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NAS PENSACOLA
5090.3a

INSTALLATION RESTORATION PROGRAM

May 2008

Proposed Plan for Operable Unit 2

Naval Air Station Pensacola
Pensacola, Florida

Introduction

As required by Section 117 of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** and 300.340 (f)(2) of the National Contingency Plan (NCP), this document summarizes the Navy's preferred alternative for site cleanup to help the public understand and comment. This plan has been developed by the Navy (the lead agency), in agreement with the United States Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (FDEP). The Navy will implement the remedy for Operable Unit 2 (OU 2) Naval Air Station (NAS) Pensacola after considering and addressing significant comments from the public.

The purpose and function of this Proposed Plan is to:

- Provide the public with the basic background information about NAS Pensacola, specifically OU 2.
- Identify the Preferred Alternative for remedial action at OU 2 and explain why it is the best alternative.
- Describe the other remedial options that were considered.
- Solicit public review of and comment on all alternatives described.
- Provide information on how the public can be involved in the remedy selection process.

This Proposed Plan highlights information that is contained in the **Remedial Investigation (RI)** and the **Feasibility Study (FS) Reports**. More detailed information can be found in those documents. The public is invited to participate in the remedy selection process, considering all the alternatives. New information or arguments the Navy learns during the public comment period could result in the selection of a remedial action that differs from the Preferred Alternative.

Site Background

NAS Pensacola is located in Escambia County, in Florida's northwest coastal area, approximately 5 miles west of the Pensacola city limits. The approximately 5,000-acre installation was constructed in the 1800's. Prior to construction, the facility was undeveloped and sparsely vegetated. Land use at NAS Pensacola consists of various military housing, training, and support facilities as well as large industrial complexes for major repairs and refurbishment of aircraft engines and frames. The shallow surficial aquifer underlying the entire OU is classified as a G-1 aquifer; however, potable water for the facility is provided by Corry Station, approximately 4 miles from the facility. In addition, the facility operates its own Industrial Waste Water Treatment Plant (IWTP).

NAS Pensacola was placed on USEPA's **National Priorities List (NPL)** in December 1989. The CERCLA governs cleanup for sites on the NPL. In addition, the Resource Conservation and Recovery Act (RCRA) regulates the handling and disposal of hazardous waste and/or their constituents. The Federal Facilities Agreement (FFA), signed in October 1990, outlines NAS Pensacola's regulatory path through these federal laws. OU 2 is one of a number of areas at the base being investigated under CERCLA.

Scope and Role of Operable Unit 2

OU 2 is comprised of the individual Sites 11, 12, 25, 26, 27, and 30. These sites were grouped together under the OU designation because the sites are physically close to each other and all are located within the same watershed. By combining these sites within a single "OU" designation, all the sites can be investigated and remediated as a single unit, therefore reducing costs and time.

The response action indicated in this Proposed Plan is intended to be the final remedy for all media at OU 2.

Site Characteristics

OU 2, including Sites 11, 12, 25, 26, 27, and 30, is located in the northeast portion of NAS Pensacola as shown in Figures 1 and 2. OU 2 extends from the western edge of the golf course east to the Yacht Basin. Figures 3 and 4 provide a visible presentation of the extent of contamination in soil and groundwater, respectively, for each of the individual OU 2 sites.

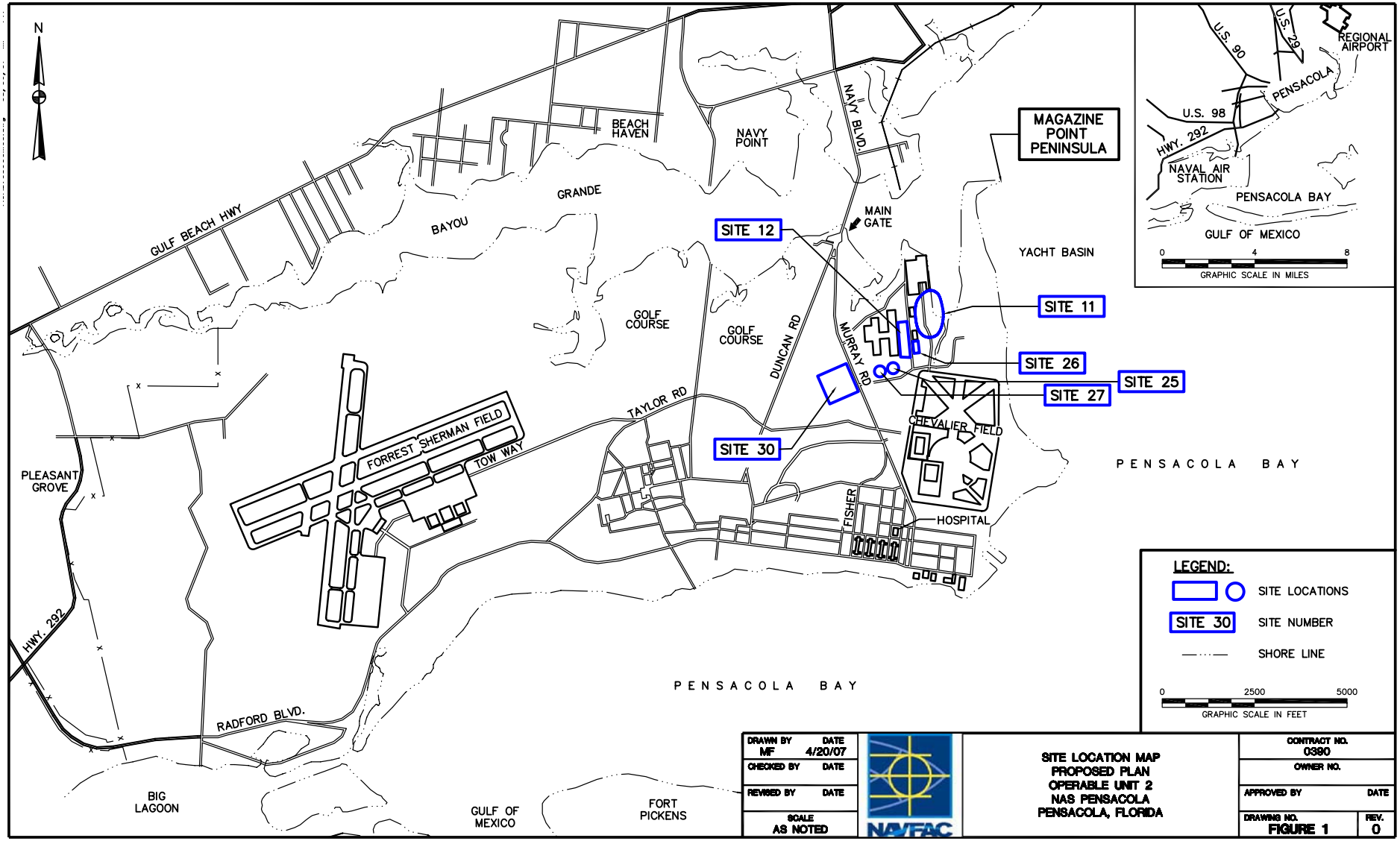
Site 11 — North Chevalier Field Disposal Area

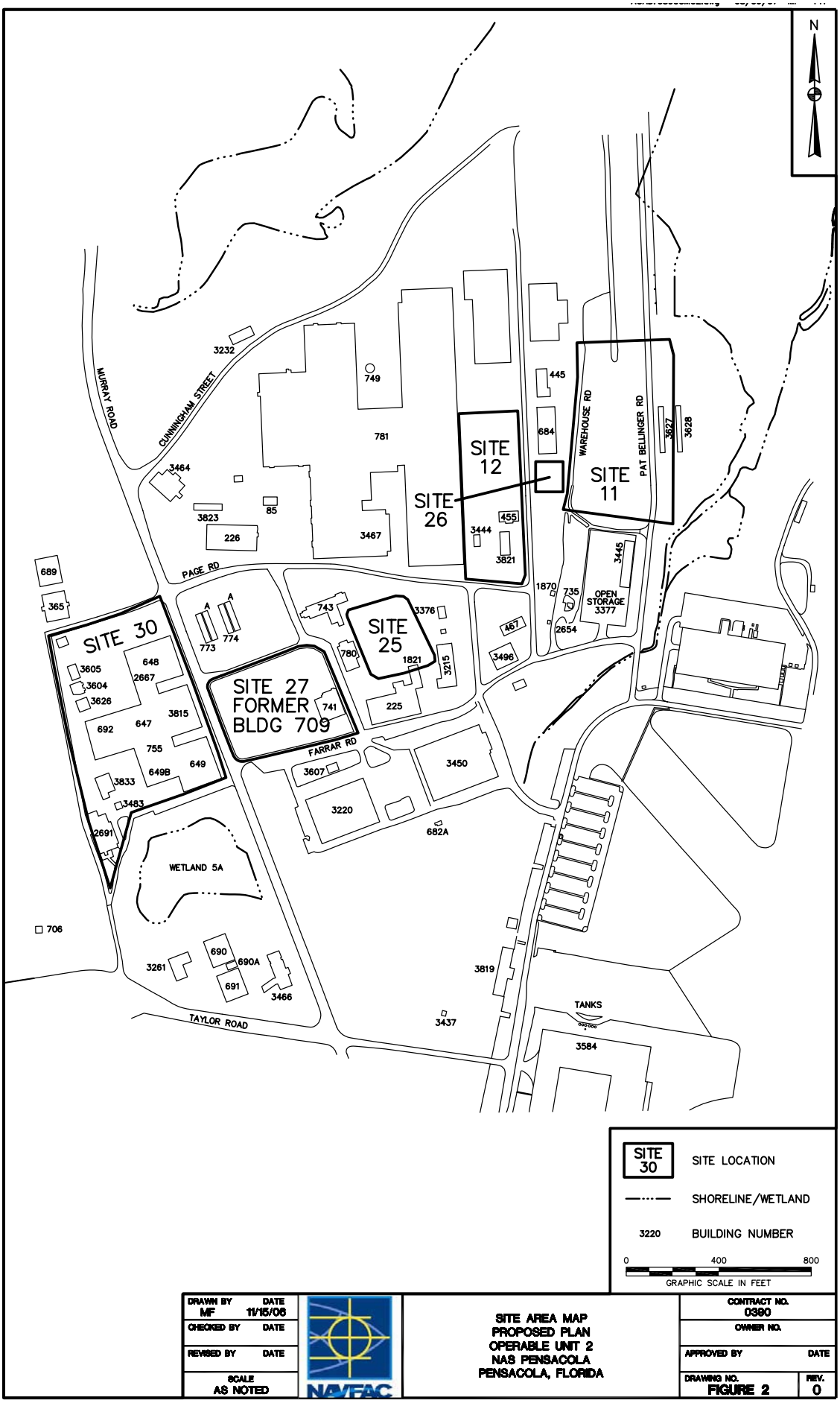
The North Chavalier Field Disposal Area, Site 11, is a former landfill where industrial and municipal wastes were disposed and burned from the late 1930s to the mid-1940s. The area occupies approximately 20 acres southwest of an extension of Bayou Grande called the Yacht Basin. Surface elevations on

Dates to Remember
Public Comment Period:
May 12, 2008 - June 25, 2008

The Navy will accept written comments on the Proposed Plan during the public comment period.

