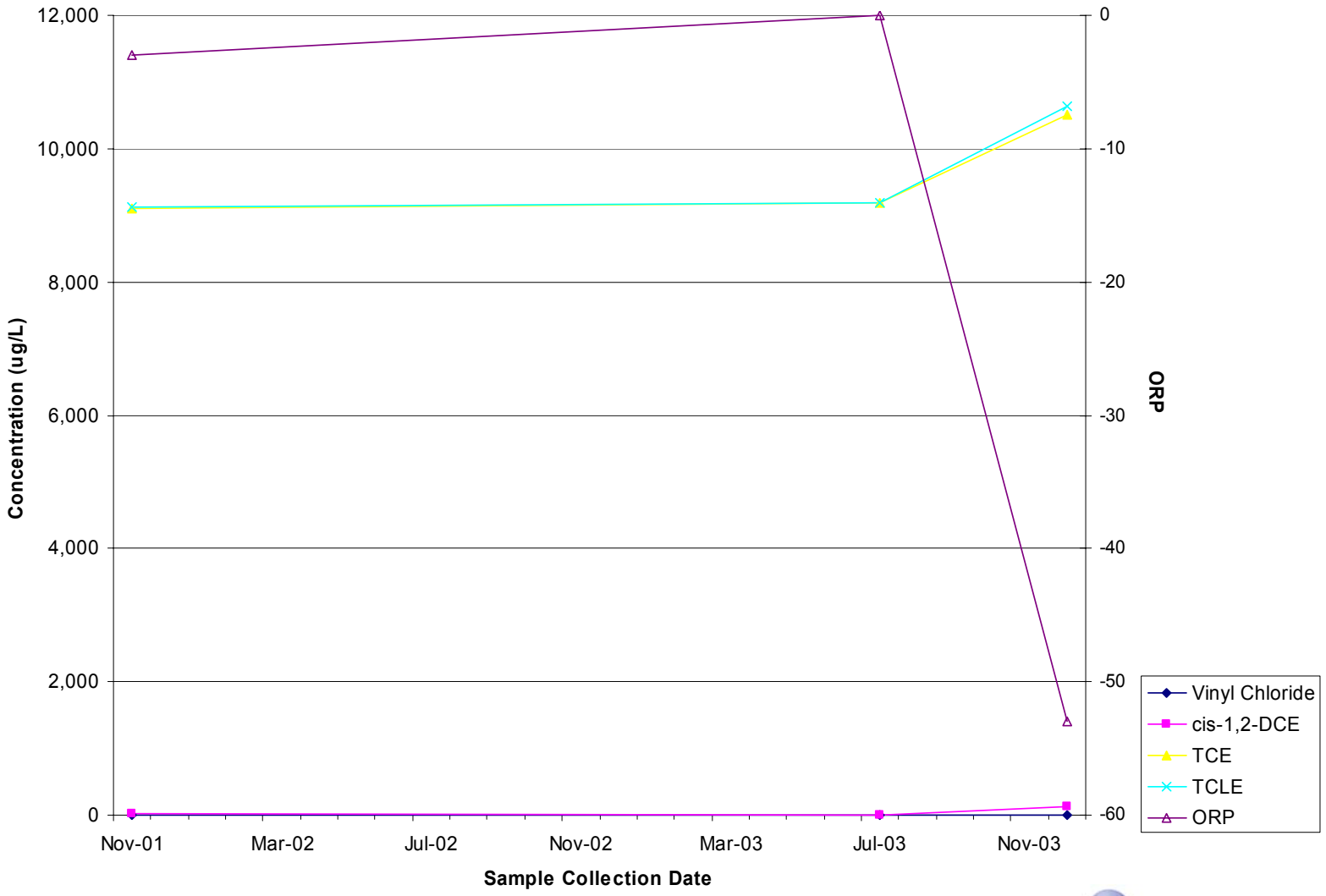
Monitoring Well U3C-MW35



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Monitoring Well U3C-MW39

- Downgradient well for “upgradient plume” and upgradient well for “downgradient plume”
- Multiport well with screened sections from 30-35, 35-40, 40-45, and 45-50 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- Major fluctuations in TCLE (primarily TCE and cis-1,2-DCE) concentrations from the baseline through post-injection monitoring events; Concentrations returned to baseline conditions for the 2nd post-injection monitoring event
- ORP has decreased and DO fluctuated from the baseline event
- Soil sample collected from the 45-50 foot bls depth interval during the 1st post-injection monitoring event showed “non-detect” TCLE concentrations
- *D. ethenogenes* not measurably present in soil and possibly present in groundwater based on 1st post-injection monitoring event

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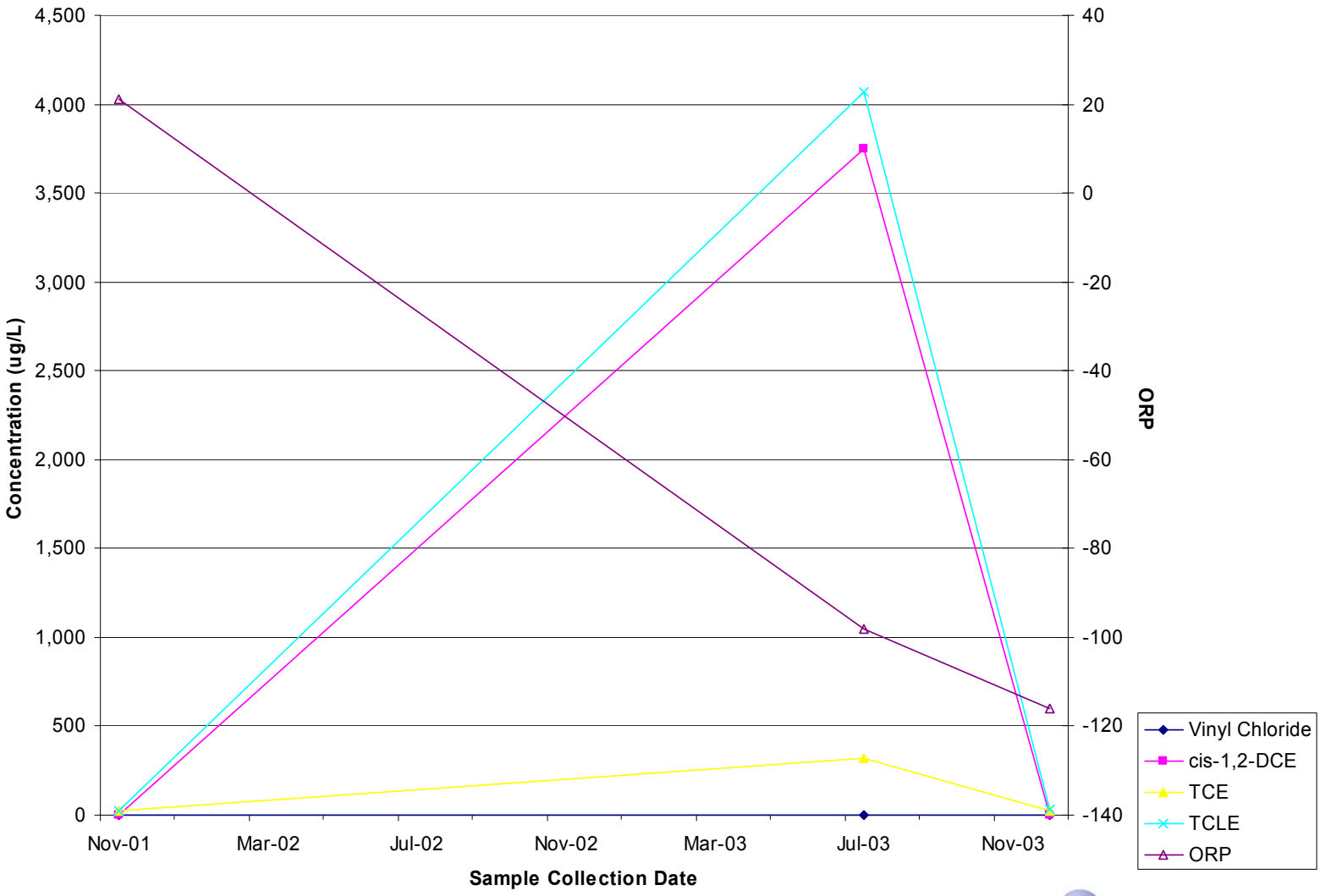
Monitoring Well U3C-MW39



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Monitoring Wells U3C-MW41 and U3C-MW42

- Sidegradient wells for “downgradient plume”
- U3C-MW41 is a multiport well with screened sections from 30-35, 35-40, 40-45, 45-50, 50-55, and 55-60 feet bls
- U3C-MW42 is a multiport well with screened sections from 30-35, 35-40, 40-45, 45-50, and 50-55 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- TCE concentrations have remained consistent in the “non detect” to 2 ug/L range from the baseline through post-injection monitoring events
- ORP has decreased and DO fluctuated from the baseline event

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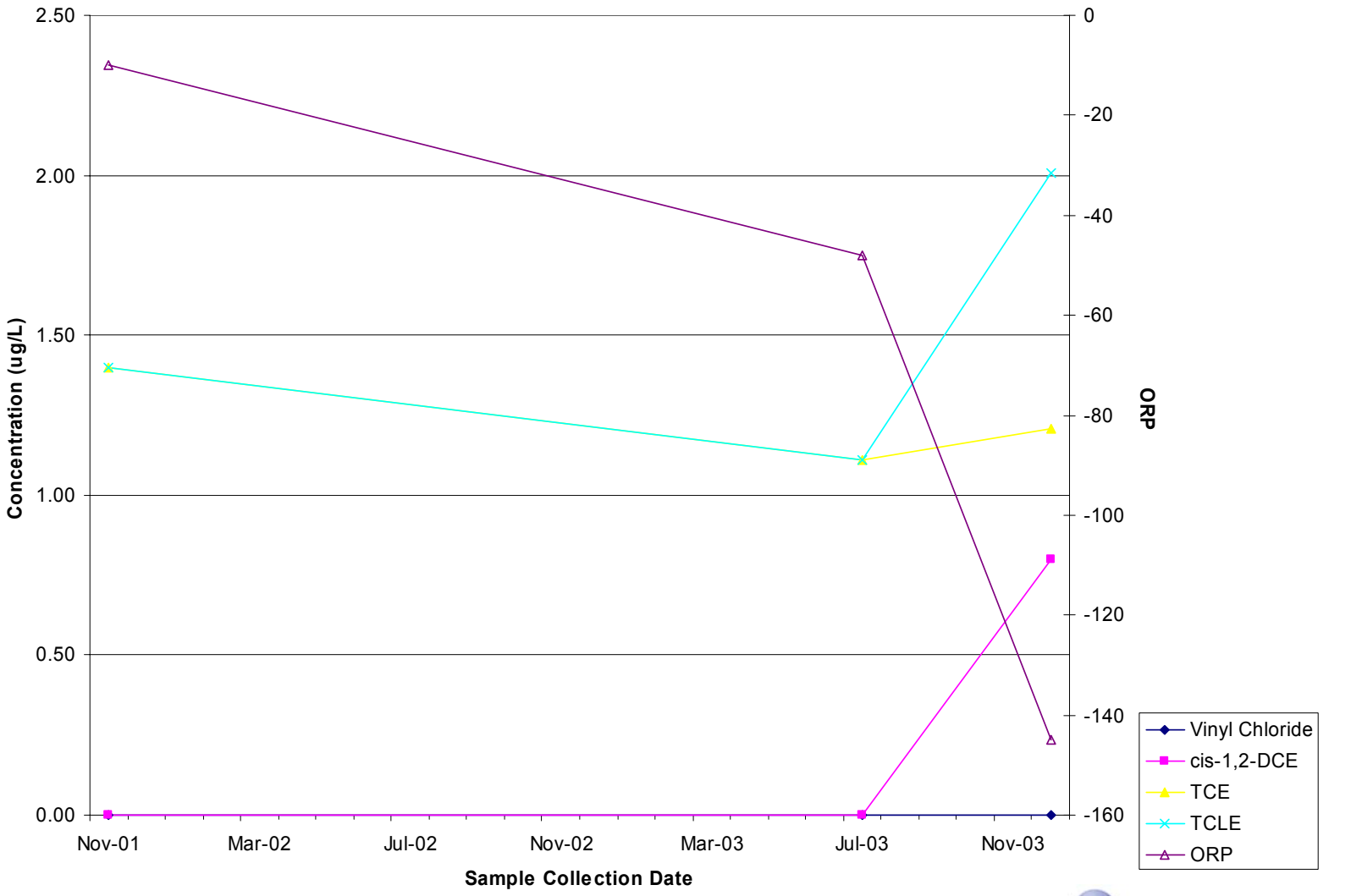
Monitoring Well U3C-MW41