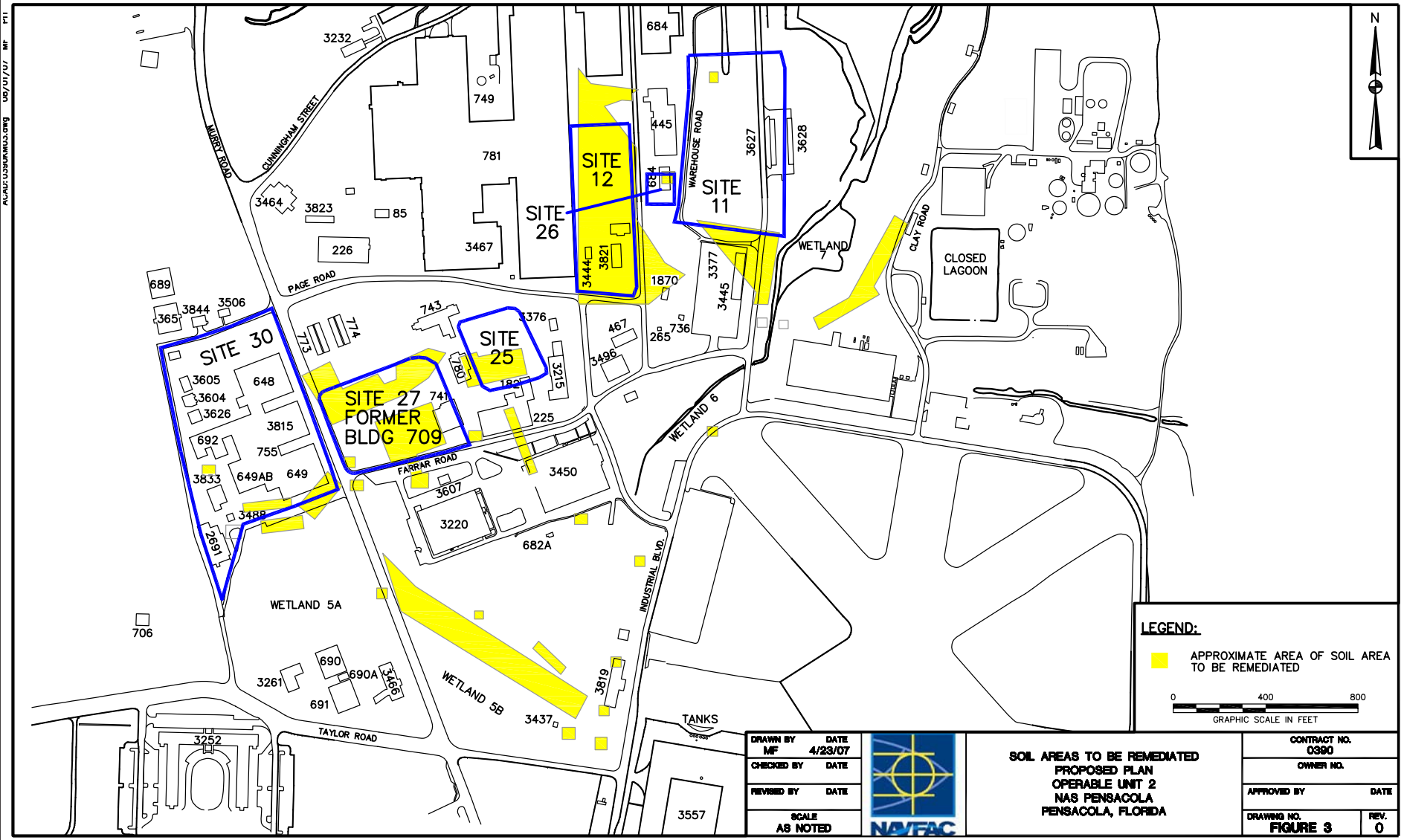
*This document summarizes the Navy's preferred alternative. For detailed information on the options evaluated for **OU 2**, the documents are available for review at the **Information Repository** located at NAS Pensacola Library, Building 634, Naval Air Station Pensacola, Pensacola, Florida 32508.*

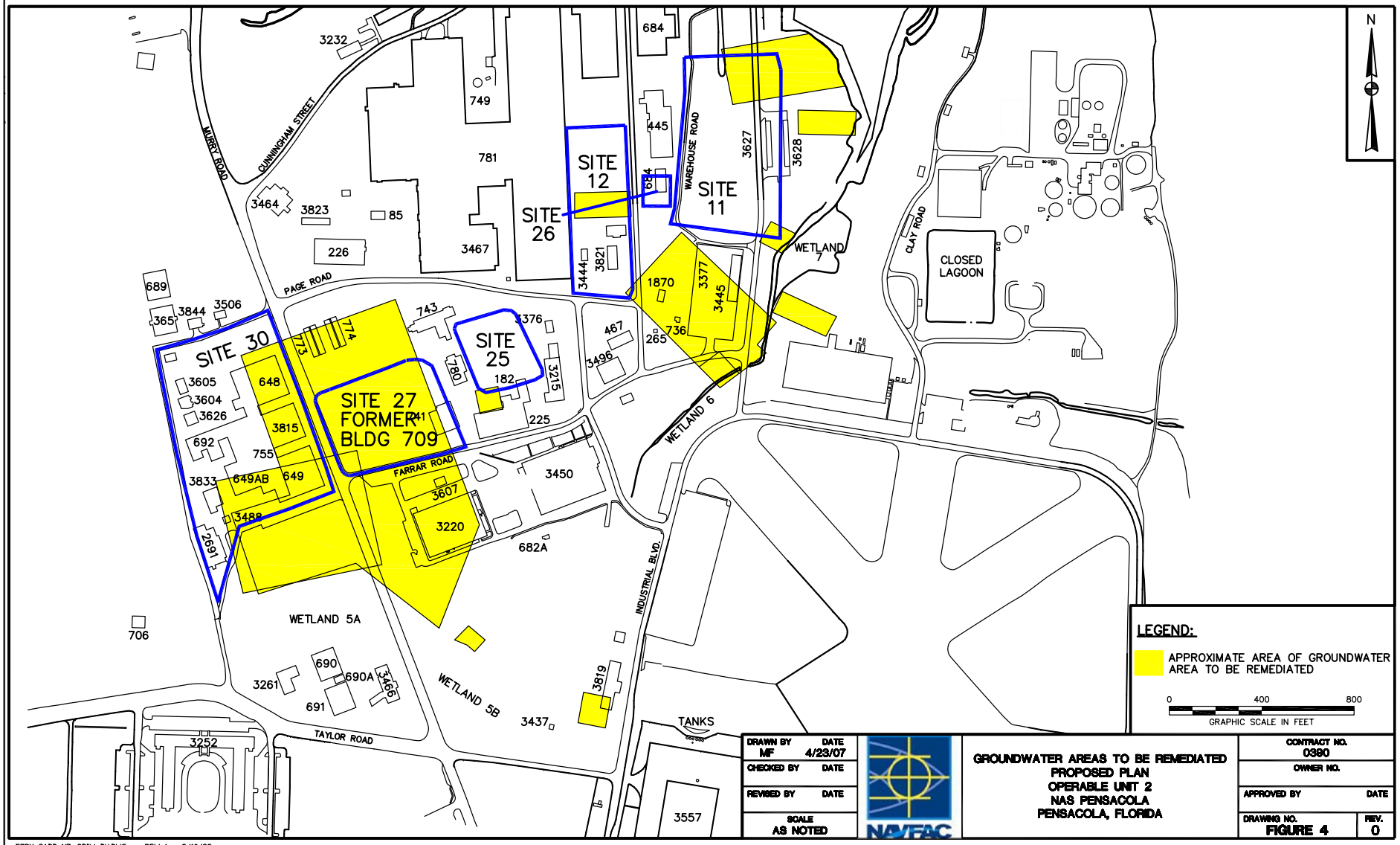

N
GULF BEACH HWY
BEACH HAVEN
NAVY POINT
NAVY BLVD.
MAGAZINE POINT PENINSULA
GRANDE
BAYOU
MAIN GATE
SITE 12
YACHT BASIN
SITE 11
GOLF COURSE
GOLF COURSE
DUNCAN RD
MURRAY RD
SITE 26
SITE 25
SITE 27
TAYLOR RD
CHEVALIER FIELD
SITE 30
FORREST SHERMAN FIELD
TOW WAY
PLEASANT GROVE
FISHER
HOSPITAL
PENSACOLA BAY
HWY. 292
RADFORD BLVD.
PENSACOLA BAY
BIG LAGOON
GULF OF MEXICO
FORT PICKENS
U.S. 90
U.S. 29
REGIONAL AIRPORT
PENSACOLA
U.S. 98
HWY. 292
NAVAL AIR STATION
PENSACOLA BAY
GULF OF MEXICO
0 4 8
GRAPHIC SCALE IN MILES
LEGEND:
SITE LOCATIONS
SITE 30
SITE NUMBER
SHORE LINE
0 2500 5000
GRAPHIC SCALE IN FEET
DRAWN BY MF
DATE 4/20/07
CHECKED BY
DATE
REVISED BY
DATE
SCALE AS NOTED
NAVFAC
SITE LOCATION MAP
PROPOSED PLAN
OPERABLE UNIT 2
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 0390
OWNER NO.
APPROVED BY
DATE
DRAWING NO. FIGURE 1
REV. 0
FORM CADD NO. SDIV-BH.DWG – REV 1 – 9/10/98



DRAWN BY MF DATE 11/15/06	NAVFAC	SITE AREA MAP PROPOSED PLAN OPERABLE UNIT 2 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 0390
CHECKED BY DATE			OWNER NO.
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2 REV. 0