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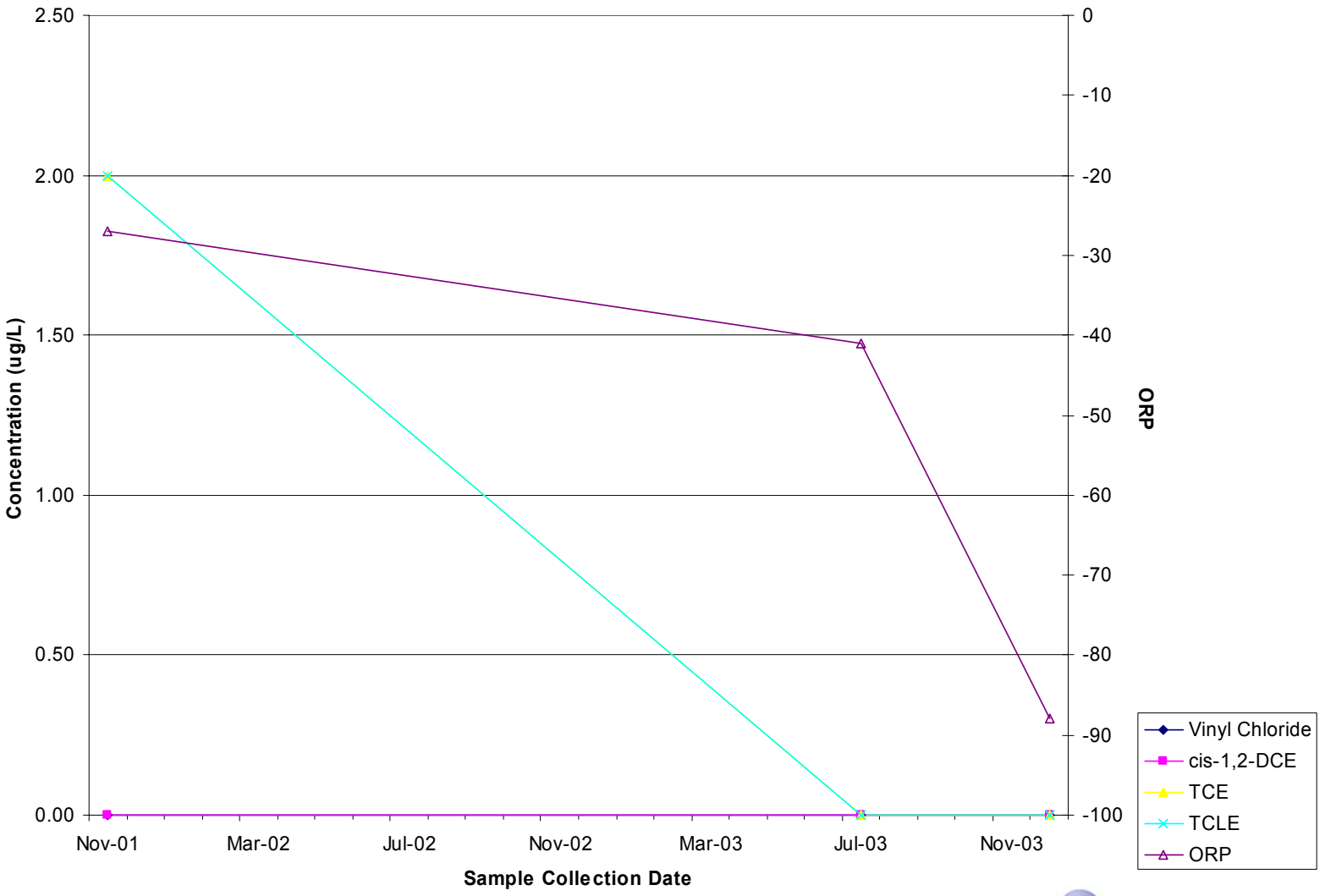
Monitoring Well U3C-MW42



CH2MHILL

Monitoring Well U3C-MW31

- Source well for “downgradient plume”
- Conventional 2-inch diameter well screened from 35-40 feet bls
- TCE concentration has decreased from 5,000 to 131 ug/L, cis-1,2-DCE concentration has increased from 260 to 4,210 ug/L, and vinyl chloride concentration has increased from 27 to 73.7 ug/L from the baseline through post-injection monitoring events
- ORP has decreased and DO fluctuated from the baseline event

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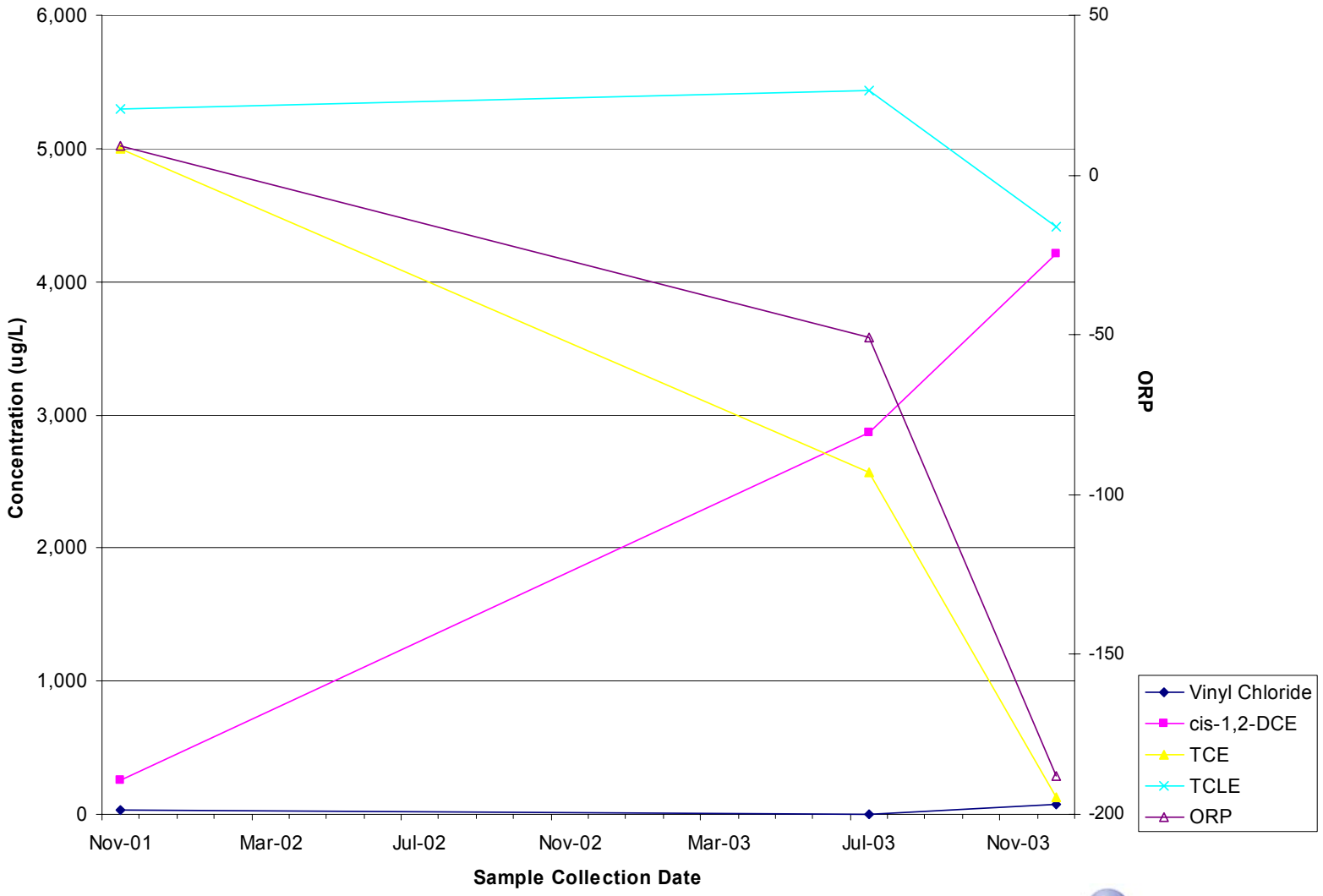
Monitoring Well U3C-MW31



CH2MHILL

Monitoring Well U3C-MW40

- Source well for “downgradient plume”
- Multiport well with screened sections from 30-35, 35-40, 40-45, 45-50, 50-55, and 55-60 feet bls
- Each screened section sampled for baseline event; 45-50 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has decreased from 2,700 to 39.5 ug/L, cis-1,2-DCE concentration has increased from 850 to 2,890 ug/L, and vinyl chloride concentration has decreased from 100 to 57.5 ug/L from the baseline through post-injection monitoring events
- ORP has fluctuated, but remains reductive, since the baseline event
- Soil sample collected from the 45-50 foot bls depth interval during the 1st post-injection monitoring event showed minimal concentrations of TCE, cis-1,2-DCE, and vinyl chloride
- *D. ethenogenes* not measurably present in soil or groundwater based on 1st post-injection monitoring event

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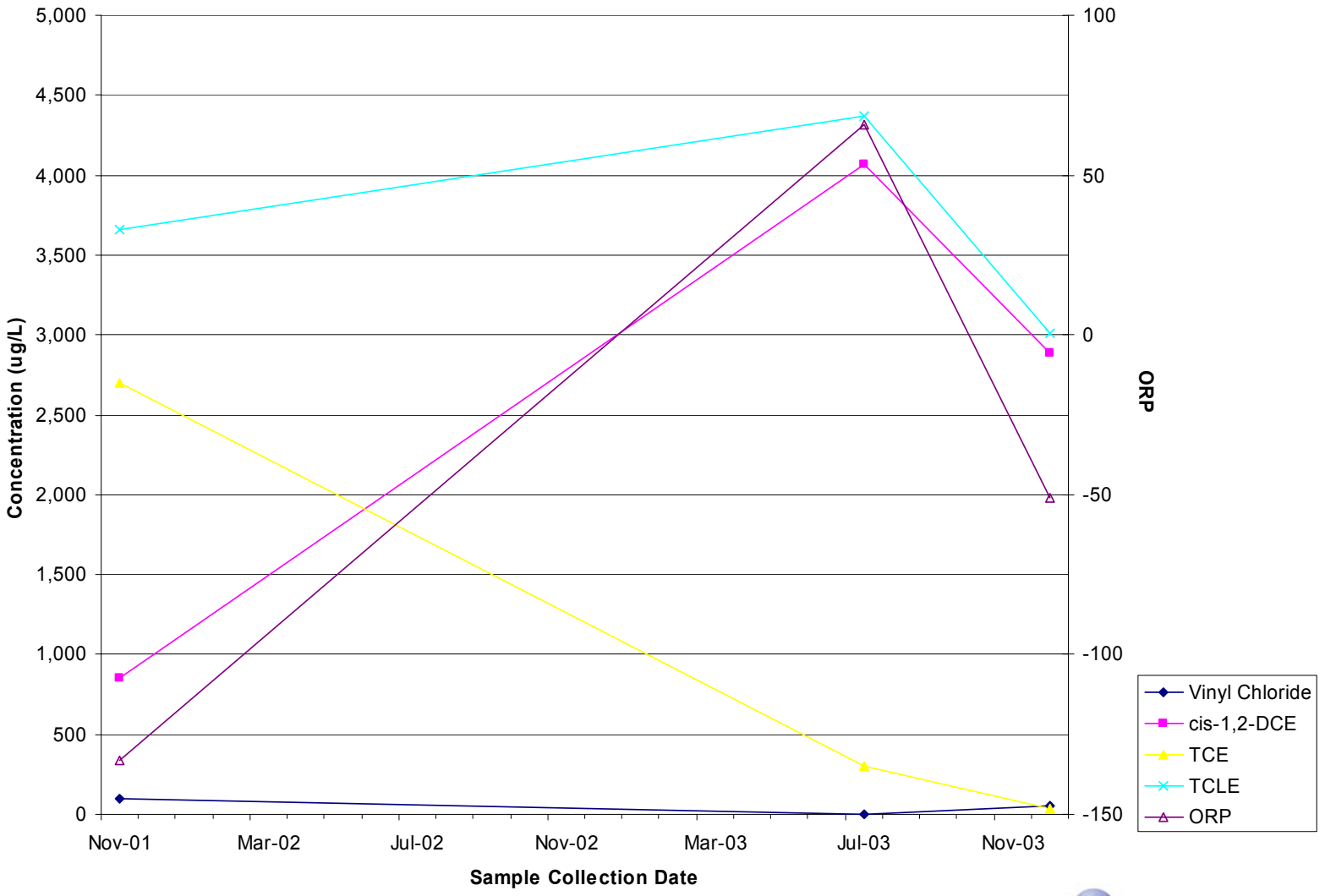
Monitoring Well U3C-MW40



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HRC Injection and Monitoring Summary - Conclusions from 1st Post-HRC Injection Monitoring Event

- Upgradient Plume
  - *U3C-MW36 (upgradient well) and U3C-MW35 (source well) showed no change in TCLE concentrations*
  - *U3C-MW37 (sidegradient well) showed significant increase in TCE concentration*
  - *U3C-MW38 (sidegradient well) showed significant decrease in TCE concentration*
- Downgradient Plume
  - *U3C-MW39 (upgradient well) showed significant increases in TCE and cis-1,2-DCE concentrations. Possible explanations include downgradient migration of contaminants. In addition, HRC may have diffused upgradient beyond the original HRC injection area. Both increases in TCE and cis-1,2-DCE possibly indicated that reductive dechlorination had been stimulated upgradient of the HRC injection area.*
  - *U3C-MW41 and U3C-MW42 (sidegradient wells) showed no changes in TCLE concentrations and remained close to non detect*
  - *U3C-MW31 (source well) showed TCE concentration reduced by 49% with significant increase in cis-1,2-DCE concentration*
  - *U3C-MW40 (source well) showed TCE concentration reduced by 89% with significant increase in cis-1,2-DCE concentration*

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HRC Injection and Monitoring Summary - Conclusions from 2nd Post-HRC Injection Monitoring Event

- Upgradient Plume
  - *U3C-MW36 (upgradient well) still shows no change in TCLE concentrations*
  - *U3C-MW37 and U3C-MW38 (sidegradient wells) returned to baseline TCLE concentrations. Contaminants may have mobilized following injection and have been allowed to stabilize over time.*
  - *U3C-MW35 (source well) shows a slight increase in TCE and cis-1,2-DCE concentrations. ORP is decreasing and this well may be showing the start of reductive dechlorination.*
- Downgradient Plume
  - *U3C-MW39 (upgradient well) returned to baseline TCLE concentrations giving evidence to the possible explanation that contaminants may have mobilized following injection and have been allowed to stabilize over time.*
  - *U3C-MW41 and U3C-MW42 (sidegradient wells) still show no change in TCLE concentrations and remain close to non detect*
  - *U3C-MW31 (source well) continues to show significant reductive dechlorination of TCE to cis-1-2-DCE to vinyl chloride*
  - *U3C-MW40 (source well) continues to show significant reductive dechlorination of TCE to cis-1-2-DCE to vinyl chloride and possibly to methane, ethane, and ethene*

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HRC Injection and Monitoring Summary - Area D

- HRC Injection Groundwater Monitoring Program includes Monitoring Wells U3D-MW30, U3D-GEW002, U3D-MW43, U3D-MW44, U3D-MW46, U3D-MW47, and U3D-MW48.
- Monitoring Well U3D-MW45 was abandoned in January 2003 to facilitate paint booth construction in Hangar 101S
- Baseline Groundwater Monitoring Event performed November 5 - 13, 2001
- HRC Injection completed from August 12, 2002 - December 13, 2002 with approximately 4,156 gallons of HRC injected into 346 injection points
- 1st Post-HRC Injection Monitoring Event performed July 15-30, 2003. The results were presented to the NAS Jacksonville Partnering Team at the October 28, 2003 meeting
- 2nd Post-HRC Injection Monitoring Event performed December 15-20, 2003 approximately 1 year following HRC injection completion