FORM CADD NO. SDIV-BV.DWG - REV 1 - 9/10/98


SITE 30
SITE 27
FORMER
BLDG 709
SITE 25
SITE 26
SITE 12
SITE 11
CLOSED
LAGOON
WETLAND 5A
WETLAND 5B
WETLAND 6
WETLAND 7
TANKS
PAGE ROAD
FARRAR ROAD
TAYLOR ROAD
CUNNINGHAM STREET
MURRY ROAD
WAREHOUSE ROAD
INDUSTRIAL BLVD.
CLAY ROAD
N
LEGEND:
APPROXIMATE AREA OF SOIL AREA TO BE REMEDIATED
0
400
800
GRAPHIC SCALE IN FEET
DRAWN BY MF
DATE 4/23/07
CHECKED BY
DATE
REVISED BY
DATE
SCALE AS NOTED
NAVFAC
SOIL AREAS TO BE REMEDIATED
PROPOSED PLAN
OPERABLE UNIT 2
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 0390
OWNER NO.
APPROVED BY
DATE
DRAWING NO. FIGURE 3
REV. 0
FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98


N
SITE 30
SITE 27
FORMER
BLDG 709
SITE 25
SITE 26
SITE 12
SITE 11
CLOSED
LAGOON
WETLAND 5A
WETLAND 5B
WETLAND 6
WETLAND 7
CUNNINGHAM STREET
MURRY ROAD
PAGE ROAD
FARRAR ROAD
TAYLOR ROAD
WAREHOUSE ROAD
INDUSTRIAL BLVD.
CLAY ROAD
TANKS
3232
749
781
3467
3464
3823
85
226
689
3844
3506
365
3605
3604
3626
648
3815
692
755
3833
649AB
649
3488
2691
706
774
773
743
780
3376
182
3215
225
3444
3821
684
445
3627
3628
1870
3377
3445
736
265
467
3496
3450
3607
3220
682A
3819
3437
3261
690
690A
3466
691
3252
3557
LEGEND:
APPROXIMATE AREA OF GROUNDWATER AREA TO BE REMEDIATED
0
400
800
GRAPHIC SCALE IN FEET
DRAWN BY MF
DATE 4/23/07
CHECKED BY
DATE
REVISED BY
DATE
SCALE AS NOTED
NAVFAC
GROUNDWATER AREAS TO BE REMEDIATED
PROPOSED PLAN
OPERABLE UNIT 2
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 0390
OWNER NO.
APPROVED BY
DATE
DRAWING NO. FIGURE 4
REV. 0
FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

the site are approximately 5 feet above mean sea level (msl), and topography slopes gently eastward toward Bayou Grande. Approximately half of the site is wooded and designated wetland areas border the Yacht Basin.

According to the initial assessment study (IAS) conducted by the Naval Facilities Engineering Service Center (NFESC), this landfill was used to burn refuse through the mid-1940s. During this time, it received combustibles such as fuels, solvents, and waste oil from aircraft engine overhauls. During landfill operations from the early 1930s to the 1940s, approximately 24 cubic yards of material were disposed of daily from several NAS Pensacola locations. During this time, an unknown number of 55-gallon drums of unknown contents were observed. Until the 1950s, oil slicks were noted during heavy rains in the Yacht Basin.

The source of contamination at Site 11 was identified to be the former landfill, where test trenches exposed a "seam" of blackened debris at the water table. The material was described as oily and containing corroded bits of metal and other debris.

Contaminants identified in soil at Site 11 included metals (arsenic, beryllium, cadmium, chromium, and iron), polychlorinated biphenyls (PCBs), and benzo(a)pyrene equivalents (BEQs). Groundwater contaminants also included the metals arsenic and beryllium, chlorinated compounds including 1,2-dichloroethene (1,2-DCE), chloroform, 1,2-dichloroethane (1,2-DCA), 1,1,2,2-tetrachloroethane, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride (VC), and the pesticides aldrin and dieldrin.

Site 12 — Scrap Bins

Site 12 is currently referred to as the Defense Reutilization and Marketing Office (DRMO) Recyclable Materials Center and used to store scrap metal. The site is approximately 800 feet northwest of former Chevalier Field and immediately west and upgradient of Site 26. Most of the site area is enclosed by a chain-link fence and covered with a large concrete pad where heavy equipment is stored. Buildings 455 and 3821 are in the southern portion of the site. Surface elevations average 15 to 18 feet above msl, and the terrain is relatively flat. The limited exposed surface soil is sandy and well drained. Building 455 houses an office, break area, and storage warehouse, whereas Building 3821 is a storage warehouse.

From the early 1930s to the 1940s, garbage was stored at Site 12 in an area known as "Pig Sty Hill" near Building 455. Approximately 16 cubic yards (two truckloads) per day of wet garbage were stored here before being hauled off for livestock feed. The site has since been used as a scrap metals storage area.

The storage of scrap metals appears to be the source of metals contamination at Site 12. Past storage of old transformers before disposal is a potential source of PCB contamination at the site. Residual fuels and oils from scrapped aircraft and vehicles stored at the site are a potential source for other organic contaminants found at the site. Radium-226 contamination was also found in parts of the site.

Contaminants identified in soil at Site 12 included metals (arsenic, cadmium, and iron), the PCB Aroclor-1260, and BEQs. In addition, soil samples contained Radium-226 in amounts equal to four times the standard in 40 Code of Federal Regulations (CFR) § 192.12. Contaminants identified in groundwater were the PCB Aroclor-1260, chlorinated compounds including chloroform 1,1-DCE and PCE, and the pesticides dieldrin and heptachlor epoxide.

Site 25 — Radium Spill Area

The approximately 50-foot by 50-foot concrete-paved area is located on the eastern portion of NAS Pensacola, immediately east of Murray Road and north of Farrar Road. The site is flat with land surface elevations averaging approximately 22 to 25 feet above msl. Where exposed, site surface soil is sandy and well drained. The site includes an area east of the radium decontamination building (Building 780) where a radium spill is reported to have occurred. A former helicopter scrap yard approximately 25 feet east of Building 780 is currently used as a parking area for Navy Exchange semi-trailers. Building 780 currently houses the Joint Oil Analysis Laboratory, which is used to check the quality of oil from aircraft and vehicles. Building 780 was constructed in 1951 to house the oxygen and carbon dioxide shops.

In approximately 1975, a radium decontamination operation was added. Radium wastes from this operation were stored in a drum on site before being disposed. In 1978, a spill occurred in the storage area between Building 780 and the scrap yard. Approximately 25 gallons of low-level radium paint waste spilled from a ruptured, corroded drum onto the underlying concrete floor. The waste was reportedly cleaned up, placed in a container, and sent to a proper disposal site. The exact location of the spill, the details of the cleanup operation, and whether the waste reached unpaved soil were not determined from the existing records.

Soil samples collected behind Building 780 revealed metals and semivolatile organic compound (SVOC) contamination. Shallow wells next to the building contained metals and a deeper well contained metals, as well as chlorinated solvents benzene and xylene. Storage and disposal of materials at Building 780 are possible sources of soil and groundwater contamination. The storage yard behind Building 225 was used as a metal prefabricating shop. Shallow and intermediate wells located here contained metals exceedances, as well as PCE and TCE. Activities in and around this building are a possible source for contamination in these wells. The loading dock where the radium-paint spill and cleanup occurred was investigated, but no evidence of Radium-226 contamination was found.

Contaminants identified in soil at Site 25 included metals (arsenic, beryllium, cadmium, chromium, and iron), the PCBs Aroclor-1254 and Aroclor-1260, BEQs, and the pesticide dieldrin. Contaminants identified in groundwater were chlorinated compounds (1,1-DCE, chloroform, PCE, TCE, and VC).

Site 26 — Supply Department Outside Storage Area

The Supply Department Outside Storage Area, Site 26, is northwest of former Chevalier Field and immediately south of Building 684. The approximately 150-foot by 200-foot area houses an open metal shed near a former chemical storage building. DRMO uses this area to store paints, fuels, and solvents. Site access is limited by an 8-foot chain-link fence surrounding the storage area. The concrete pavement inside the fence is bordered by sandy soil and mowed grass. Site 26

is bounded on the west by a paved road and on the east by a wooded area (Site 11). The site gently slopes eastward to a topographic break where elevations abruptly drop to approximately 5 feet above msl. A closed depression exists on the southern portion of the site.

From 1956 until 1964, the supply department used Site 26 to store incoming paint strippers and acids. Containers of these materials were placed outside on steel matting and sometimes leaked on the ground.

No significant contamination was detected in soil at Site 26. Groundwater contaminants included arsenic, beryllium, cadmium, dieldrin, and PCE.

Site 27 — Radium Dial Shop Sewer

The Radium Dial Shop Sewer extends through the concrete foundation of former Building 709. The building was demolished and the foundation is currently a parking lot. The building foundation is 2 to 4 feet above the surrounding area. Outside the foundation the sewer easement is unpaved. Originally, the site consisted of a small radium dial shop in former Building 709 with a connection to the sanitary sewer. However, recent investigations have associated additional areas of contamination within the site, expanding the area of investigation to approximately 6 acres.

Building 709 was constructed in 1941 and used for several purposes, including carburetor repair, propeller repair, painting and maintenance, various instrument shops (including a radium paint room), and a plating shop. In 1949, a small shop in Building 709 was used to rework luminous instrument dials. Building 709 also housed a large plating operation from 1941 to approximately 1970.

Site 27 is on the remaining concrete foundation of former Building 709, which is currently a parking lot. SVOC exceedances were noted from monitoring wells previously installed for fuel tank removals at this location, the former tanks are possible contributors of contamination in these wells. The radiological survey revealed a small area south of former Building 709 where there appeared to be a spill adjacent to an old stairway from Building 709. Outside this limited area, no significant soil radiological contamination was found anywhere on these sites.

Contaminants identified in soil at Site 27 included aluminum, arsenic, cadmium, chromium, iron, mercury, dieldrin, and BEQs. Contaminants in groundwater included (chromium, iron, and manganese), chlorinated compounds (1,4-dichlorobenzene, 1,1-DCE, 1,2-DCA, chloroform, PCE, and TCE), and the pesticide dieldrin.

Site 30 — Complex of Industrial Buildings and Industrial Wastewater Treatment Plant Sewer Line

The approximate 35-acre site houses a complex of industrial buildings known as the Building 649 Complex. The complex includes interconnected Buildings 647, 648, 649, 692, 755, 3815, and several smaller separate, associated buildings. The site area is primarily covered with buildings and paved parking areas. Immediately south of the site is a wooded area that includes a designated wetland. The buildings were used by the Dynamic Component Division of the former Naval Aviation Depot (NADEP) and several aircraft component repair functions. Operations in this complex began in the 1940s and continued until NADEP closed. Also included in the Site 30 investigation were the areas surrounding Buildings 3220 and 3450, former NADEP buildings where aircraft electronics were repaired. The Site 30 investigation also included a portion of the sewer line from the Building 649 complex to the IWTP. The portions of the sewer investigated with Site 30 include those lines at Sites 25, 27, and 30, and downstream segments. The portions include the segment extending from the Building 649 complex, the feeder line from Building 3220, and the main line running to the IWTP.

Aircraft and parts were painted in booths in the Building 649 Complex beginning in 1940. A tin-cadmium plating shop operated in the Building 649 Complex from the mid-1940s to the early 1960s. At this time, it was replaced by a magnesium treatment line, which operated until the early 1970s.

The IWTP, originally built in 1948, was replaced in 1971 with a modern plant that could accept industrial wastes.

At Site 30, numerous monitoring wells associated with previous fuel tank removals within the Building 649 Complex revealed chlorinated solvents and benzene in groundwater exceeding **preliminary remediation goals (PRGs)**. Wells installed on the western side of this complex revealed SVOC and **volatile organic compound (VOC)** exceedances in groundwater. Aboveground storage tanks at this complex, the former underground storage tanks (USTs), and associated buried piping are considered sources for this contamination. Several wells in and around Building 3220 exhibited benzene, chlorinated solvents, and phenol in groundwater exceeding PRGs. Also, wells south of Building 3450 exhibited phenol in groundwater above PRGs. These wells were associated with former UST removals. A shallow well (30GS154) installed on the north side of Building 3450 exhibited VC and xylene in groundwater above PRGs.

Contaminants identified soil at Site 30 included arsenic and beryllium, BEQs, and PCBs. Groundwater contaminants include arsenic, cadmium, chromium, benzene, chloroform, 1,1-DCE, 1,4-dichlorobenzene, PCE, and 1,1,1-trichlorethane. Site 30 also includes a portion of the IWTP sewer line. Monitoring wells adjacent the southwest corner of Building 3189 exhibited chlorinated VOCs, benzene, iron, manganese, and sodium above PRGs for groundwater. Activities at the former hazardous materials accumulation area likely contributed to this contamination. Chlorobenzene and toxaphene were detected at a well near a lift station for the IWTP sewer line. Past spills from this lift station are the suspected contributors of this contamination.

Summary of Site Risks

Federal regulations require that a baseline risk assessment (BRA) be completed to determine if the site poses an unacceptable risk, now or in the future, to human health or the environment. The BRA provides a basis for determining if cleanup is needed and what the cleanup levels should be. The OU 2 BRA was included in the RI Report and included two parts: a **Human Health Risk Assessment (HHRA)** and an **Ecological Risk Assessment (ERA)**.

The area of OU 2 is currently identified as “Industrial”, which is the anticipated future use of the area. Because NAS Pensacola is not proposed for Base Realignment and Closure (BRAC), it

is reasonable for the facility and OU 2 to also be projected in the future as Industrial or "nonresidential". The groundwater at OU 2 is not used at this time and NAS Pensacola does not anticipate its future use. However, as a conservative evaluation of the associated risks at OU 2, the HHRA evaluated risks associated with future residential use of the sites and potable use of the groundwater.

The HHRA assessed the human health risks associated with exposure to contaminants in soil and groundwater for a current and future site worker, hypothetical future site resident, and hypothetical adolescent trespasser. The HHRA performs calculations to determine the Incremental Lifetime Cancer Risk (ILCR) or the cancer risk over and above the normal background risk. The HHRA then compares the calculated ILCR to determine **chemicals of potential concern (COPCs)** regulatory standards for acceptable target risk ranges. Currently the USEPA's acceptable target risk range (40 CFR § 300) is 1 in 10,000 to 1 in 1,000,000 (1.0E-4 to 1.0E-6) and Florida's acceptable risk [62-777 Florida Administrative Code (FAC)] is 1 in 1,000,000 (1.0E-6).

Potential non-carcinogenic compounds are also evaluated using calculations to determination of a Hazard Quotient (HQ) for individual compounds and a Hazard Index (HI), which is a summation of the HQ for all the contaminants within a media or across all media for a given population. The HI is the ratio for the level of exposure to an acceptable level for the COPC. A HI greater than 1.0 indicates that there may be a concern for non-carcinogenic health effects.

The HHRA identified soil inorganic COPCs included arsenic, beryllium, cadmium, chromium, iron, mercury, and Radium-226. Soil organic COPCs included BEQs, dieldrin, and PCBs (Aroclor-1254 and Aroclor-1260). Groundwater COPCs included the inorganic compounds: arsenic, beryllium, cadmium, chromium, iron, and manganese; and organic compounds: 1,1-DCE, chloroform, 1,2-DCE, 1,4-dichlorobenzene, aldrin, benzene, 1.2-DCA, dieldrin, 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, PCE, TCE, and VC.

The ERA assessed the risk to plants and animals for the six sites included in OU 2. Based on model predictions the exposure risk to terrestrial species near OU 2 sites is relatively low considering the potential for effects to lower-level species. The transfer of contaminants up to higher levels of the food chain will not be a concern as contaminants are not present at concentrations that indicate an accumulation. The low soil concentrations and limited distribution of contaminants will limit the incidental ingestion risk to acceptable concentrations for locally foraging species.

The nature and extent of contamination was based on exceedances of the Florida Cleanup Target Levels (CTLs) as defined by Chapter 62-777, FAC Tables I and II. The reported soil and groundwater concentrations were compared to the **Soil Cleanup Target Levels (SCTLs)** and **Groundwater Cleanup Target Levels (GCTLs)**, respectively, to identify the **chemicals of concern (COCs)** and define the nature and extent of contamination. Surface soils were compared to the residential direct exposure SCTLs and the groundwater-based leachability SCTLs to identify COCs. Subsurface soils were compared to groundwater-based leachability SCTLs. Groundwater samples were compared to GCTLs based on ingestion and freshwater and marine Class III surface water criteria, as appropriate. Tables 1 and 2 summarize the COCs and screening values. Based on the above criteria, COCs in surface soil included the inorganic analytes: arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, silver, vanadium; the PCBs Aroclor-1260, Aroclor-1242, and Aroclor-1254; and the pesticide dieldrin. In subsurface soils the identified COCs included only chromium. In groundwater COCs include: aluminum, iron, manganese, barium cadmium, chromium, lead, SVOCs, benzene, thylbenzene, xylene, and chlorinated ethenes.

A response action is warranted for OU 2 because cumulative excess cancer risk to an individual exceeds USEPA and FDEP criteria for current and reasonably anticipated future land use and potential use of groundwater. In addition, chemical specific standards that define acceptable risk levels are exceeded.

It is the Navy's judgment, as lead agency, the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect the public health or welfare of the environment from actual or threatened releases of hazardous substances into the environment.

Remedial Action Objectives

The FS identified **Remedial Action Objectives (RAOs)** to describe what site cleanup is expected to accomplish. The RAOs identified in the FS were based on Florida Rule 62-780, FAC, which provides three risk management options to be pursued. The remedies identified and evaluated in the FS were selected to fulfill the Florida Level IIB criteria for soil– "No Further Action with institutional controls and if appropriate engineering controls that are agreed to by the real property owners of the source property." And one FS groundwater alternative was evaluated pursuant to Florida Level IID criteria for groundwater – "No further action with institutional controls and, if appropriate, engineering controls that are agreed to by the real property owners of all properties subject to the institutional or engineering controls."

The Navy has reviewed the previously stated generalized RAO and identified the following more specific Remedial Goals (RG) for OU 2.

- Protect Human Health by eliminating or preventing exposure to contamination in surface soils by COCs that exceed the Florida residential and commercial/ industrial SCTLs.
- Eliminate a continuing contamination source to groundwater by reducing or eliminating COCs in subsurface soils that exceed Florida SCTLs for leachability.
- Reduce human health risk from exposure to groundwater by reducing groundwater contamination at OU 2 to meet the Florida GCTLs.

Based on the RGs, the FS estimated volumes of contaminated media that require cleanup. The volumes estimated are summarized as follows:

- Surface soils exceeding residential SCTLs – 19,520 CY

TABLE 1
SUMMARY OF SOIL CONTAMINANTS OF CONCERN - RANGE OF DETECTION
OPERABLE UNIT 2, NAS PENSACOLA, FLORIDA

	FLORIDA SCTLs			USEPA REGION IX PRGs		OU 2 INDIVIDUAL SITES					
	Residential	Commercial/ Industrial	Leaching	Residential	Industrial	**Site 11**	**Site 12**	**Site 25**	**Site 26**	**Site 27**	**Site 30**
Inorganics (mg/kg)											
Antimony	27	370	5.4	31	410	NA	0.59-12.1	NA	NA	NA	NA
Arsenic	2.1	12	*	0.39	1.6	0.47 - 4.1	1.4 - 2.8	0.72 - 4.5	NA	0.75 - 5.9	0.52 - 4.8
Barium	120	130,000	1,600	5,400	67,000	6.6 - 134	NA	NA	NA	NA	2.4 - 158
Cadmium	82	1,700	7.5	37	450	1.9 - 23.3	2.2 - 562	1.4 - 34.6	NA	1.1 - 67.1	1.1 - 35.9
Chromium	210	470	38	210	450	2.3 - 1610	1.1 - 70.8	1.7 - 234	NA	1.9 - 314	2.1 - 395
Copper	150	89,000	*	3,100	41,000	NA	4 - 516	0.83 - 25.3	NA	0.85 - 137	NA
Iron	53,000	*	*	23,000	100,000	NA	NA	1330 - 27400	NA	NA	NA
Lead	400	1,400	*	400	800	1.2 - 790	NA	0.76 - 1840	NA	0.74 - 1550	NA
Mercury	3	17	2.1	23	310	NA	NA	0.2 - 3.7	NA	0.16 - 84	NA
Silver	410	8,200	17	390	5,100	NA	NA	0.87 - 45.5	NA	0.87 - 156	NA
Vanadium	67	10,000	980	78	1,000	2.1 - 47.9	1.5 - 21.9	2.7 - 21.4	NA	1.9 - 41.9	2.4 - 33.8
Pesticides/PCBs (mg/kg)											
Aroclor 1260	0.5	2.6	17	0.22	0.74	0.043 - 1.4	0.36 - 15	0.006 - 31	NA	NA	0.045 - 0.58
Aroclor 1254	0.5	2.6	17	0.22	0.74	NA	NA	0.028 - 0.91	NA	NA	0.069 - 1.8
Aroclor 1242	0.5	2.6	17	0.22	0.74	NA	NA	NA	NA	NA	10
Dieldrin	0.06	0.3	0.002	0.03	0.11	0.0065 - 0.022	0.00056 - 0.018	0.000094 - 0.071	NA	0.000079 - 0.8	0.0038 - 0.064
Endrin Aldehyde	25	510	1	18	180	NA	NA	0.0019 - 1.7	NA	NA	NA
Alpha BHC	0.1	0.6	0.0003	0.32	1.3	NA	NA	NA	NA	0.000044 - 0.0014	NA
Semivoltile Organic Compounds (mg/kg)											
Benzo(a)anthracene	0.1	0.7	0.8	0.62	2.1	0.14 - 4.6	NA	0.057 - 3.8	NA	0.059 - 9.5	0.094 - 22
Benzo(b)fluoranthene	1.4	4.8	2.4	0.62	2.1	NA	NA	0.064 - 7.7	NA	0.037 - 13	0.053 16
Benzo(a)pyrene	0.1	0.7	8	0.062	0.21	0.05 - 4.5	0.066 - 1.9	0.048 - 3.4	NA	NA	0.05 - 18
Carbazole	49	240	0.2	24	86	0.82	NA	0.1 - 1.2	NA	0.048 - 3	1.2
Phenol	500	220,000	0.05	18,000	100,000	NA	NA	NA	NA	0.93	NA
4 Methylphenol	300	3,400	0.03	310	3,100	NA	0.092 - 0.29	NA	NA	NA	NA
Volatile Organic Compounds (mg/kg)											
1,2 DCA	0.5	0.7	0.01	0.28	0.6	NA	NA	NA	NA	NA	0.0009 - 0.096
Methylene Chloride	17	26	0.02	9.1	21	NA	NA	NA	NA	NA	0.31