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HRC Injection Plan

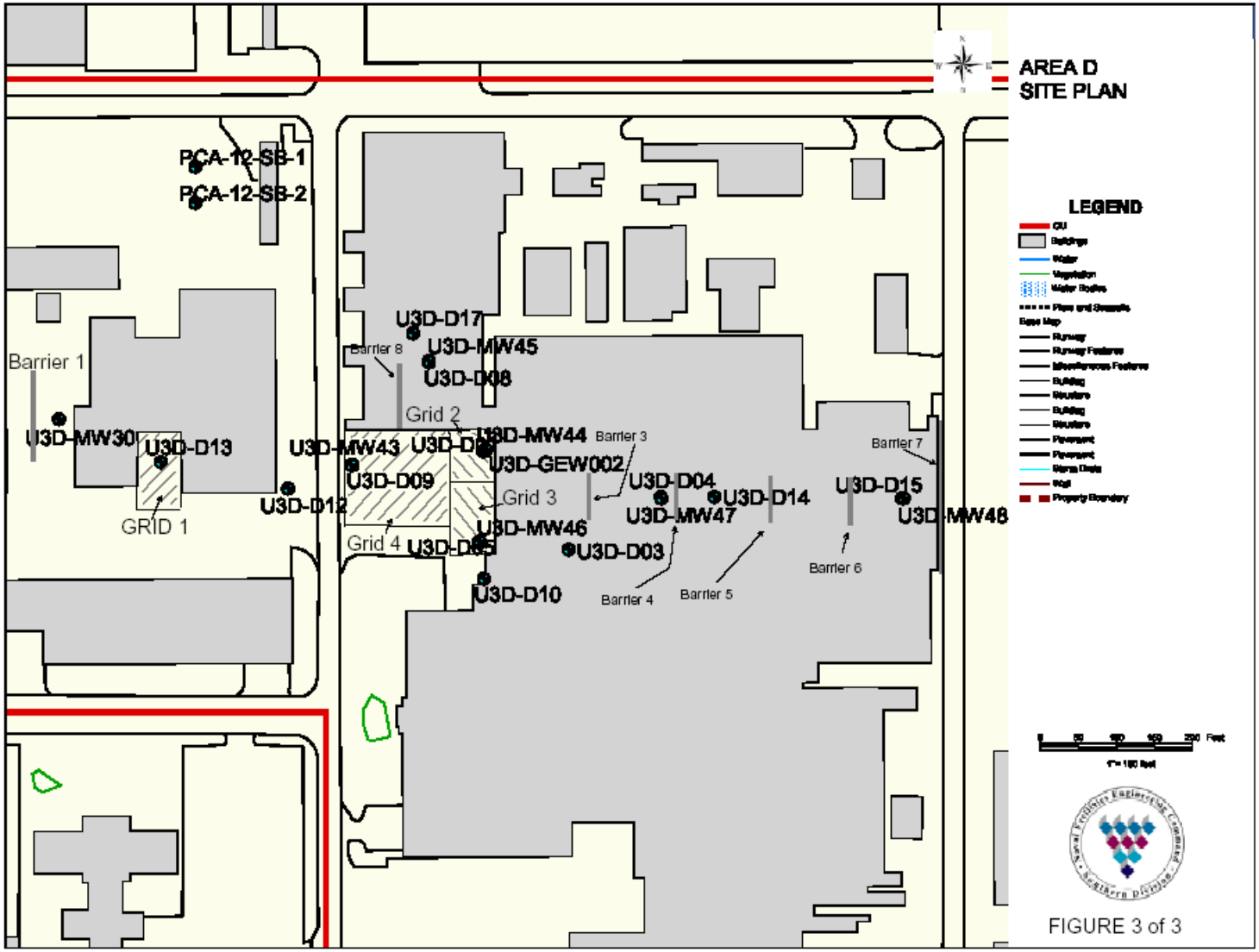

FIGURE 3 of 3

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POST-HRC INJECTION GROUNDWATER MONITORING RESULTS - TCLE

AREA D, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3D-MW30	U3D-GEW002	U3D-MW43	U3D-MW44	U3D-MW46	U3D-MW47	U3D-MW48
Interval No.		--	--	4	4	4	4	4
Screen Interval (ft bls)		30 to 35	27 to 52	34 to 39	34 to 39	34 to 39	34 to 39	34 to 39
Vinyl Chloride (ug/L)	Nov-01	<1	<1	<1	0.54	<1	<50	<10
	Jul-03	<50	<10	<10	<20	<1	<20	<1
	Dec-03	<10	<5	<10	<20	<1	<20	<1
1,1-DCE (ug/L)	Nov-01	2.0	1.1	<1	1.8	<1	<50	<10
	Jul-03	<50	<50	<50	<100	<5	<100	<5
	Dec-03	<50	<25	<50	<100	<5	<100	<5
cis-1,2-DCE (ug/L)	Nov-01	39.0	34.0	13.0	55	1.9	<50	<10
	Jul-03	<250	932.0	22.3	13.5	8.49	<100	<5
	Dec-03	1,520.0	776.0	42.2	58.5	23	12.8	1.24
trans-1,2-DCE (ug/L)	Nov-01	<1	1.8	1.2	2.4	<1	<50	<10
	Jul-03	<250	<50	<50	<100	3.82	<100	<5
	Dec-03	<50	11.5	7.87	<100	7.74	<100	<5
TCE (ug/L)	Nov-01	120	3,700	500	4,700	1.20	2,100	130
	Jul-03	95.3	577.0	691.0	2,340.0	15.5	1,900.0	125.0
	Dec-03	58.2	155.0	742.0	2,190.0	29.5	2,030.0	113.0
PCE (ug/L)	Nov-01	1,400	9.00	29.0	303	<1	<50	<10
	Jul-03	4,090	<30	<30	<60	<3	<60	<3
	Dec-03	1,060	5.76	12.40	9.22	<3	<60	<3
TCLE (ug/L)	Nov-01	1,561.0	3,745.9	543.2	5,062.7	3.1	2,100.0	130.0
	Jul-03	4,185.3	1,509.0	713.3	2,353.5	27.8	1,900.0	125.0
	Dec-03	2,638.2	948.3	804.5	2,257.7	60.2	2,042.8	114.2

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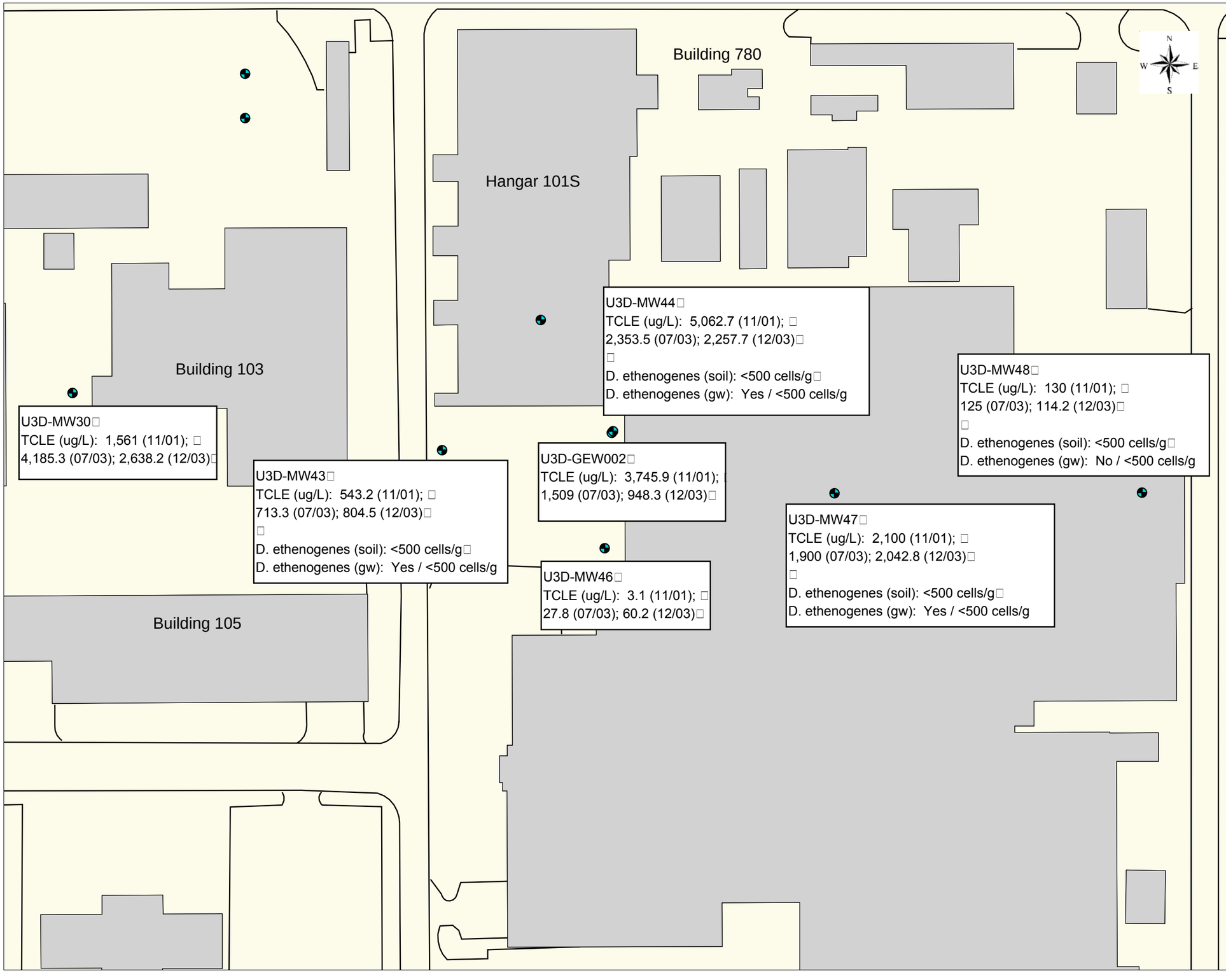

TETRA TECH, INC.

Area D Site Plan

LEGEND

- Buildings
- Water
- Water Bodies
- Piers and Seawalls

Base Map

- Runway
- Runway Features
- Miscellaneous Features
- Building
- Structure
- Building
- Structure
- Pavement
- Pavement
- Storm Drain
- Wall
- Property Boundary

0 50 100 150 200 Feet

1"= 100 feet

Naval Facilities Engineering Command • Southern Division •

FIGURE 1 of 1

This graphic was generated using the TtNUS EGIS module

Plot date: Oct 23, 2003; c:\copy of egis\egis_jacksonville_nas_r3.apr

Monitoring Well U3D-MW30

- Upgradient well for Area D plume; Downgradient of Building 106 Old Dry Cleaners
- Conventional 2-inch diameter well screened from 30-35 feet bls
- PCE concentration has fluctuated significantly (1,400 to 4,090 to 1,060 ug/L); TCE concentration has decreased from 120 to 58.2 ug/L; and cis-1,2-DCE concentration has increased from 39 to 1,520 ug/L from the baseline through post-injection monitoring events
- ORP and DO have decreased from the baseline event

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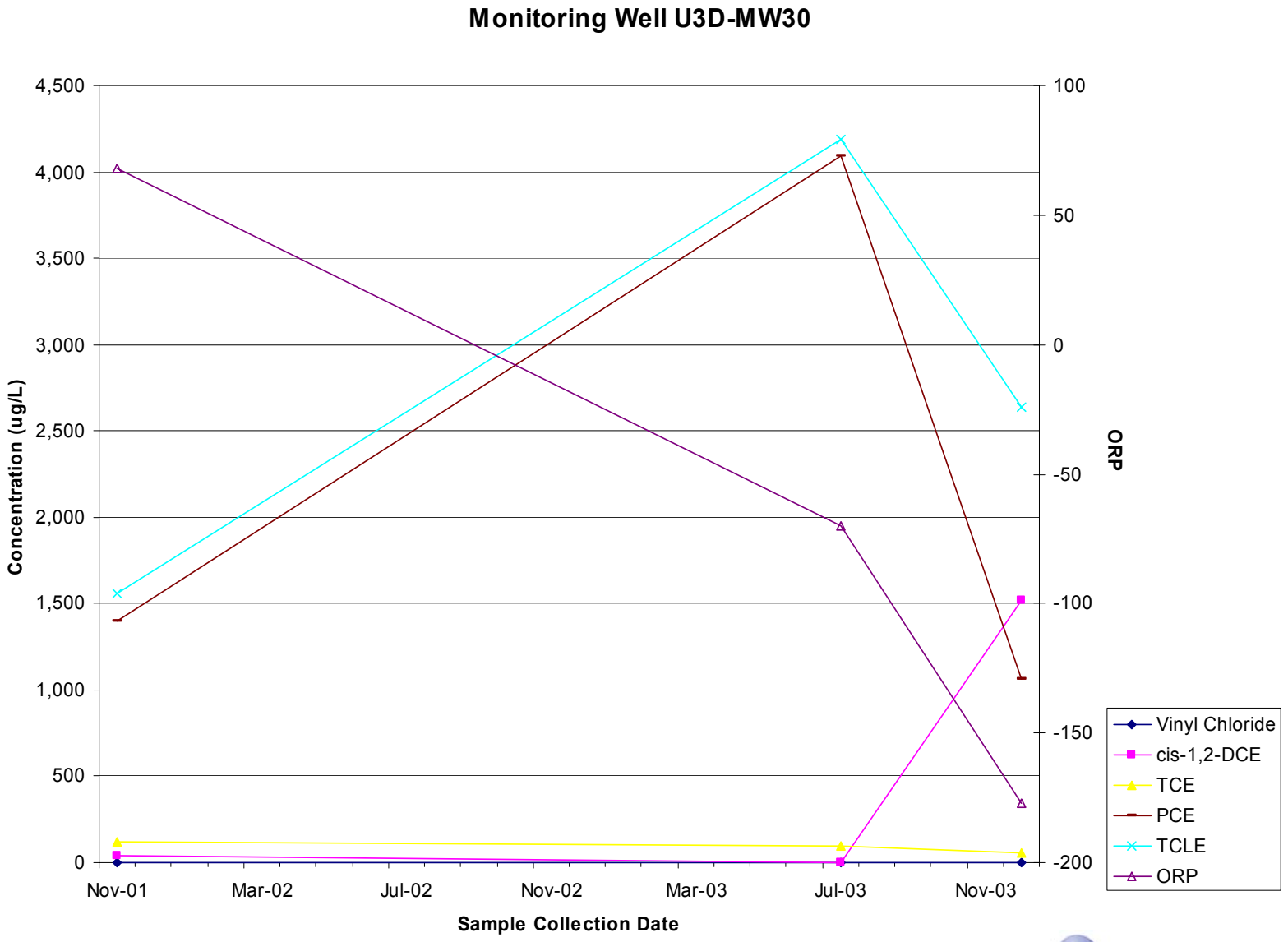
Monitoring Well U3D-MW30
Concentration (ug/L)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
100
50
0
-50
-100
-150
-200
ORP
Nov-01
Mar-02
Jul-02
Nov-02
Mar-03
Jul-03
Nov-03
Sample Collection Date
Vinyl Chloride
cis-1,2-DCE
TCE
PCE
TCLE
ORP