Florida SCTL - Soil Cleanup Target Level - 62-777 Florida Administrative Code
mg/kg - milligrams per kilogram
* - MCL not established by USEPA
NA - Not a contaminant of concern at this site
USEPA Region IX PRGs = Preliminary Remediation Goals

TABLE 2
SUMMARY OF GROUNDWATER CONTAMINANTS OF CONCERN - RANGE OF DETECTION
OPERABLE UNIT 2, NAS PENSACOLA, FLORIDA

	Florida GCTL	USEPA MCL	OU 2 INDIVIDUAL SITES					
			Site 11	Site 12	Site 25	Site 26	Site 27	Site 30
Inorganics (ug/L)								
Barium	2,000	2,000	8 - 3,900	NA	NA	NA	NA	NA
Cadmium	5	5	4 - 33	2.1 - 17	NA	NA	4.2 - 8	0.59 - 120
Chromium	100	100	NA	NA	NA	NA	8 - 160	4.6 - 250
Iron	300	300	184 - 8,300	16.4 - 2,700	NA	NA	543 - 3,000	23.6 - 30,000
Lead	15	15	1 - 42	NA	NA	NA	NA	0.95 - 130
Manganese	50	50	0.96 - 240	NA	NA	NA	NA	15.5 - 110
Semivoaltile Organic Compounds (ug/L)								
1-methylnaphthalene	28	*	28	NA	NA	NA	NA	NA
2-methylnaphthalene	28	*	39	NA	NA	NA	0.14 - 12	0.025 - 32
Naphthalene	14	*	NA	NA	NA	NA	3 - 150	0.042 - 90
Carbazole	1.8	*	NA	NA	NA	NA	NA	13
Pentachlorophenol	1	1	NA	NA	NA	NA	NA	2.2
1,4 Dichlorobenzene	75	75	NA	NA	NA	NA	NA	7.2 - 100
2,4 Dichlorophenol	0.3	*	NA	NA	NA	NA	NA	1.3
3,4 Methylphenol	3.5	*	NA	NA	NA	NA	2 - 110	1.7 - 63
Volatile Organic Compounds (ug/L)								
Benzene	1	5	3.2 - 11	NA	NA	NA	3.1	0.5 - 9.8
Ethylbenzene	30	700	0.87 - 59	NA	NA	NA	4.8 - 61	0.12 - 810
Xylene	20	10,000	4.8 - 170	NA	NA	NA	78 - 530	1.1 - 500
Tetrachloroethene	3	5	1.6 - 25	NA	NA	NA	0.58 - 65	0.73 - 35
Trichloroethene	3	5	0.2 - 22	NA	1.4 - 8.2	NA	0.56 - 3.6	0.63 - 310
cis 1,2 Dichloroethene	70	70	0.2 - 360	NA	NA	NA	0.36 - 300	0.38 - 100
Vinyl Chloride	1	2	0.37 - 12	NA	NA	NA	NA	0.19 - 7.9
1,1 Dichloroethene	7	7	NA	NA	NA	NA	0.31 - 18	NA
1,1 Dichloroethane	70	*	NA	NA	NA	NA	NA	0.12 - 180
1,2 Dichloroethane	3	5	NA	NA	NA	NA	NA	0.22
Chloroethane	12	*	NA	NA	NA	NA	4.6 - 13	22 - 32
Chlorobenzene	100	100	NA	NA	NA	NA	NA	0.57 - 830

Florida GCTL - Groundwater Cleanup Target Level - 62-777 Florida Administrative Code
USEPA MCL - Maximum Contaminant Level
ug/L - micrograms per liter
* - MCL not established by USEPA
NA - Not a contaminant of concern at this site

- Surface soils exceeding commercial/industrial SCTLs – 1,590 cubic yards
- Surface soils exceeding leachability SCTLs – 15,690 cubic yards
- Subsurface soils exceeding leachability SCTLs – 120 cubic yards
- Groundwater area exceeding secondary drinking water GCTLs, specifically aluminum, iron, and manganese – 14.4 million gallons
- Groundwater area exceeding GCTLs for barium, cadmium, chromium, and lead – 2.26 million gallons
- Groundwater area exceeding GCTLs for SVOCs – 0.82 million gallons

Summary of Cleanup Alternatives for OU 2

The OU 2 FS analyzed the options that the Navy considered for cleanup of OU 2. These options, referred to as "Cleanup Alternatives", are different combinations of plans to restrict access and to contain, remove, or treat contamination in order to protect human health and the environment.

Soil Cleanup Alternatives

The **Remedial Action Alternatives** for soil contamination include the no-action alternative, land use controls (LUCs) as a limited action alternative, soil and asphalt capping as a control alternative, phytoremediation covers and selected asphalt capping as a treatment alternative, and excavation and offsite disposal as a removal alternative. The **preferred cleanup alternative for soil is *Alternative S-5: Excavation and Offsite Disposal***.

Alternative S-1: No Action
The National Oil and Hazardous Substances Pollution Contingency Plan requires that a no-action alternative be considered as a starting point for the evaluation of other alternatives. Under this alternative, no changes would be made to existing site operations. While the current and projected land use for this site is expected to remain industrial, there would be no additional LUCs to guarantee that it stays this way. Therefore this alternative would not meet the RAO because contaminants above the residential and commercial/industrial CTLs are left on site.

Alternative S-2: Land Use Controls
This alternative would be limited to LUCs, which would permit OU 2 to be managed using Florida's Risk Management Option Level II, pursuant to 62 780.680(2), FAC. **Institutional controls** would be implemented and enforced to restrict the property use to non-residential. The prohibited uses of the property under these criteria would include, but not be limited to, any form of housing,child care facilities, any kind of school including preschools, elementary schools, and secondary schools, playgrounds, and adult convalescent or nursing home facilities. Excavation, disturbance or removal of soils is prohibited unless prior written approval is obtained from the facility's Environmental Coordinator. This option would require annual inspections to confirm compliance with the LUC agreement. The alternative would not provide any additional effectiveness for current use scenario, but would provide long-term effectiveness by restricting future use and access.

The estimated cost of the initial implementation of the LUC alternative is $21,974. The long term costs including an estimated cost for 5-year reviews of $16,625 and the value discounted at 6 percent indicates a 30-year Net Present Worth (NPW) of $76,566.

Alternative S-3: Soil and Asphalt Capping and LUCs
Covering the surface or capping reduces the risk of exposure to contaminated soil, thus eliminating the direct exposure pathway. When constructed as low permeability covers, they also reduce the flow of water and reduce the risk of rain and surface water carrying any contamination downward into the groundwater. Asphalt covers would be constructed 22 inches thick in four distinct areas and soil covers would be constructed 2-feet thick in four separate distinct areas. The table below describes the locations and sizes of the proposed capping areas.

Alternative 3
Description of Proposed Capping Areas

Description	Location	Dimensions
Asphalt Cap No. 1	Site 12, east of Building 781, south of Building 740, north of Building 455	280-ft x 600-ft rectangular cap
Asphalt Cap No. 2	Site 12, east of Building 3821	80-ft x 160-ft rectangular cap
Asphalt Cap No. 3	Site 25, east of Building 780	160-ft x 240-ft rectangular cap
Asphalt Cap No. 4	Site 27	360-ft x 440-ft rectangular cap
Soil Cap No. 1	Site 11, east of Pat Bellinger Road	50-ft x 300-ft rectangular cap
Soil Cap No. 2	Site 11, east of Yacht Basin, west of Clay Road	240-ft x 240-ft right-triangular cap
Soil Cap No. 3	Site 30, along Wetland 5B	100-ft x 970-ft rectangular cap
Soil Cap No. 5	Site 30, south of Building 649	100-ft x 400-ft rectangular cap

Although the proposed asphalt and soil caps are protective of most of the commercial/industrial direct exposure and leachability SCTL exceedances, several isolated exceedances occur near Sites 27 and 30. These exceedances would be addressed by excavating the top 2 feet of soil from these locations and consolidating it under the Site 27 asphalt cap. The total estimated excavation volume is 950 cubic yards. Excavated soil would remain in the same area, and is therefore appropriate. If soil concentrations exceed land disposal restrictions (LDR), the Site 27 asphalt cap would need to be constructed pursuant to the disposal Corrective Action Management Unit regulations (40 CFR §264.552). Excavated areas would be re-covered with clean fill.

Because contamination would be left on site, this alternative would require implementation of LUCs as specified in Alternative S-2, and regular inspection and maintenance of the soil covers. Although the surface capping does not reduce

the volume or toxicity of wastes, it does provide immediate and long-term reliable protection against direct exposure to contaminated soils.

The estimated initial cost of the soil and asphalt capping and LUC alternative is $2,682,063. The long-term costs including 5-year reviews estimated at $16,625 and the value discounted at 6 percent indicates a 30-year NPW of $2,736,325.

Alternative S-4: Phytoremediation Covers, Asphalt Capping and LUCs

Phytoremediation is a process that uses plants to remove, transfer, stabilize, and degrade contaminants in soil and groundwater.