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Monitoring Well U3D-MW43

- Upgradient well for Area D plume
- Multiport well with screened sections from 24-29, 29-34, 34-39, 39-44, 44-49, 49-54, and 54-59 feet bls
- Each screened section sampled for baseline event; 34-39 feet bls depth interval sampled for post-injection monitoring
- PCE concentration has slightly decreased and TCE/DCE concentrations have slightly increased from the baseline through post-injection monitoring events
- ORP has fluctuated, but remains reductive, since the baseline event
- Soil sample collected from the 34-39 foot bls depth interval during the 1st post-injection monitoring event showed minimal concentrations of PCE, TCE, and cis-1,2-DCE
- *D. ethenogenes* not measurably present in soil and possibly present in groundwater based on 1st post-injection monitoring event

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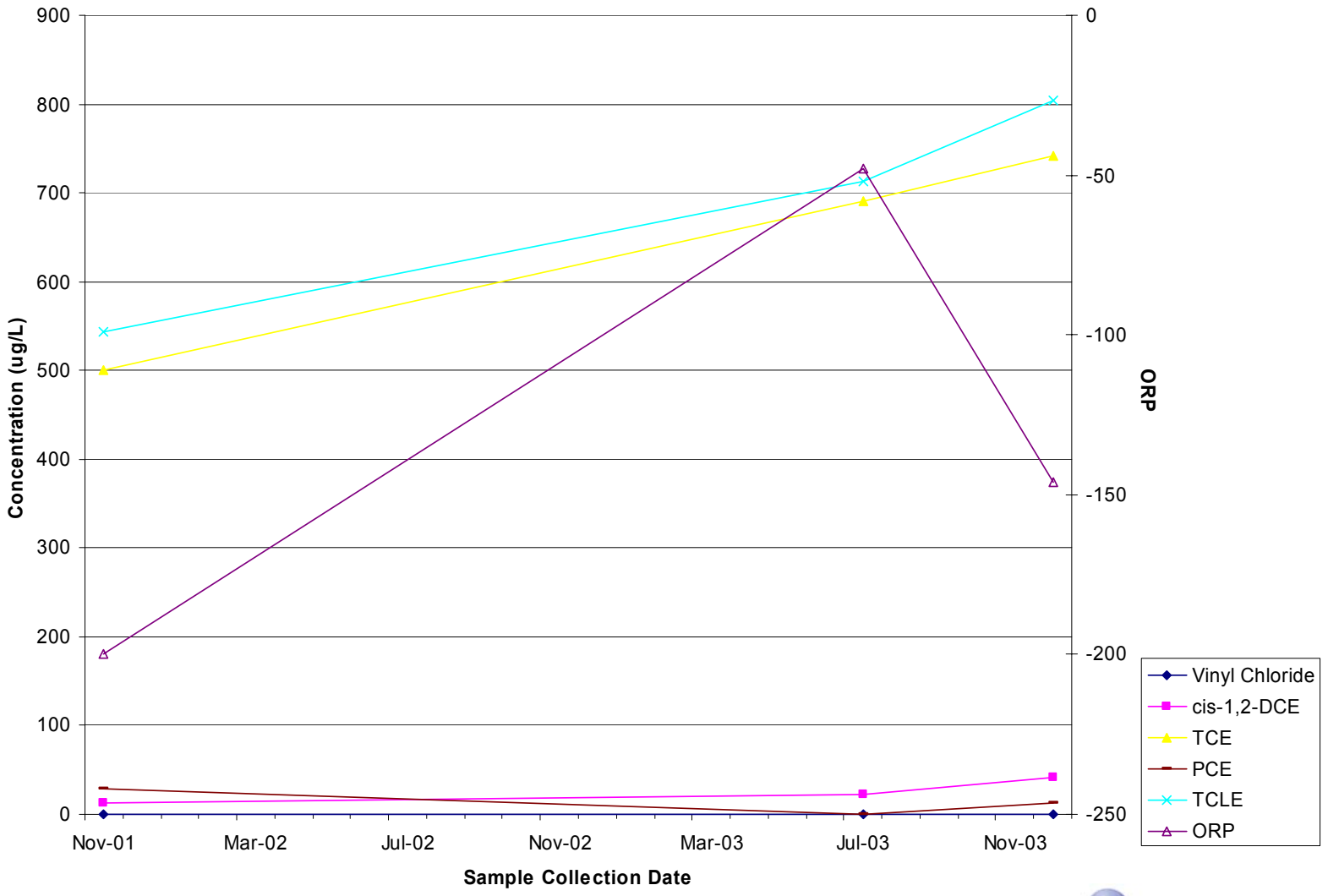
Monitoring Well U3D-MW43



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Monitoring Well U3D-MW44

- Source well for Area D plume
- Multiport well with screened sections from 24-29, 29-34, 34-39, 39-44, 44-49, 49-54, and 54-59 feet bls
- Each screened section sampled for baseline event; 34-39 feet bls depth interval sampled for post-injection monitoring
- PCE/TCE concentrations have significantly decreased and cis-1,2-DCE has returned to baseline concentration from the baseline through post-injection monitoring events
- ORP has decreased since the baseline event
- Soil sample collected from the 34-39 foot bls depth interval during the 1st post-injection monitoring event showed no TCLE concentrations
- *D. ethenogenes* not measurably present in soil and possibly present in groundwater based on 1st post-injection monitoring event

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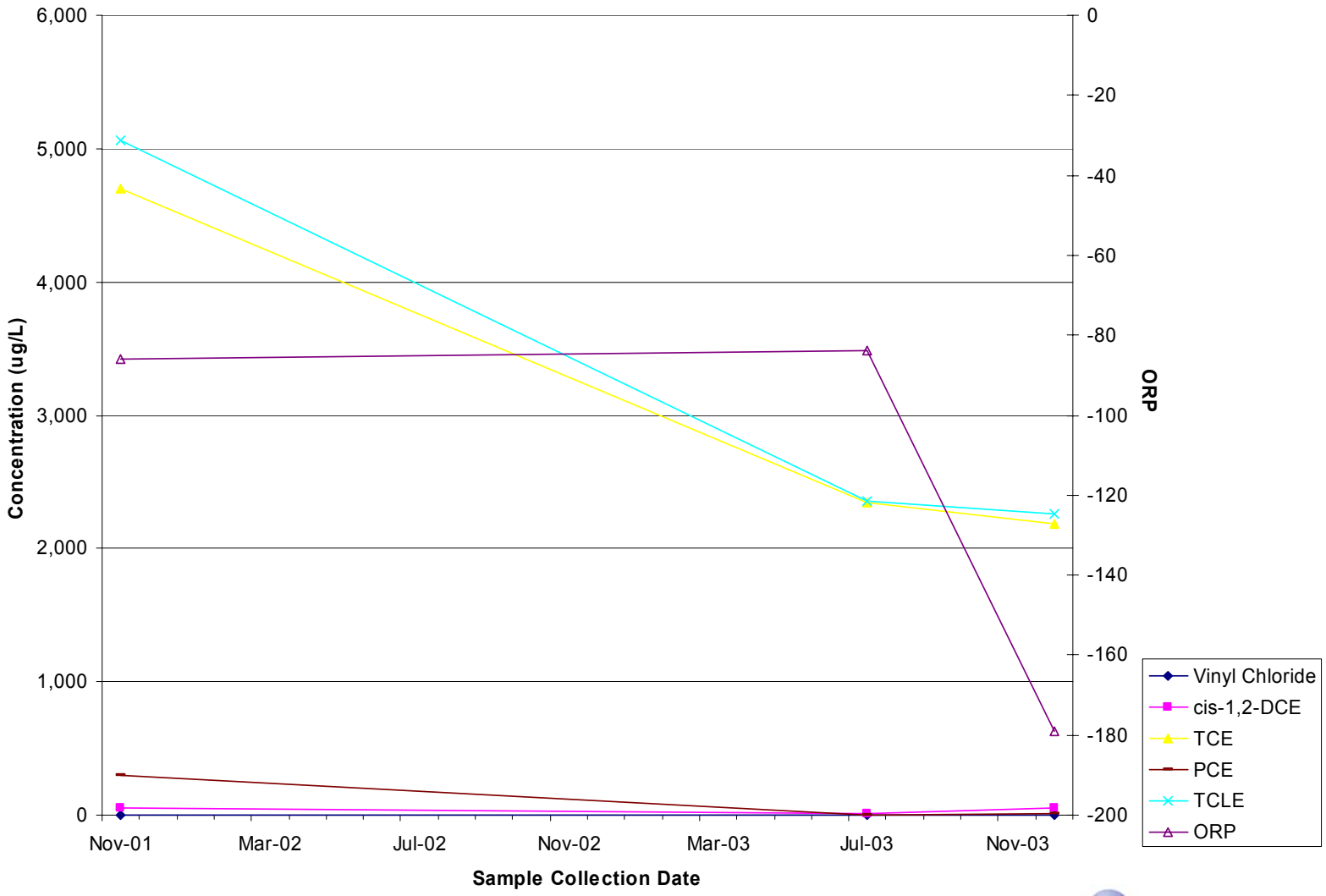
Monitoring Well U3D-MW44



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Monitoring Well U3D-GEW002

- Source well for Area D plume
- Conventional 6-inch diameter well screened from 27-52 feet bls
- PCE concentration has slightly decreased, TCE concentration has significantly decreased from 3,700 to 155 ug/L, and cis-1,2-DCE concentration has significantly increased from 34 to 776 ug/L from the baseline through post-injection monitoring events
- ORP has decreased from the baseline event
- Arsenic at 63 ug/L remains above the FDEP GCTL of 50 ug/L

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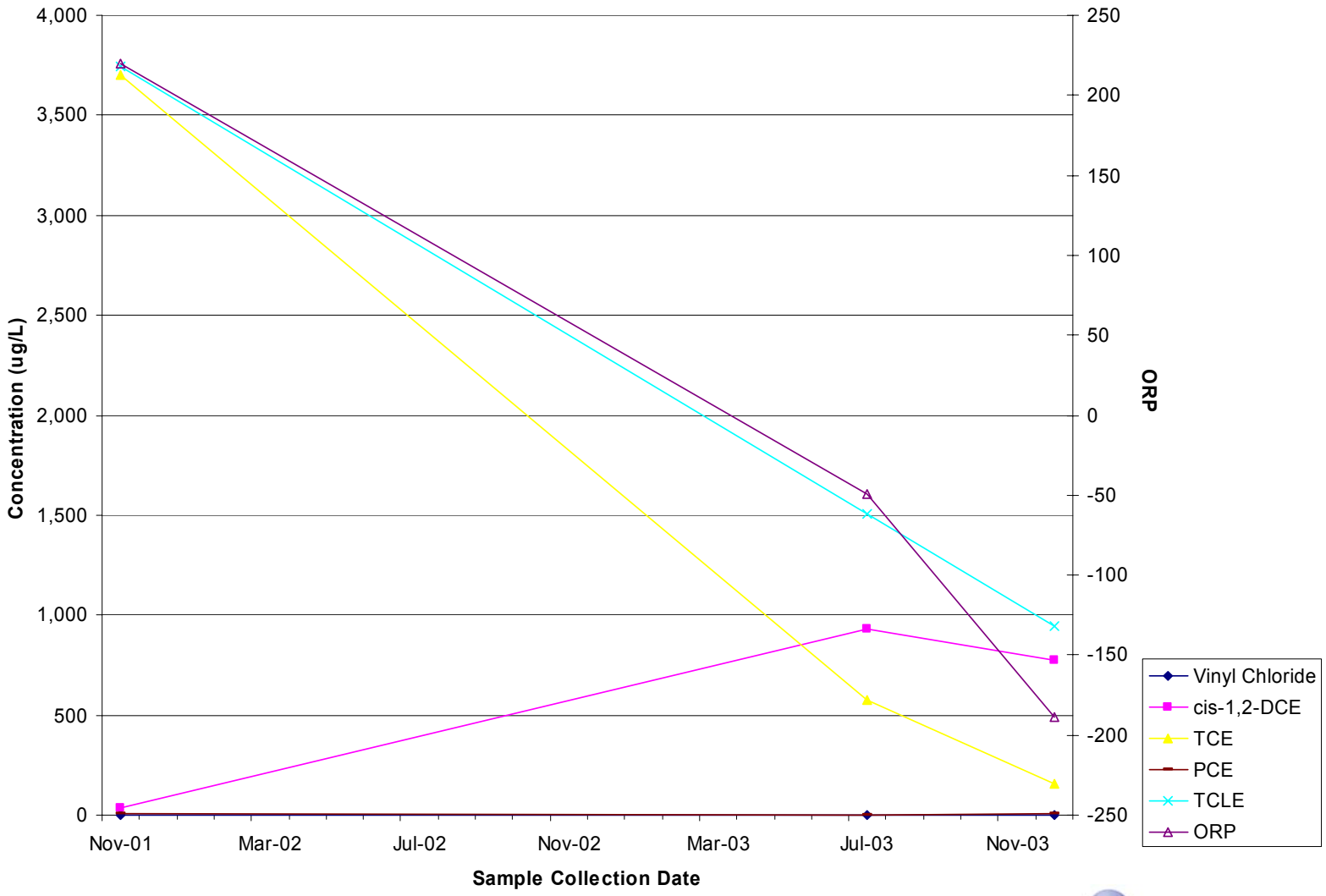
Monitoring Well U3D-GEW002



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Monitoring Well U3D-MW46

- Sidegradient well for Area D plume
- Multiport well with screened sections from 24-29, 29-34, 34-39, 39-44, 44-49, 49-54, and 54-59 feet bls
- Each screened section sampled for baseline event; 34-39 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has slightly increased from 1.2 to 29.5 ug/L and DCE concentration has increased from the baseline through post-injection monitoring events
- ORP has fluctuated, but remains reductive, since the baseline event

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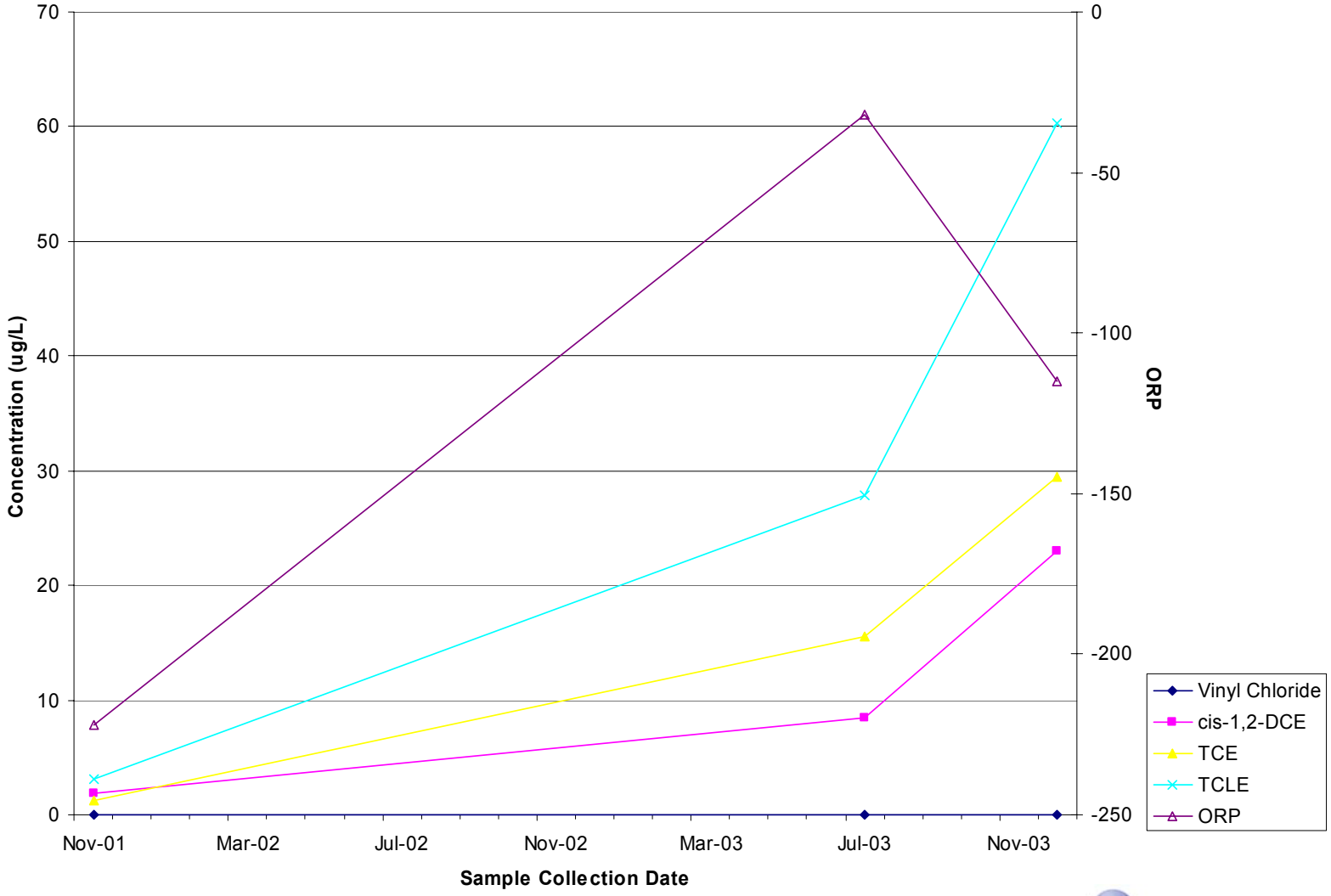
Monitoring Well U3D-MW46



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Monitoring Well U3D-MW47

- Downgradient Source well for Area D plume
- Multiport well with screened sections from 24-29, 29-34, 34-39, 39-44, 44-49, 49-54, and 54-59 feet bls
- Each screened section sampled for baseline event; 34-39 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has remained consistent in the 1,900 to 2,100 ug/L range from the baseline through post-injection monitoring events
- ORP has fluctuated, but remains reductive, since the baseline event
- Soil sample collected from the 34-39 foot bls depth interval during the 1st post-injection monitoring event showed minimal concentrations of TCE and cis-1,2-DCE
- *D. ethenogenes* not measurably present in soil and possibly present in groundwater based on 1st post-injection monitoring event

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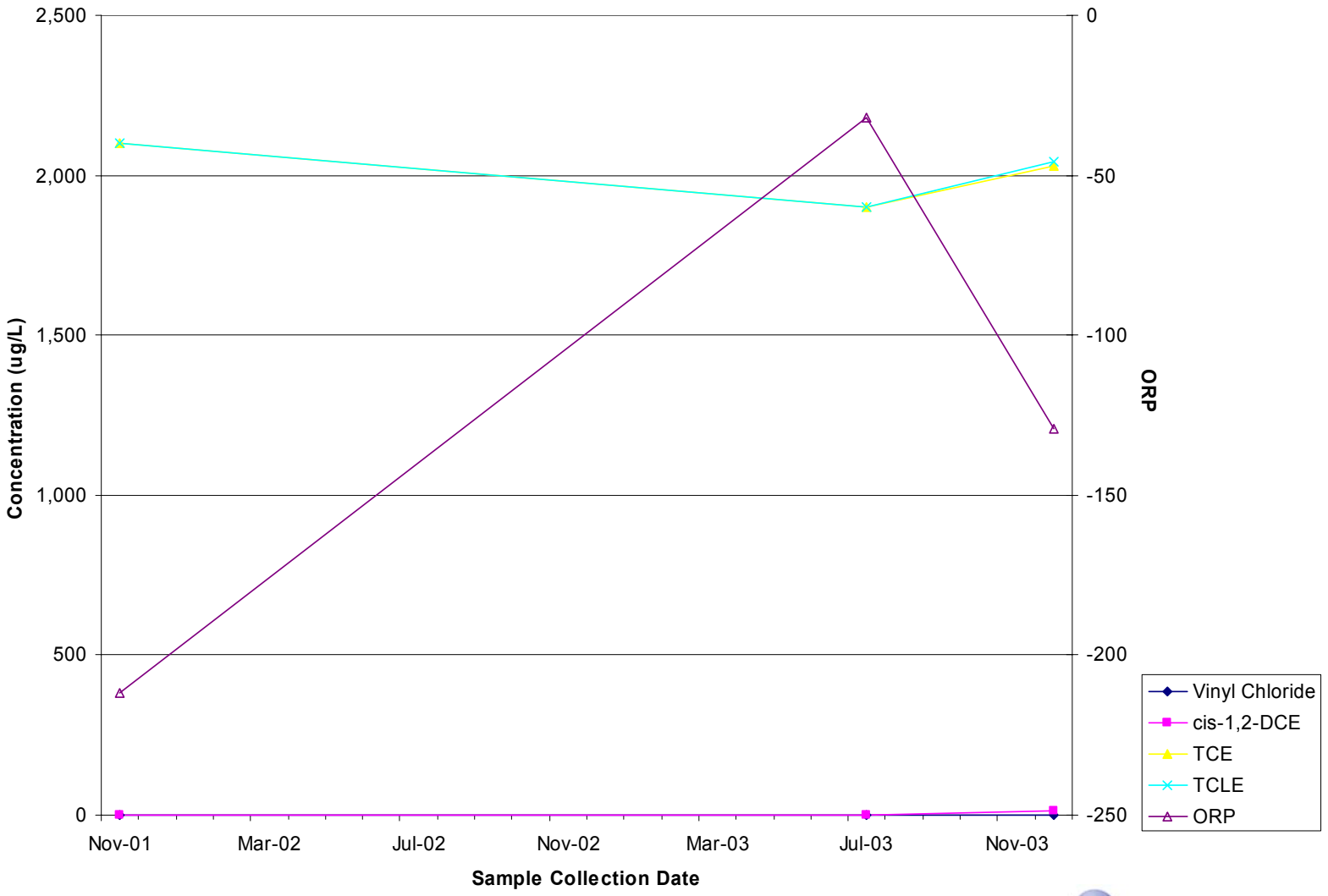
Monitoring Well U3D-MW47



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Monitoring Well U3D-MW48

- Downgradient well for Area D plume
- Multiport well with screened sections from 24-29, 29-34, 34-39, 39-44, 44-49, 49-54, and 54-59 feet bls
- Each screened section sampled for baseline event; 34-39 feet bls depth interval sampled for post-injection monitoring
- TCE concentration has decreased from 130 to 113 ug/L from the baseline through post-injection monitoring events
- ORP has fluctuated, but remains reductive, since the baseline event
- Soil sample collected from the 34-39 foot bls depth interval during the 1st post-injection monitoring event showed minimal concentration of TCE
- *D. ethenogenes* not measurably present in soil or groundwater based on 1st post-injection monitoring event

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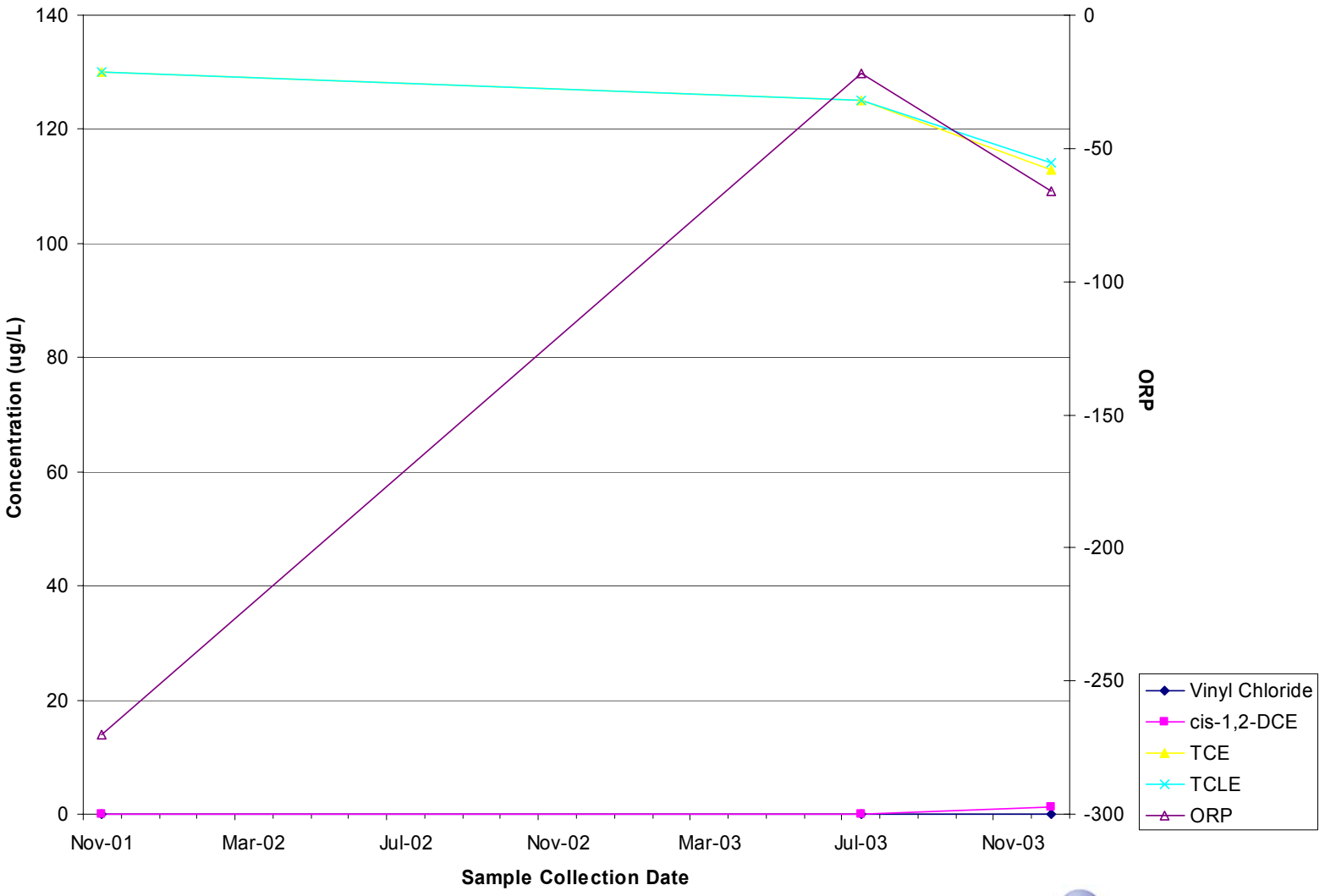
Monitoring Well U3D-MW48



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HRC Injection and Monitoring Summary - Conclusions from 1st Post-HRC Injection Monitoring Event

- *U3D-MW30 (upgradient well) showed significant increase in PCE concentration*
- *U3D-MW43 (upgradient well) showed no significant changes to TCLE concentrations*
- *U3D-MW44 (source well) showed a 50% reduction in TCE concentration with no reductive dechlorination evident*
- *U3D-GEW002 (source well) showed an 85% reduction in TCE concentration with a significant increase in cis-1,2-DCE concentration*
- *U3D-MW46 (sidegradient well) showed no significant changes to TCLE concentrations*
- *U3D-MW47 (downgradient source well) showed no significant changes to TCLE concentrations*
- *U3D-MW48 (downgradient well) showed no changes to TCLE concentrations*

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HRC Injection and Monitoring Summary - Conclusions from 2nd Post-HRC Injection Monitoring Event

- *U3D-MW30 (upgradient well) shows significant decrease in PCE/TCE concentrations with a significant increase in cis-1,2-DCE concentration*
- *U3D-MW43 (upgradient well) shows a slight decrease of PCE and slight increase of TCE and cis-1,2-DCE concentrations*
- *U3D-MW44 (source well) remains consistent with the 1st Post-HRC Injection Monitoring Event results*
- *U3D-GEW002 (source well) continues to show a reduction in TCE concentration*
- *U3D-MW46 (sidegradient well) shows a slight increase in TCLE concentrations*
- *U3D-MW47 (downgradient source well) still shows no significant changes to TCLE concentrations*
- *U3D-MW48 (downgradient well) still shows no changes to TCLE concentrations*

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HRC Injection and Monitoring Summary - Overall

- Area C
  - Results appear promising, especially for the downgradient plume. “DCE stall” does not appear to be occurring.
  - For the upgradient plume, there is no definitive evidence of reductive dechlorination, however, the latest monitoring may indicate the start.
- Area D
  - PCE and TCE concentration reductions continue, however, degradation by-product production is minimal, except in wells U3D-MW30 and U3D-GEW002.
  - ORP continues to decrease and the latest monitoring may indicate the start of reductive dechlorination
- The 3rd Post-HRC Injection Monitoring Event is scheduled for June 2004 and will follow the sampling strategy utilized for the 1st Post-HRC Injection Monitoring Event.