In a soil remedy, phytoremediation is typically applied as a vegetative cover system. Vegetative covers are designed as long-term, self-sustaining systems of plants growing in and/or over materials that pose environmental risk. A vegetative cover may reduce the risk to an acceptable level and generally requires minimal maintenance. Vegetative covers are distinguished as follows:

- *Evapotranspiration covers* are composed of soil and plants engineered to maximize the available storage capacity of soil, evaporation rates, and transpiration processes of plants to minimize water infiltration. The evapotranspiration cap is a form of hydraulic control by plants. Risk reduction relies on the isolation of contaminants to prevent human or wildlife exposure and the reduction of leachate formation and movement. Caps are designed with sufficient thickness and permeability to hold moisture such that infiltration is minimized by evapotranspiration processes.

- *Phytoremediation covers* consist of soil and plants to minimize infiltration of water and to aid in the degradation of underlying waste. Risk reduction relies on the degradation of contaminants, the isolation of contaminants to prevent human or wildlife exposure, and the reduction of leachate formation and movement. Phytoremediation covers incorporate certain aspects of hydraulic control, phytodegradation, rhizodegradation, phytovolatilization, and perhaps phytoextraction.

The phytoremediation covers and asphalt capping alternative is identical to the Alternative S-3 Soil and Asphalt Capping and LUCs, except that phytoremediation covers are used instead of soil covers. Phytoremediation covers may be especially applicable near the adjacent wetlands, where surface capping is invasive and where site use is limited. Phytoremediation covers may also be more compatible with the selected groundwater Remedial Action Alternatives.

Because contamination would be left on site, this alternative would require implementation of LUCs as specified in Alternative S-2, and regular inspection to maintain the vegetative presence and possibly harvest plants. Although phytoremediation does not immediately reduce the volume or toxicity of wastes it may be sufficient to reduce contamination below the commercial/industrial direct exposure and leachability CTLs. Asphalt capping also does not reduce the volume or toxicity of wastes but does provide reliable protection against direct exposure to contaminated soils.

The estimated initial cost of the phytoremediation, asphalt capping and LUC alternative is $2,136,689. The long-term costs including Operations and Maintenance (O&M) and natural attenuation sampling conducted over 10 years and 5-year reviews when discounted at 6 percent indicates a 30-year NPW of $2,445,454.

Alternative S-5: Excavation and Offsite Disposal and LUCs

This alternative involves excavating surface soil that exceeds commercial/industrial direct exposure SCTLs and vadose zone soil that exceeds leachability SCTLs. When soil contamination appears contiguous, larger areas of soil would be excavated. In cases were the soil contamination appears isolated, smaller excavations would be performed in 40-foot by 40-foot sections. The proposed areas of soil removal would be excavated to 2 feet below land surface (bls), and subsurface soil contamination is not addressed.

Subsurface SCTLs were only exceeded in three locations. In the first instance, the sample depth was 20 feet bls and presumably below the water table, and thus would be treated as part of the groundwater cleanup. In the second instance, total chromium concentration was 48 micrograms per kilogram (µg/kg), which barely exceeded the hexavalent chromium leachability SCTL of 38 µg/kg. Because hexavalent chromium was not tested for and most of the chromium presumably exists as trivalent chromium, this was excluded from consideration. In the third instance, the concentration of PCE was 30 µg/kg, which was equal to leachability SCTL of 30 µg/kg. This sample was also excluded from consideration.

The excavated soils would be disposed offsite.

Because contamination would be left on site, this alternative would require implementation of LUCs, as specified in Alternative S-2. Excavation and offsite disposal of soil immediately reduces the volume of contamination and on-site toxicity of the wastes.

The estimated initial cost of the excavation, offsite disposal and LUC alternative is $5,071,284. The long-term costs including 5-year reviews estimated at $16,625 and the value discounted at 6 percent indicates a 30-year NPW of $5,125,545.

Groundwater Cleanup Alternatives

The Remedial Action Alternatives for groundwater contamination include the No Action Alternative, a LUCs Alternative; **Monitored Natural Attenuation (MNA)** and LUCs, Riparian Corridors and LUCs, and Permeable Reactive Barriers and LUCs as treatment alternatives; and Groundwater Pumping and LUCs as a removal and control alternative.

Groundwater remedies are inherently long term and contamination is usually left on site. Thus, 5-year reviews are needed for all of the groundwater Remedial Action Alternatives. Because 5-year reviews are considered in the media-specific Remedial Action Alternatives for soil, they are not estimated in the costs for the groundwater Remedial Action Alternatives. Similarly, the inclusion of LUCs would be redundant and they are not included in the costs for groundwater Remedial Action Alternatives. The **preferred cleanup alternative for groundwater is GW-3 Monitored Natural Attenuation and LUCs**.

Prior to initiation of the preferred cleanup alternative, the groundwater/surface water interface (GSI) will be investigated during the preliminary design. Additional information and details concerning the hydraulic interaction between groundwater and surface water is needed to optimize installation of the remedial actions.

The GSI investigation will be completed in two phases: Phase I will be a direct-push technology (DPT) investigation of the groundwater contamination at Site 11 and 30 and installation of nested monitoring wells. Groundwater samples from the DPT sampler and new nested monitoring wells will be used to evaluate MNA processes in groundwater flow paths prior to nearby wetlands. Based on the Phase I results, the Phase II GSI investigation will be conducted in the areas of groundwater discharge into the wetlands. The investigation will utilize recently developed tools called the Trident Probe and UltraSeep system. The two tools are used to investigate the flow patterns and the interface between the groundwater and surface water. Initially the Trident probe is used to track the water temperature and conductivity to identify areas of potential groundwater discharge to surface water. The UltraSeep is then used to monitor the groundwater discharge rate and collect samples when discharge is occurring.

Alternative GW-1: No Action

The National Oil and Hazardous Substances Pollution Contingency Plan requires that a no-action alternative be considered as a "baseline" for the evaluation of other alternatives. The no-action alternative does not include any remedial action or LUCs, and does not include groundwater monitoring. Although the previously completed FS for OU 2 included groundwater monitoring as part of the No Action Alternative, CERCLA specifically indicates that a No Action Alternative shall not include any actions. Under this alternative, no changes would be made to existing site operations and groundwater use.

The No Action Alternative is not effective at protecting human health and does not meet the proposed RAOs. Although the surficial zone of the sand gravel aquifer currently has no beneficial use, groundwater may continue to exceed ingestion criteria. Groundwater may also continue to discharge to the adjacent wetlands at concentrations exceeding Class III surface water standards, which would be detrimental to recreation use and the propagation and maintenance of a healthy population of fish and wildlife.

The groundwater No Action Alternative does not include the GSI investigation or conducting 5-year reviews because the 5-year reviews would be redundant with the estimate for the soil no action and remaining cleanup alternatives.

Alternative GW-2: LUCs and Monitoring

This alternative would include the evaluation of the groundwater to determine whether alternative GCTLs are appropriate for OU 2 groundwater. The groundwater currently is not being used and the many of the natural chemical constituents exceed the secondary drinking water standards. This may permit the groundwater to be classified as groundwater of poor quality, which would increase most GCTLs by an order of magnitude. Additionally, LUCs would be established to reduce the exposure to groundwater, which would permit the groundwater plume to be managed at the LUC boundary or surface water boundary.

If the groundwater is determined to be poor quality, default GCTLs for groundwater of low yield or poor quality would apply. Although this alternative would reduce the number of exceedances, the groundwater would still have exceedances of the default GCTLs for groundwater of low yield or poor quality. Therefore alternative GCTLs would need to be established. The establishment of alternative GCTLs is appropriate as long as groundwater does not and will not affect freshwater or marine surface water. The previously identified GSI investigation would be used to establish these criteria. In addition, at the LUC boundary groundwater would need to be compliant with GCTLs, or if appropriate, groundwater of low yield or poor quality GCTLs.

NAS Pensacola currently operates as an industrial facility and is not proposed for closure. Continued commercial/industrial status could be achieved using LUCs to limit site access and property use. The LUCs would need to specifically prohibit use of groundwater for potable purposes (drinking, washing, cooking, cleaning, and turf irrigation) and sufficiently limit occupational exposures. In the event the property is transferred and on-site contamination remains above applicable requirements, the Navy would be required to deed restrict OU 2 as a nonresidential property and restrict groundwater usage. The LUC alternative would not provide additional protection for the current use of the site but would provide long-term protection by restricting future use and access.

The groundwater LUCs alternative includes the GSI investigation and determination of alternative CTLs using a focused risk assessment. The establishment of LUCs is redundant with the soil Remedial Action Alternative and additional LUC agreements for groundwater are immaterial for the cost estimation. The groundwater LUC alternative also includes quarterly sampling of six groundwater wells to comply with Risk Management Option II Criteria until No Further Action (NFA) status is achieved. The estimated cost of the GSI investigation is $155,392 and the estimated cost of the focused risk assessment is $13,386. The annual cost of monitoring is $55,244, multiplied by an escalation factor. The long-term costs for the LUCs and Monitoring Alternative when discounted at 6 percent indicates a 30-year NPW of $1,175,293.

Alternative GW-3: Monitored Natural Attenuation and LUCs

Many COCs may decrease by natural processes, including dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials. The predominant GCTL exceedances are VOCs from Sites 11 and 30. Both oxidized and reduced VOCs are present at Site 30. Upgradient from Wetland 5A, highly oxidized chlorinated ethenes are predominant. Several of the OU 2 monitoring wells were sampled for MNA parameters in 2003. OU 2 groundwater generally exists under iron and sulfate reducing conditions and is favorable for reductive dechlorination, based on a geochemical ranking system provided in *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* .

Most of the SVOC exceedances exceeded the GCTLs by less than an order of magnitude, which means degradation may be achievable through physical means. Additionally, naphthalene and methylnaphthalene are the predominant SVOCs that exceed GCTLs, and these SVOCs are generally amenable to biodegradation. Other SVOCs, such as the pentachlorophenol exceedance in one of the wells, barely exceed the GCTL.

There are relatively few GCTL exceedances of naturally occurring metals, such as barium, cadmium, chromium, and lead, and none of these metals exceed the GCTL by more than a factor of 3. These metal exceedances may be naturally attenuated through physical means. Iron and manganese are the only other metals to exceed GCTLs. These metals are naturally occurring and may not be indicative of contamination. The high concentrations of iron and manganese may indicate that there are strong reducing conditions in the groundwater near Sites 11 and 30, which will be favorable for chlorinated ethane reduction and chromium reduction.

The MNA and LUC alternative would not provide additional protection for the current use of the site, but would provide long-term protection by restricting future use and access. Until the RAOs are obtained, LUCs as specified in Alternative GW-2 would need to be in place to specifically restrict potable water groundwater use and sufficiently limit occupational exposures. The remedial performance would be evaluated annually to measure the progress toward the RAOs, and the LUCs would remain in place until the RAOs are achieved. The GSI investigation previously detailed in "Groundwater Cleanup Alternatives" would be used to determine if groundwater is contributing to surface water and sediment contamination in adjacent wetlands and also be used to select points of compliance for groundwater and surface water long-term monitoring. The MNA alternative would require completion of a monitoring plan proposing source area and point of compliance monitoring locations as well as monitoring frequency. The monitoring would continue until the GCTLs have been reached for the required number of monitoring events and NFA status is achieved. In addition, the remedial performance would be evaluated annually to measure the progress toward the RAO.