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POST-HRC INJECTION GROUNDWATER MONITORING RESULTS

AREA C, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3C-MW31	U3C-MW35	U3C-MW36	U3C-MW37	U3C-MW38	U3C-MW39	U3C-MW40	U3C-MW41	U3C-MW42
Interval No.		--	1	1	1	1	1	3	3	2
Screen Interval (ft bls)		35 to 40	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50
Vinyl Chloride (ug/L)	Nov-01	27.0	<1	<1	<1	<1	<1	100	<1	<1
	Jul-03	<25	<100	<1	<5	<1	<20	<50	<1	<1
	Dec-03	73.7	<100	<1	<1	<10	<1	57.5	<1	<1
1,1-DCE (ug/L)	Nov-01	1.7	1.2	<1	<1	12.0	<1	3.8	<1	<1
	Jul-03	<125	<50	<5	26.9	<5	<100	<250	<5	<5
	Dec-03	<250	<500	<5	<5	23.2	<5	<100	<5	<5
cis-1,2-DCE (ug/L)	Nov-01	260	29.0	0.88	0.38	1.6	0.69	850	<1	<1
	Jul-03	2,870	<500	<5	<25	<5	3,750.00	4,070	<5	<5
	Dec-03	4,210	130	1.34	<5	15	3.08	2,890	0.798	<5
trans-1,2-DCE (ug/L)	Nov-01	3.6	0.81	<1	<1	<1	<1	5.5	<1	<1
	Jul-03	<125	<500	<5	<25	<5	<100	<250	<5	<5
	Dec-03	<250	<500	<5	<5	<50	<5	20.9	<5	<5
TCE (ug/L)	Nov-01	5,000	9,100	40	28	780	23	2,700	1.40	2.0
	Jul-03	2,570	9,190	46	654	23.5	316	298	1.11	<3
	Dec-03	131	10,500	44.7	26.7	839	27.8	39.5	1.21	<3
PCE (ug/L)	Nov-01	<1	1.1	<1	<1	<1	<1	<1	<1	<1
	Jul-03	<75	<300	<3	<15	<3	<60	<150	<3	<3
	Dec-03	<150	<300	<3	<3	<30	<3	<60	<3	<3
TCLE (ug/L)	Nov-01	5,292.3	9,132.1	40.9	28.4	793.6	23.7	3,659.3	1.4	2.0
	Jul-03	5,440	9,190	46	681	24	4,066	4,368	1	0
	Dec-03	4,414.7	10,630	46.0	26.7	877.2	30.88	3,007.9	2	0
Total VOCs (ug/L)	Nov-01	5,298	9,134.6	44.9	37.1	796.8	30.3	3,667.5	3.5	20.3
	Jul-03	5,440	9,190	46.0	686.01	23.5	4,066	4,368	1.10	0.0
	Dec-03	4,414.7	10,630	46.04	26.7	877.2	30.88	3,008	2.01	0.0
Dissolved Iron (ug/L)	Nov-01	3,090	1,720	2,090	10,800	300	82	--	--	--
	Jul-03	7,010	270	3,130	870	9,180	1,300	8,540	1,990	1,540
Ferrous Iron (mg/L)	Nov-01	3.0	2.4	2.8	5.2	3.2	2.2	--	--	--
	Jul-03	10.0	1.0	3.5	1.5	10.0	4.5	10	2.5	2.5
Bioavailable Iron (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	--	474	440	--	--	400	1,040	--	--
Dissolved Manganese (ug/L)	Nov-01	118	142	268	243	146	220	--	--	--
	Jul-03	230	82	110	120	63	270	700	120	120
Nitrate (mg/L)	Nov-01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--	--
	Jul-03	<0.01	<0.01	0.02	0.03	<0.01	0.01	0.03	0.02	<0.01
Sulfate (mg/L)	Nov-01	8.14	6.93	4.09	2.28	2.15	7.44	--	--	--
	Jul-03	<10	<10	3.50	<10	<10	7.90	<10	<10	<10
Sulfide (mg/L)	Nov-01	<2	<2	<2	<2	<2	<2	--	--	--
	Jul-03	1.91	0.06	0.04	0.11	0.11	0.04	1.30	0.07	0.24
Chloride (mg/L)	Nov-01	20.1	20.9	24.5	17.5	21.9	24.0	--	--	--
	Jul-03	21.7	22.2	29.1	23.5	22.4	23.1	23.0	25.2	20.3
Alkalinity (mg/L)	Nov-01	39.4	91.2	94.1	54.7	114	153	--	--	--
	Jul-03	59.6	70.4	50.9	67.7	43.4	111	<1	44.8	60.7
TOC (mg/L)	Nov-01	2.33	1.59	1.61	<1	2.17	2.62	--	--	--
	Jul-03	71.6	3.00	140	2.8	2.5	3.60	280	2.50	2.90
Carbon Dioxide (mg/L)	Nov-01	68.6	41.2	41.6	54.9	27.5	16.1	--	--	--
	Jul-03	73.9	62.6	82.0	47.6	71.1	36.7	105	47.7	46.6
Methane (ug/L)	Nov-01	128	15.5	27.3	29.0	20.9	94.0	--	--	--
	Jul-03	1,130	72.6	30.3	240	37.6	61.9	1,870	571	659

POST-HRC INJECTION GROUNDWATER MONITORING RESULTS

AREA C, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3C-MW31	U3C-MW35	U3C-MW36	U3C-MW37	U3C-MW38	U3C-MW39	U3C-MW40	U3C-MW41	U3C-MW42
Interval No.		--	1	1	1	1	1	3	3	2
Screen Interval (ft bls)		35 to 40	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50	45 to 50
Ethane (ug/L)	Nov-01	<5.8	<5.8	7.77	7.23	3.09	9.89	--	--	--
	Jul-03	<60	<10	<10	<10	<10	<10	<100	<30	<60
Ethene (ug/L)	Nov-01	<6.2	<6.2	3.86	5.56	2.66	6.55	--	--	--
	Jul-03	<60	<10	<10	<10	<10	<10	<100	<30	<60
Acetic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	30	<0.07	<0.07	<0.07	0.07	<0.07	75.6	<0.07	<0.07
Butyric Acid (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	18.6	<0.07	<0.07	<0.07	0.07	<0.07	68.4	<0.07	<0.07
Lactic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	<0.7	<0.07	<0.07	<0.07	0.07	<0.07	<1.4	<0.07	<0.07
Propionic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	34.1	<0.07	<0.07	<0.07	0.07	<0.07	86.6	0.26	<0.07
Pyruvic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--	--	--
	Jul-03	<0.7	<0.07	<0.07	<0.07	0.07	<0.07	<1.4	<0.07	<0.07
Temperature (^{o}C)	Nov-01	25.3	25.9	24.1	25.8	25.5	25.8	25.2	24.7	24.0
	Jul-03	26.9	27.5	27.2	26.6	27.5	28.1	31.6	27.5	27.7
	Dec-03	26.4	26.0	26.2	26.5	25.6	25.7	25.4	25.7	25.2
pH	Nov-01	6.22	7.59	9.08	7.11	7.75	9.53	8.37	7.62	9.59
	Jul-03	5.36	5.85	5.71	5.90	5.57	6.38	4.41	5.83	5.79
	Dec-03	5.93	6.35	6.03	6.03	6.34	6.49	4.74	6.13	6.07
Turbidity (NTU)	Nov-01	-10	970	999	209	999	237	535	791	999
	Jul-03	98.0	61.0	40.0	32.0	29.0	86.0	176.0	86.0	261.0
	Dec-03	0.0	65.0	24.0	9.5	10.0	160.0	25.0	9.0	253.0
Conductivity (mS/cm)	Nov-01	0.126	0.189	0.243	0.155	0.207	0.319	0.149	0.191	0.273
	Jul-03	0.143	0.207	0.205	0.206	0.165	0.297	0.283	0.176	0.179
	Dec-03	0.193	0.227	0.225	0.178	0.220	0.281	0.149	0.226	0.220
ORP	Nov-01	9	-3	-314	-329	0	21	-133	-10	-27
	Jul-03	-51	0	-12	-41	-57	-98	66	-48	-41
	Dec-03	-188	-53	-4	-71	-68	-116	-51	-145	-88
DO (mg/L)	Nov-01	0.59	0.46	1.05	1.32	0.96	0.71	0.49	1.05	3.09
	Jul-03	1.79	3.07	2.07	1.89	1.90	2.40	4.67	2.07	6.43
	Dec-03	0.28	0.99	0.66	0.72	0.66	0.94	0.50	0.43	0.84
Dehalococcoides ethenogenes (DNA detectable or cells/mL)	Jul-03	--	Yes	Yes	--	--	Yes	None	--	--
	Jul-03	--	1050	<500	--	--	<500	<500	--	--

NOTES:

ft bls: feet below land surface
ug/L: micrograms per liter
mg/L: milligrams per liter
DCE: dichloroethene
TCE: trichloroethene
PCE: tetrachloroethene
TCLE: total chlorinated ethenes (sum of vinyl chloride, DCE, TCE, and PCE)
Total VOCs: total detected volatile organic compounds by USEPA Method 8260B

POST-HRC INJECTION GROUNDWATER MONITORING RESULTS

AREA D, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3D-MW30	U3D-GEW002	U3D-MW43	U3D-MW44	U3D-MW46	U3D-MW47	U3D-MW48
Interval No.		--	--	4	4	4	4	4
Screen Interval (ft bls)		30 to 35	27 to 52	34 to 39	34 to 39	34 to 39	34 to 39	34 to 39
Vinyl Chloride (ug/L)	Nov-01	<1	<1	<1	0.54	<1	<50	<10
	Jul-03	<50	<10	<10	<20	<1	<20	<1
	Dec-03	<10	<5	<10	<20	<1	<20	<1
1,1-DCE (ug/L)	Nov-01	2.0	1.1	<1	1.8	<1	<50	<10
	Jul-03	<50	<50	<50	<100	<5	<100	<5
	Dec-03	<50	<25	<50	<100	<5	<100	<5
cis-1,2-DCE (ug/L)	Nov-01	39.0	34.0	13.0	55	1.9	<50	<10
	Jul-03	<250	932.0	22.3	13.5	8.49	<100	<5
	Dec-03	1,520.0	776.0	42.2	58.5	23	12.8	1.24
trans-1,2-DCE (ug/L)	Nov-01	<1	1.8	1.2	2.4	<1	<50	<10
	Jul-03	<250	<50	<50	<100	3.82	<100	<5
	Dec-03	<50	11.5	7.87	<100	7.74	<100	<5
TCE (ug/L)	Nov-01	120	3,700	500	4,700	1.20	2,100	130
	Jul-03	95.3	577.0	691.0	2,340.0	15.5	1,900.0	125.0
	Dec-03	58.2	155.0	742.0	2,190.0	29.5	2,030.0	113.0
PCE (ug/L)	Nov-01	1,400	9.00	29.0	303	<1	<50	<10
	Jul-03	4,090	<30	<30	<60	<3	<60	<3
	Dec-03	1,060	5.76	12.40	9.22	<3	<60	<3
TCLE (ug/L)	Nov-01	1,561.0	3,745.9	543.2	5,062.7	3.1	2,100.0	130.0
	Jul-03	4,185.3	1,509.0	713.3	2,353.5	27.8	1,900.0	125.0
	Dec-03	2,638.2	948.3	804.5	2,257.7	60.2	2,042.8	114.2
Total VOCs (ug/L)	Nov-01	1,563.9	3,747.9	548.5	4,771.0	9.7	2,100	130.0
	Jul-03	4,185.3	1,509.0	713.3	2,353.5	27.8	1,900	125.0
	Dec-03	2,654.26	961.76	804.47	2,275.92	60.24	2,061.1	115.74
Arsenic (ug/L)	Nov-01	10.0	<20	--	--	--	--	<20
	Jul-03	8.7	53.0	<10	26.0	10.0	15.0	20.0
	Dec-03	11.0	63.0	18.0	11.0	11.0	14.0	29.0
Dissolved Iron (ug/L)	Nov-01	87,100	131	33,400	34,600	28,800	46,600	21,600
	Jul-03	94,100	75,000	36,600	48,800	21,100	21,300	30,800
Ferrous Iron (mg/L)	Nov-01	3.6	0.8	5.0	2.4	2.4	4.2	4.6
	Jul-03	10.0	10.0	--	10.0	10.0	10.0	--
Bioavailable Iron (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	--	--	2,400	2,400	--	5,000	2,200
Dissolved Manganese (ug/L)	Nov-01	632	148	282	258	351	339	150
	Jul-03	840	450	44	80	44	310	60
Nitrate (mg/L)	Nov-01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Jul-03	<0.01	<0.01	0.02	0.01	0.03	<.01	0.03
Sulfate (mg/L)	Nov-01	18.2	11.1	11.5	12.3	3.39	15.7	6.36
	Jul-03	17.40	<10	<10	11.10	<10	11.20	7.90
Sulfide (mg/L)	Nov-01	<2	<2	<2	<2	<2	<2	<2
	Jul-03	0.03	0.24	0.20	0.08	0.20	0.07	<0.059
Chloride (mg/L)	Nov-01	587	65.1	68.5	181	63.6	235	30.3
	Jul-03	576.0	231.0	63.8	211.0	84.6	111.0	35.9
Alkalinity (mg/L)	Nov-01	27.8	2.88	15.4	12.5	29.8	22.1	55.7
	Jul-03	28.3	109.0	8.6	7.1	30.5	34.7	37.1
TOC (mg/L)	Nov-01	1.42	1.01	2.39	2.87	2.27	1.35	1.20
	Jul-03	3.80	2.90	21.10	2.90	4.20	3.40	3.60
Carbon Dioxide (mg/L)	Nov-01	159	39.5	48.4	116	43.3	116	61.8
	Jul-03	81.6	1,200.0	77.6	51.4	77.1	63.0	56.6

POST-HRC INJECTION GROUNDWATER MONITORING RESULTS

AREA D, NAS JACKSONVILLE, JACKSONVILLE, FL

Monitoring Well ID		U3D-MW30	U3D-GEW002	U3D-MW43	U3D-MW44	U3D-MW46	U3D-MW47	U3D-MW48
Interval No.		--	--	4	4	4	4	4
Screen Interval (ft bls)		30 to 35	27 to 52	34 to 39	34 to 39	34 to 39	34 to 39	34 to 39
Methane (ug/L)	Nov-01	287	5.43	30.6	72.6	110	75.2	53.1
	Jul-03	418	8,770	1,900	144	313	184	129
Ethane (ug/L)	Nov-01	<5.8	<5.8	14.6	27.7	7.76	70.3	19.0
	Jul-03	<10	<200	<60	<10	<10	<10	<10
Ethene (ug/L)	Nov-01	<6.2	<6.2	9.14	43.7	<6.2	19.5	5.95
	Jul-03	<10	<200	<60	<10	<10	<10	<10
Acetic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	<0.07	23.60	13.00	0.03	0.35	<0.07	<0.07
Butyric Acid (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	<0.07	18.5	2.63	<0.07	<0.07	<0.07	<0.07
Lactic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	0.07	<0.7	0.48	0.02	0.07	<0.07	<0.07
Propionic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	0.07	42.20	7.43	<0.07	0.19	<0.07	<0.07
Pyruvic Acid (mg/L)	Nov-01	--	--	--	--	--	--	--
	Jul-03	0.07	<0.7	0.04	<0.07	0.07	<0.07	<0.07
Temperature (^{o}C)	Nov-01	24.6	25.9	27.3	24.8	24.9	24.2	23.9
	Jul-03	25.2	27.2	28.3	26.0	25.5	24.9	25.3
	Dec-03	25.0	25.6	27.0	25.4	24.7	24.6	24.3
pH	Nov-01	8.55	6.47	7.99	6.80	7.91	8.54	9.34
	Jul-03	5.67	5.64	5.07	5.80	5.66	5.72	5.74
	Dec-03	6.10	6.22	5.89	6.13	5.91	5.95	5.94
Turbidity (NTU)	Nov-01	5	37	507	765	396	171	384
	Jul-03	22.0	5.6	33.0	40.0	34.0	24.0	187.0
	Dec-03	0.0	17.5	22.0	64.0	101.0	20.0	12.0
Conductivity (mS/cm)	Nov-01	1.600	0.201	0.258	0.542	0.271	0.387	0.224
	Jul-03	1.970	1.060	0.247	0.725	0.333	0.456	0.212
	Dec-03	2.070	0.940	0.261	0.854	0.381	0.470	0.229
ORP	Nov-01	68	220	-200	-86	-222	-212	-270
	Jul-03	-70	-49	-48	-84	-32	-32	-22
	Dec-03	-177	-189	-146	-179	-115	-129	-66
DO (mg/L)	Nov-01	2.13	2.89	0.14	0.29	0.75	0.35	0.30
	Jul-03	1.71	4.18	1.19	1.27	2.10	2.43	3.54
	Dec-03	0.40	0.34	0.58	0.38	0.42	0.35	0.41
Dehalococcoides ethenogenes (DNA detectable or cells/mL)	Jul-03	--	--	Yes	Yes	--	Yes	None
	Jul-03	--	--	<500	<500	--	<500	<500

NOTES:

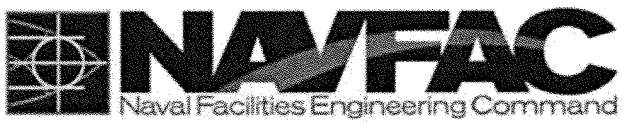
ft bls: feet below land surface
ug/L: micrograms per liter
mg/L: milligrams per liter
DCE: dichloroethene
TCE: trichloroethene
PCE: tetrachloroethene
TCLE: total chlorinated ethenes (sum of vinyl chloride, DCE, TCE, and PCE)
Total VOCs: total detected volatile organic compounds by USEPA Method 8260B

APPENDIX F

OU 3 AREA G INFORMATION

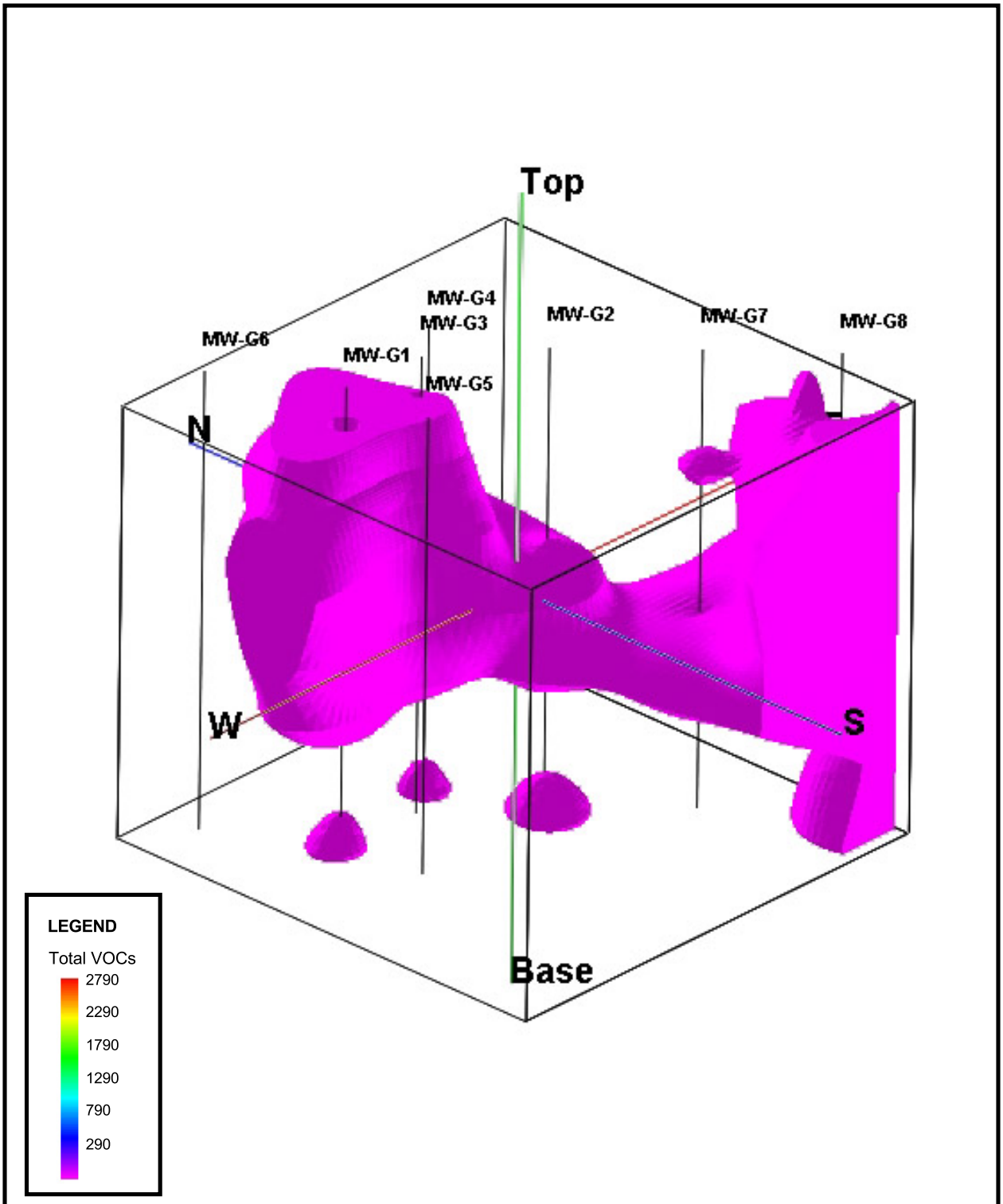
Annual Sampling Report
for
Areas B and G
Operable Unit 3

Naval Air Station Jacksonville
Jacksonville, Florida



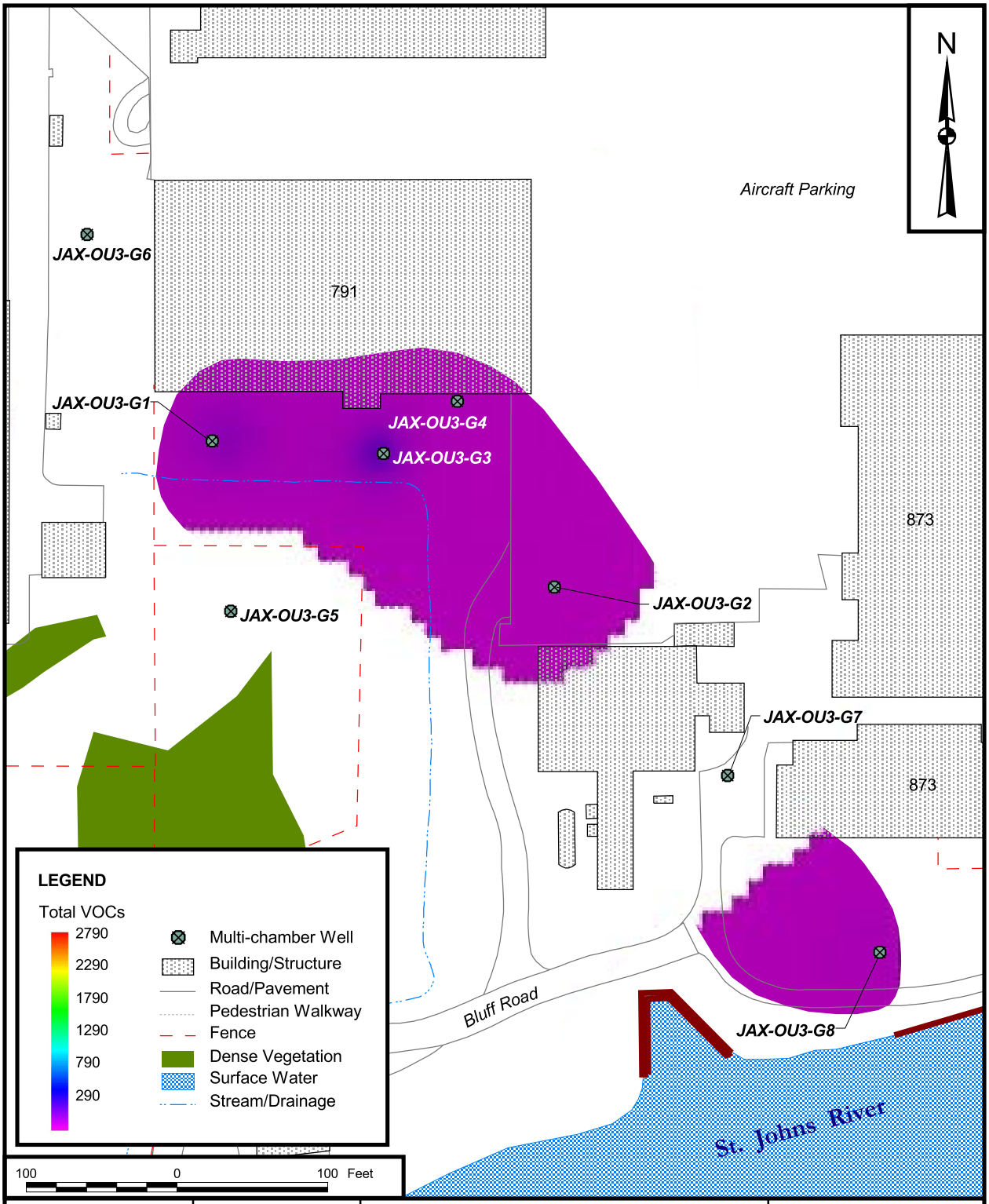
Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0227