The MNA alternative includes the GSI investigation and installation of additional point of compliance monitoring wells. The establishment of LUCs is redundant with the soil Remedial Action Alternative and additional LUC agreements for groundwater, as specified in Alternative GW-2, are immaterial for the cost estimation. The estimated cost of the GSI investigation is $155,392 and the estimated cost of the additional point of compliance wells is $15,035. The annual cost of MNA sampling is $22,999, multiplied by an escalation factor. The long-term costs for the groundwater MNA when discounted at 6 percent indicates a 30-year NPW of $1,598,950.

Alternative GW-4: Riparian Corridors and LUCs

Riparian corridors are a type of phytoremediation. In a groundwater remedy, phytoremediation is typically applied as a riparian corridor and/or used for hydraulic control. These two applications are summarized as follows:

- *Hydraulic control* is the use of plants to remove groundwater through uptake and consumption in order to contain or control the migration of contaminants.
- *Riparian corridors/buffer strips* are generally applied along streams and river banks to control and remediate surface water runoff and groundwater contamination moving into the river. They may incorporate certain aspects of hydraulic control, phytodegradation, rhizodegradation, phytovolatilization, and perhaps phytoextraction.

Because the rooting depths of most crops are 1 to 4 feet, groundwater remedies predominantly use trees, which have deeper root penetration. Trees have been shown capable of remediating groundwater with water table depths of less than 30 feet. Riparian corridors are constructed by planting certain fast growing trees, including cottonwoods and poplars, in closely-spaced trenched rows. Typically, the riparian corridor consists of a triple row of trees and has a minimum width of 30 feet. The riparian corridor would be constructed by planting approximately 1,674 whip trees and installing an irrigation system. In addition, ten 2-inch monitoring wells would be installed to facilitate performance monitoring.

The riparian corridor and LUC alternative would not directly address groundwater exceedances in the industrial, developed areas of OU 2. In these areas, groundwater contamination would be permitted to naturally attenuate. Riparian corridors would be planted along the banks of the adjacent wetlands near Sites 11 and 30. The intended purpose of the riparian corridors would be to protect the surface water receptors by treating and removing groundwater contamination and by potentially limiting the infiltration of groundwater into surface water by transpiring the groundwater into the trees.

The riparian corridors and LUCs alternative includes post-active remediation monitoring, including monitoring one downgradient well, and one well in the area(s) of highest groundwater contamination. The monitoring activities would be completed quarterly or at approved intervals and samples would be analyzed for contaminants present before the start of active remediation. Using this standard, six monitoring wells are selected as candidates for long-term monitoring. The candidate monitoring wells were selected based on the groundwater CTL exceedances for metals, SVOCs and VOCs. Long-term monitoring would be conducted for 30 years.

Riparian corridors are not immediately effective. Although poplars are fast growing trees, they would probably take a year to become established. Thus, the riparian corridor alternative effectiveness increases with time. Many of the trees, however, will not reach maturity due to overcrowding, competition, and disease. Young trees may also be prone to damage by animals. Poplar trees also have a relatively short lifespan of approximately 20 years. Therefore, until the RAOs are obtained, LUCs as specified in Alternative GW-2 would need to be in place to specifically restrict potable water groundwater use and sufficiently limit occupational exposures. The remedial performance would be evaluated annually to measure the progress toward the RAOs, and the LUCs would remain in place until the RAOs are achieved. Because the riparian corridors would be constructed adjacent to surface water receptors, the short term exposure to site workers would be limited.

The riparian corridors alternative includes the GSI investigation and performance monitoring for 30 years. The establishment of LUCs is redundant with the soil Remedial Action Alternative and additional LUC agreements for groundwater, as specified

in Alternative GW-2, are immaterial for the cost estimation. The first year cost of the riparian corridors alternative is $413,731 which includes the GSI investigation; the design, construction, first year operation, and performance sampling; and the long-term groundwater sampling. Performance sampling could continue for 30 years. The long-term costs for the Riparian Corridors Alternative when discounted at 6 precent indicates a 30-year NPW of $2,061,272.

Alternative GW-5: Permeable Reactive Barrier, Riparian Corridors, and LUCs

Although riparian corridors would be protective of adjacent surface waters, they would not be applied to meet GCTLs away from the adjacent wetlands. In Alternative GW-5, Permeable Reactive Barriers (PRBs) are added as a complementary component of Alternative GW-4, which treats the chlorinated solvent plume extending from the southeast corner of the Building 649 Complex. Thus, Alternative GW-5 includes all of the components of Alternative GW-4, plus the construction of a PRB.

Zero-valent iron (ZVI) PRBs are typically applied to remediate dilute plumes of chlorinated solvents, or other oxidized contaminants, and are not typically used for source zone treatment. As chlorinated solvents interact with the PRB, the ZVI serves to reduce the reductive dechlorination of the chlorinated solvents, which oxidizes the iron. In use of this method, TCE degrades to DCE isomers, which may then degrade to vinyl chloride and ethene.

PRBs are frequently constructed as funnel-and-gate systems, where impermeable funnels direct groundwater through reactive ZVI permeable gates. When properly designed, the impermeable funnels increase the groundwater head and direct groundwater through the permeable gates at an increased velocity. Although this configuration can reduce the material costs for PRB construction, it is probably not appropriate at OU 2. Without a competent aquitard below the contaminated groundwater, the impermeable funnels would not direct groundwater through the PRB gates. Given the high hydraulic conductivity of the formation, the construction of a sufficiently porous PRB would be difficult. Because of these constraints, the PRB would probably need to be constructed across the entire downgradient edge of contaminated zone and be connected into the underlying confining zone.

Although PRBs are effective at reducing the concentrations of many of the COCs, they produce undesirable groundwater quality immediately downgradient of the PRB. The undesirable effects include increased pH, decreased dissolved oxygen, and ferrous iron leaching. Although these effects are generally limited to the groundwater immediately downgradient of the PRB, the aquifer resiliency is highly site-specific.

The construction of a PRB and riparian corridors alternative would provide an additional level of effectiveness compared to the riparian corridors alone. The PRB have an immediate effect on treating passing groundwater and therefore reduce the human health exposure potential and provide an additional level of protection for the surface waters.

Although the construction of the PRB would result in a short-term risk to site construction workers, this risk would be minimized through the use of proper personal protective equipment.

The PRB and riparian corridors alternative includes the GSI investigation and performance monitoring for 30 years. Also, until the RAOs are obtained, LUCs as specified in Alternative GW-2 would need to be in place to specifically restrict potable water groundwater use and sufficiently limit occupational exposures. The remedial performance would be evaluated annually to measure the progress toward the RAOs, and the LUCs would remain in place until the RAOs are achieved. The establishment of LUCs is redundant with the soil Remedial Action Alternative and additional LUC agreements for groundwater are immaterial for the cost estimation. The first year cost of the PRB and riparian corridors alternative is $2,816,423, which includes the GSI investigation; the design, construction, first year operation, and performance sampling of the PRB and riparian corridors; and the long-term groundwater sampling. Performance sampling could continue for 30 years. The long-term costs for the PRB and Riparian Corridors Alternative when discounted at 6 percent indicates a 30-year NPW of $4,929,829.

Alternative GW-6: Groundwater Pumping, Discharge to Federally Owned Treatment Works, and LUCs

Alternatives GW-6 and GW-7 differ only in the groundwater disposal option. In Alternative GW-6, groundwater is discharged directly to the Federally Owned Treatment Works (FOTW), whereas in Alternative GW-7, groundwater is treated and discharged to the adjacent wetlands.

Groundwater pumping is a conventional method for containment or removal of contaminated groundwater from a site. Extraction wells are installed near contaminant hotspots to remove groundwater contamination. Pumping also has the capability of hydraulically containing groundwater contamination, which may prevent the seepage of contaminated groundwater into adjacent surface waters. Extracted groundwater is then treated and disposed.

The extraction well network would consist of 13 extraction wells, constructed to 25 feet bls, on the downgradient perimeter of OU 2 to address groundwater discharging to surface water, and 3 extraction wells, constructed to 25 feet bls, to treat the VOC source area in the Building 649 Complex. Extraction wells would be spaced at an approximate 200-foot interval, which is estimated to hydraulically contain groundwater.

For More Detailed Information

To help the public understand and comment on the preferred cleanup alternative for the site, this document summarizes a number of reports and studies. The technical and public information documents prepared to date for the site are available at the following **Information Repository**:

John C. Pace Library
University of West Florida
11000 University Parkway
Building 32
Pensacola, Florida
M-F: 8 a.m. to 5 p.m.

The groundwater pumping alternative is immediately effective in containment and removal of contamination and, therefore, protective of human health. The proposed extraction wells adjacent to the wetlands would prevent contaminated groundwater from discharging to the wetlands and are thus protective of Class III surface water. In addition, the performance of remedial systems that leave contamination on site will be evaluated at least annually to measure progress toward the RAO. This evaluation would include the spatial and temporal analyses of groundwater data to assess whether there are increasing, decreasing, or stationary trends in the concentrations of groundwater contaminants. This evaluation would be used to recommend continuation, increases, or decreases in the number of samples and types of analyses required to reevaluate the groundwater pumping alternative in subsequent 5-year reviews. Because 5-year reviews are considered in the media-specific Remedial Action Alternatives for soil, they are not estimated here. In addition, until the RAOs are obtained, LUCs as specified in Alternative GW-2 would need to be in place to specifically restrict potable water groundwater use and sufficiently limit occupational exposures. The remedial performance would be evaluated annually to measure the progress toward the RAOs, and the LUCs would remain in place until the RAOs are achieved.

However, it should be noted that the Navy is predisposed against the installation of new groundwater pumping systems. The predisposition is because the groundwater pumping remedies are typically long-term remedies that have trouble meeting the RAOs and are rarely optimized for maximum performance. Although this does not preclude the application of the remedy it increases the burden for its implementation.

The Groundwater Pumping and Discharge to a FOTW alternative includes the GSI investigation. The first year cost of the Groundwater Pumping and Discharge to a FOTW alternative is $1,153,716 which includes the GSI investigation, O&M, compliance sampling, and the long-term groundwater sampling. The O&M, compliance sampling and long-term monitoring could continue for 30 years. The long-term costs for the Groundwater Pumping and Discharge to a FOTW Alternative when discounted at 6 percent indicates a 30-year NPW of $3,501,880.