June 2004



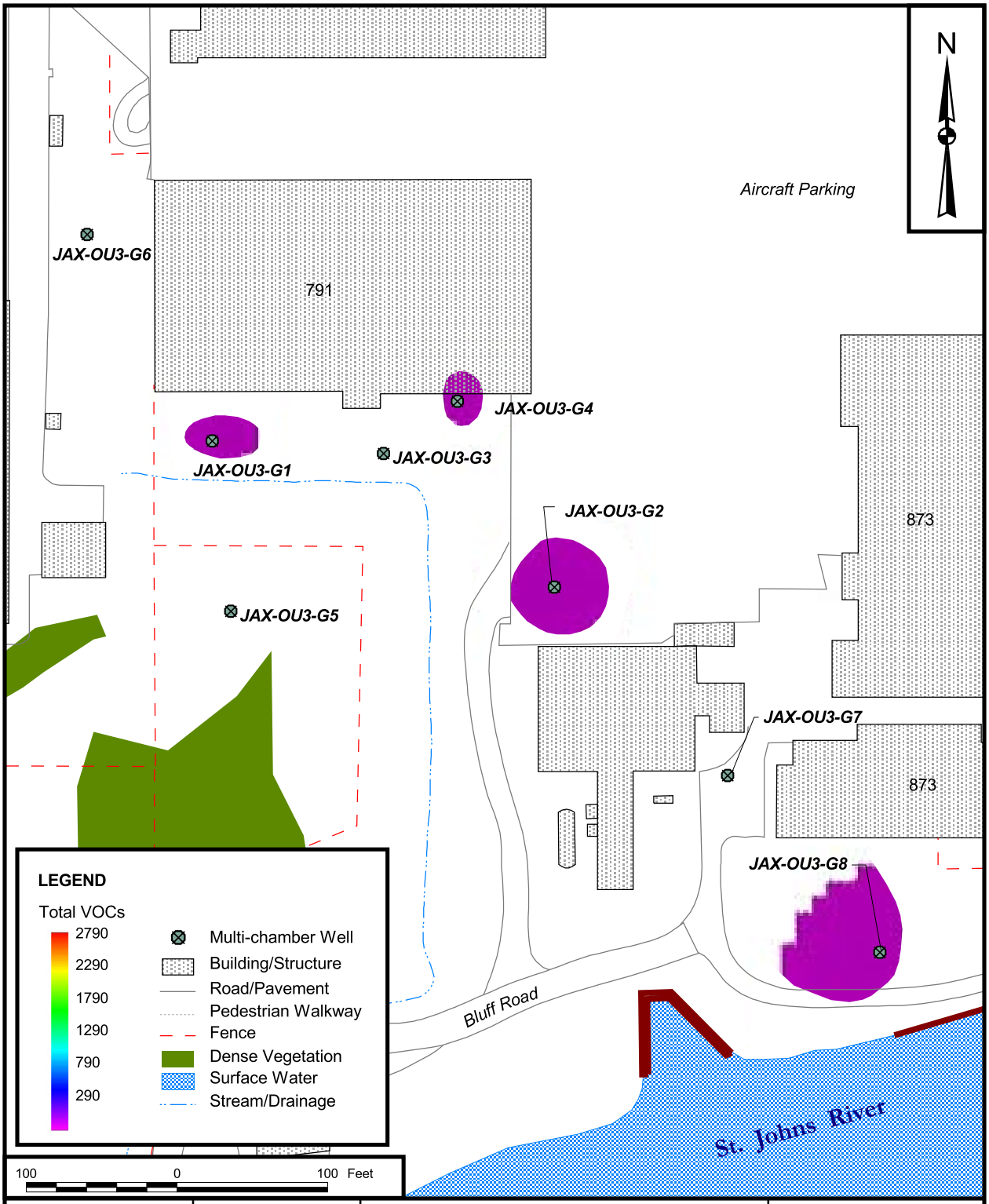
DRAWN BY J. LAMEY	DATE 8/29/03		CONTRACT NUMBER 4185
CHECKED BY	DATE	TOTAL VOCs OPERABLE UNIT 3, AREA G NAS JACKSONVILLE JACKSONVILLE, FLORIDA	APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4-3 / REV 0

P:\GIS\JACKSONVILLE_NAS\APR\AREA_G.APR TOTAL VOC PLUME 10/27/03 JAL



DRAWN BY J. LAMEY	DATE 8/28/03	TOTAL VOCs AT 30 FEET BLS OPERABLE UNIT 3, AREA G NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4185
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4-6 / REV 0

P:\GIS\JACKSONVILLE_NAS\APR\AREA_G.APR TOTAL VOCS-30 FEET 10/27/03 JAL



DRAWN BY J. LAMEY	DATE 8/28/03	TOTAL VOCs AT 60 FEET BLS OPERABLE UNIT 3, AREA G NAS JACKSONVILLE JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4185
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4-9 / REV 0

P:\GIS\JACKSONVILLE_NAS\APR\AREA_G.APR TOTAL VOCS-60 FEET 10/27/03 JAL

FINAL REPORT

NAVAL FACILITIES ENGINEERING COMMAND

NAVAL AIR STATION
Jacksonville, Florida

ANNUAL
LONG TERM MONITORING (LTM) REPORT

For

AREA B (PSC 11) AND AREA G (PSC 15)
OPERABLE UNIT 3

Contract N62467-03-G-0111
Delivery Order 0002

June 2004

Apex Environmental
Engineering & Compliance, Inc.

TABLE 3-3
GROUNDWATER MONITORING ANALYTICAL RESULTS
DECTECTED COMPOUNDS ONLY
AREA G
MARCH 2004 ANNUAL LTM REPORT
NAS JACKSONVILLE
JACKSONVILLE, FLORIDA

Sample Location	Date	Sample ID	Concentration (µg/L)													
			Vinyl Chloride	cis-1,2-DCE	trans-1,2-DCE	TCE	PCE	1,1-DCE	CHLOROFORM	1,1-DCA	1,1,1-TCA	1,2,4-TMB	1,1,2-TCFA*	ACETONE	2-BUTANONE	2-HEXANONE
JAX-OU3-G1	07/02/02	JAX-OU3-G1	< 100	350	< 100	**2100**	< 100	340	< 100	< 100	< 100	NA	< 100	< 100	< 100	< 100
(18.6-19.6 Ft)	12/04/02		0.5	490	2	**1,200**	0.90	240	0.2	7	19	NA	< 5	< 5	< 5	< 5
	09/26/03		< 1	680	31	**1,200**	< 2	280	< 1	9.4	5.3	< 1	NA	< 50	< 20	< 20
	01/09/04		<10	540	< 10	**900**	<30	230	<10	<10	<10	<10	NA	<500	<200	<200
JAX-OU3-G2	07/02/02	JAX-OU3-G2	< 5	< 5	< 5	34	< 5	3	< 5	< 5	< 5	NA	< 5	< 5	< 5	< 5
(37.8-38.8 Ft)	12/04/02		< 5	< 5	< 5	28	< 5	3	< 5	< 5	< 5	NA	< 5	< 5	< 5	< 5
	09/26/03		< 1	1.8	< 1	30	< 2	1.1	< 1	< 1	< 1	2.1	NA	< 50	< 20	< 20
	01/10/04		<1	3	< 1	38	<3	1.2	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G3	07/02/02	JAX-OU3-G3	< 25	21	< 25	**440**	< 25	< 25	< 25	< 25	< 25	NA	< 25	< 25	< 25	< 25
(18.7-19.7 Ft)	12/04/02		0.2	56	< 5	**320**	< 5	2	< 5	< 5	< 5	NA	< 5	< 5	< 5	< 5
	09/26/03		4.7	140	12	100	< 2	1.6	< 1	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/10/04		2.4	68	2	98	<3	1.1	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G4	07/02/02	JAX-OU3-G4	< 5	5	< 5	7	< 5	2	< 5	< 5	< 5	NA	11	19	1	
(30.5-31.5 Ft)	12/04/02		< 5	11	< 5	28	< 5	2	< 5	< 5	< 5	NA	11	< 5	< 5	< 5
	09/26/03		< 1	12	1.5	35	< 2	2.4	< 1	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/09/04		< 1	13	< 1	30	<3	1.9	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G5	07/02/02	JAX-OU3-G5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	NA	< 5	7B	< 5	< 5
(25.8-26.8 Ft)	12/04/02		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	NA	< 5	< 5	< 5	< 5
	09/26/03		< 1	< 1	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/10/04		< 1	< 1	< 1	< 1	<3	<1	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G6	07/02/02	JAX-OU3-G6	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	NA	1	7	2	0.8
(18.3-19.3 Ft)	12/04/02		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	NA	1	< 5	< 5	< 5
	09/26/03		< 1	< 1	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/10/04		< 1	< 1	< 1	< 1	<3	<1	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G7	07/02/02	JAX-OU3-G7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(16.4-17.4 Ft)	12/04/02		< 5	0.5	< 5	4	< 5	< 5	< 5	< 5	< 5	NA	< 5	< 5	< 5	< 5
	09/26/03		< 1	1.1	< 1	3	< 2	< 1	1.2	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/10/04		< 1	1.1	< 1	2.8	<3	<1	<1	<1	<1	<1	NA	<50	<20	<20
JAX-OU3-G8	07/02/02	JAX-OU3-G8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
(27-28 Ft)	07/02/03		< 5	11	< 5	26	< 5	< 5	< 5	< 5	< 5	NA	NA	< 5	< 5	< 5
	09/26/03		< 1	2.1	< 1	4.5	< 2	< 1	< 1	< 1	< 1	< 1	NA	< 50	< 20	< 20
	01/10/04		< 1	2.2	< 1	4.3	<3	<1	<1	<1	<1	<1	NA	<50	<20	<20
GCTL			1	70	100	3	3	7	5.7	70	200	10	500,000	700	4,200	280
NADSC			100	700	1,000	300	300	700	570	700	200,000	100	5,000,000	7,000	42,000	2,800

Notes: GCTL = Ch 62.777 F.A.C. Groundwater Cleanup Target Levels (mg/L)
NADSC = Ch 62.777 F.A.C. Natural Attenuation Default Source Concentration (mg/L)
ug/L = micrograms per liter

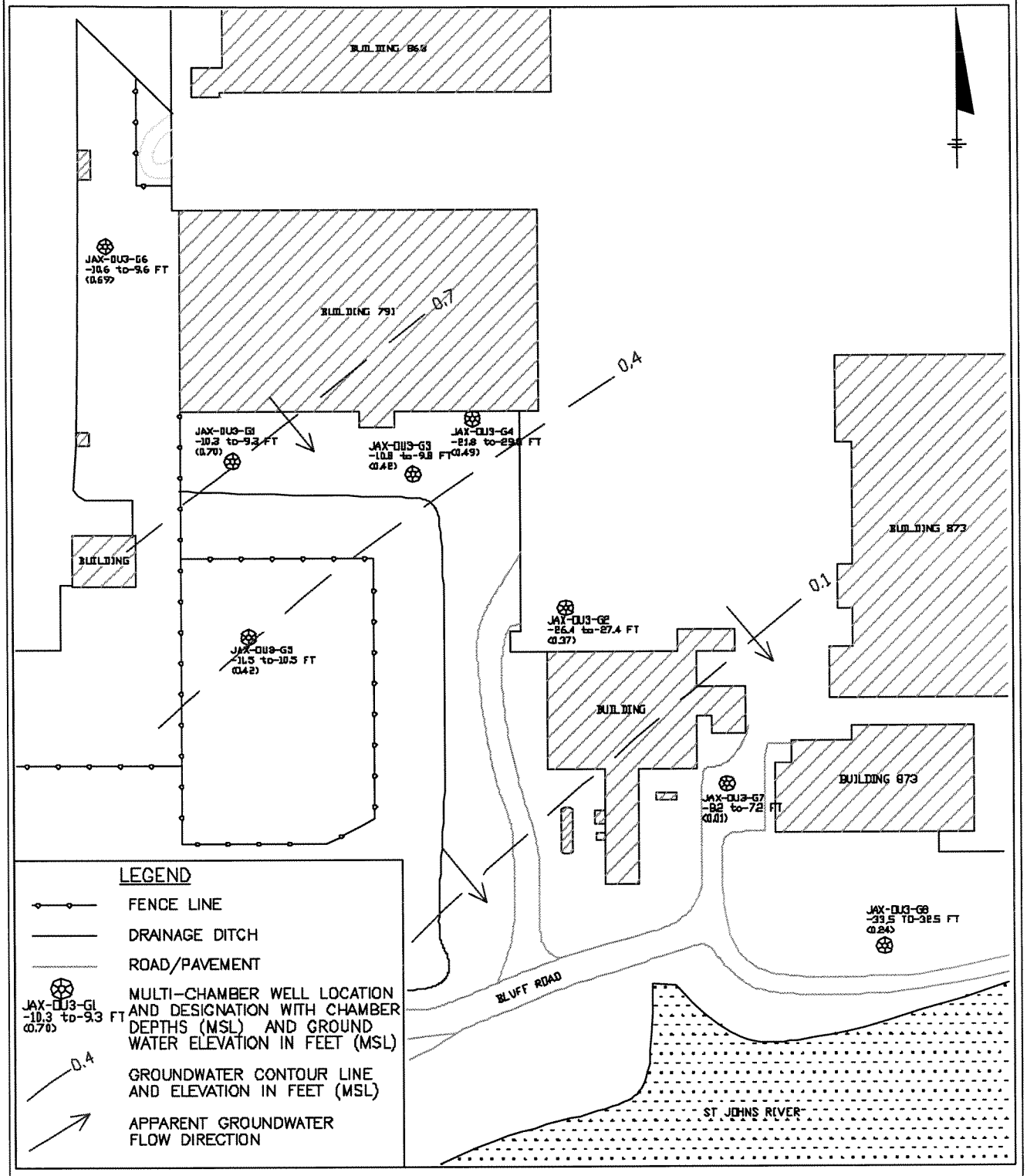
TCE = Trichloroethene
PCE = Tetrachloroethene
DCE = Dichloroethene
DCA=Dichloroethane

TCA=Trichloroethane
TMB=Trimethylbenzene
TCFA = Trichlorotrifluoroethane

Shaded = Concentration Exceeds GCTL
Bold = Concentration Exceeds NADSC
NA = Not Analyzed
J = Denotes an estimated value because the analyte was detected at a concentration greater than the method detection limit, but less than the reported detection limit
B = field blank contamination

C:\APEX\PROJECTS\JAXNAS\FIGURES\AREA G BASEMAP.DWG 01/09/04

FIGURE 1-3



JACKSONVILLE NAVAL AIR STATION
JACKSONVILLE, FLORIDA

AREA G OPERABLE UNIT 3 SITE MAP AND GROUNDWATER ELEVATIONS (01/09/04)

100 0 100

APPROXIMATE SCALE 1"=100'

MARCH 2004

Apex Environmental
Engineering & Compliance, Inc.

PLOT DATE:02/16/04 J. SEAVY

APPENDIX G

OU 3 PSC 16 LETTER