Alternative GW-7: Groundwater Pumping, Treatment, and Discharge to Wetlands

The groundwater pumping scenario in Alternative GW-7 is identical to Alternative GW-6, and is not repeated in this section. Alternative GW-7 differs in the disposal option for the extracted groundwater. Because the extracted groundwater may exceed the quality and quantity criteria for the FOTW, an independent treatment and disposal option is developed. Extracted groundwater would be primarily contaminated with VOCs, but may also need treatment for SVOC and metal exceedances. The treatment scenario developed in this alternative includes air stripping as primary treatment and granulated activated carbon (GAC) adsorption as secondary treatment. Air stripping is a conventional method for removing chlorinated solvents and benzene, toluene, ethylbenzene, and xylene (BTEX) from extracted groundwater. Air stripping may also have limited effectiveness for SVOCs and metals treatment, possibly through scaling processes. However, liquid-phase GAC adsorption would be required as secondary treatment to remove residual SVOCs, VOCs, and metals from the waste stream. After primary treatment, extracted groundwater would be routed through sequential GAC adsorption canisters and the water quality would be measured from a sample port in between the GAC canisters. After primary and secondary treatment, the treated groundwater would be discharged to the adjacent wetlands.

The groundwater pumping alternative is immediately effective in containment and removal of contamination and therefore protective of human health. The proposed extraction wells adjacent to the wetlands would prevent contaminated groundwater from discharging to the wetlands and are thus protective of Class III surface water. In addition, discharging the extracted and treated groundwater to the wetland would help maintain the existing water balance.

The performance of remedial systems that leave contamination on site will be evaluated at least annually to measure progress toward the remedial action objective. This evaluation would include the spatial and temporal analyses of groundwater data to assess whether there are increasing, decreasing, or stationary trends in the concentrations of groundwater contaminants. This evaluation would be used to recommend continuation, increases, or decreases in the number of samples and types of analyses required to reevaluate the groundwater pumping alternative in subsequent 5-year reviews. Because 5-year reviews are considered in the media-specific Remedial Action Alternatives for soil, they are not estimated here. In addition, until the RAOs are obtained, LUCs as specified in Alternative GW-2 would need to be in place to specifically restrict potable water groundwater use and sufficiently limit occupational exposures. The remedial performance would be evaluated annually to measure the progress toward the RAOs, and the LUCs would remain in place until the RAOs are achieved.

The Groundwater Pumping and Discharge to Wetlands alternative includes the GSI investigation. The first year cost of the Groundwater Pumping and Discharge to Wetlands alternative is $2,521,620, which includes the GSI investigation, the design, construction, O&M, compliance sampling and the long-term groundwater sampling. The O&M, compliance sampling and long-term monitoring would continue for 30 years. The long-term costs for the Groundwater Pumping and Discharge to Wetlands Alternative when discounted at 6 percent indicates a 30-year NPW of $12,683,467.

Evaluation of Cleanup Alternatives

Nine criteria were used to evaluate the different remediation alternatives individually against each other in order to select a remedy. The relative performance of each alternative against the nine criteria has been evaluated. How each alternative compares to the other options under consideration has also been examined. The nine evaluation criteria are discussed below. The comparison of the evaluation criteria for each of the soil and groundwater remedial alternatives is provided in Tables 1 and 2, respectively.

The Evaluation Criteria used for evaluation of the various cleanup alternatives are:

Overall Protection of Human Health and the Environment – determines whether an alternative eliminates, reduces or

controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) – evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

Long-term Effectiveness and Permanence – considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment – evaluates an alternative's use of treatment to reduce harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness – considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Implementability – considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost – includes estimated capital and annual O&M costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 percent to -30 percent.

State / Support Agency Acceptance – considers whether the state agrees with the Navy's analyses and recommendations, as described in the RI, the FS, and this Proposed Plan.

Community Acceptance – Following the public comment period, this criteria considers whether the local community agrees with the Navy's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Preferred Alternative

The following alternatives have been selected as "preferred" for soil and groundwater. The Navy believes these alternatives will adequately protect human health and the environment, attain all federal and state requirements (including ARARs), and are cost effective, implementable, and effective.

The USEPA and FDEP are expected to concur with the recommended alternatives. However, the Navy, in consultation with the USEPA and FDEP, will not select a final alternative until public comment has been considered.

Soil: Alternative S-5: Excavation and Offsite Disposal with LUCs is the Navy's preferred method of cleanup for soil. This alternative was selected because it is protective of human health and the environment, compliant with ARARs and has long-term effectiveness and permanence. The excavation and offsite disposal could be quickly completed and is very feasible to complete; however, it also has the highest cost of any of the remedial alternatives.

Groundwater: Alternative GW-3: Monitored Natural Attenuation and LUCs is the Navy's preferred method of cleanup for groundwater. This alternative allows natural processes to treat and remediate the groundwater as it is monitored to make sure there is no additional threat to human health or the environment. There is currently no significant risk because the exposure pathway is not complete. Potable water for NAS Pensacola is provided by Corry Station, approximately 4 miles from the facility. If the preferred alternative for soil, Alternative S-5 Excavation and Offsite Disposal, is completed and contaminated soil is removed, a potential future impact to groundwater would be eliminated.

This remedy was selected for the following reasons:

- Except for the areas identified for removal, detected concentrations remaining in soil do not present an unacceptable threat to human health or the environment assuming that only nonresidential uses are permitted. Surface soil areas identified as exceeding SCTLs will be removed and replaced with clean fill to prevent unacceptable exposure.
- Although contamination is present in groundwater at concentrations greater than FDEP GCTLs, detected concentrations are relatively low and do not present an unacceptable threat to human health or the environment under the groundwater use restrictions to be implemented as part of the selected remedy.
- The contaminant plume is small and stable and confined to the shallow aquifer, and there is no evidence of ongoing contaminant migration.

Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after the initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

Community Participation

The Navy, as the lead agency, is accepting formal public comments on this proposal from May 12, 2008 to June 25, 2008. You don't have to be a technical expert to comment. If you have a comment, the Navy wants to hear it before beginning the cleanup. To comment formally:

Send written comments postmarked no later than June 25,2008 to:

Mr. Greg Campbell
Remedial Project Manager
Naval Air Station Pensacola
Code 2200, 310 John Tower Road
Pensacola, Florida 32508-5000
Fax: (850) 452-5136

E-mail comments by June 25, 2008 to:

gregory.campbell@navy.mil

If requested a public meeting will be held. The Navy will review comments received at the meeting and written comments received during the comment period before making a final cleanup decision. Written comments will be included in the Responsiveness Summary contained in the Record of Decision for OU 2.

For More Detailed Information

To help the public understand and comment on the preferred cleanup alternative for this site, this document summarizes a number of reports and studies. The technical and public information documents prepared to date for the sites are available at the following **Information Repository**:

John C. Pace Library
University of West Florida
11000 University Parkway
Building 32
Pensacola, Florida

Glossary of Terms

Applicable or Relevant and Appropriate Requirements (ARARs): The federal, state, and local environmental rules, regulations, and criteria that must be met by the selected cleanup action under CERCLA.

Chemicals of Concern (COCs): A substance detected at a level and/or in a location where it could have an adverse effect on human health and the environment.

Chemicals of Potential Concern (COPCs): A substance detected at a level and/or location that was determined during the RI to possibly have the potential for adverse effects on human health and the environment.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A Federal law also known as "Superfund." This law was passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). This law created a special tax that goes into a trust fund to investigate and cleanup abandoned or uncontrolled hazardous waste sites. However, Federal facilities are funded separately.

Ecological Risk Assessment (ERA): An evaluation of current and future potential for adverse environmental effects from exposure to site contaminants.

Feasibility Study (FS): A report that presents the development, analysis, and comparison of cleanup alternatives.

Groundwater Cleanup Target Levels (GCTLs): Groundwater quality levels established by the Florida Administrative Code. Contaminant levels exceeding these values must be reduced to below these values.

Human Health Risk Assessment (HHRA): An evaluation of current and future potential for adverse human health effects from exposure to site contaminants.

Information Repository: The public location for community access of documents regarding the installation cleanup activities. The NAS Pensacola information repository is located at the NAS Pensacola Library, Building 634, Naval Air Station Pensacola, Pensacola, Florida.

Institutional Controls: Administrative measures taken to restrict site access, current land use or future development, or groundwater use. Typical institutional controls consist of deed restrictions.

Monitored Natural Attenuation (MNA): A cleanup technique, which relies on the natural breakdown of groundwater contamination to significantly reduce the levels of contaminants in soil or groundwater.

National Priorities List (NPL): The list of select national CERCLA sites.

Preliminary Remedial Goal (PRG): An acceptable level of contaminants based on environmental regulatory guidelines.

Remedial Action Alternative: Any of the many different combinations of plans to restrict access and to contain, remove, or treat contamination in order to protect human health and the environment These may be No Action, Engineering and/or Institutional Controls, Treatment, or Excavation and Offsite Disposal.

Remedial Action Objective (RAO): A cleanup objective agreed upon by the NAS Pensacola Partnering Team. One or more RAOs are typically formulated for each environmental site.

Remedial Investigation (RI): A report that describes the site, documents the type and location of environmental contaminants, and presents the results of the risk assessment.

Soil Cleanup Target Levels (SCTLs): These are regulatory levels established to guide cleanups for sites in Florida.

Volatile Organic Compounds (VOCs): Organic compounds that evaporate readily at normal air temperatures. Typical VOCs include the light fraction of gasoline (benzene, toluene, xylenes) and low molecular weight solvents, such as trichloroethylene.

Use This Space to Write Your Comments or to Be Added to the Mailing List

Please use this form for your written comments and mail to the address below. Your comments must be postmarked no later than June 25, 2008.

Mr. Greg Campbell
Remedial Project Manager
Naval Air Station Pensacola
Code 2200
310 John Tower Road
Pensacola, Florida 32508-5000
email: Gregory.Campbell@navy.milll

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(Attach additional sheets as needed.)

Comment submitted by: _____

Mailing List Additions, Deletions, or Changes

I would like to:

- ☐ be added to the site mailing list.
- ☐ note a change of address.
- ☐ be deleted from the mailing list.
- ☐ obtain additional information concerning the Restoration Advisory Board.

Name: _____

Address: _____

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_____

Please check the appropriate box and fill in the correct address information above.

Fold, staple, stamp, and mail

Place
Stamp
Here

MR. GREG CAMPBELL
REMEDIAL PROJECT MANAGER
NAVAL AIR STATION PENSACOLA
CODE 2200
310 JOHN TOWER ROAD
PENSACOLA, FLORIDA 32508-5000