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NAS CECIL FIELD, FL
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WORK PLAN FOR UNDERGROUND STORAGE TANK INVESTIGATIONS AT SOUTH FUEL FARM AND OTHER SITES NAS CECIL FIELD FL

7/1/2002

TETRA TECH NUS INC

Work Plan
for
UST Investigations at South Fuel Farm and Other Sites

Naval Air Station Cecil Field
Jacksonville, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0248

July 2002

WORK PLAN
FOR
UST INVESTIGATIONS AT
SOUTH FUEL FARM AND OTHER SITES

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Naval Facilities Engineering Command
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JULY 2002

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ACRONYMS

ABB-ES	ABB Environmental Services
APHA	American Public Health Association
AST	Aboveground Storage Tank
AS/VE	Air Sparge/Vapor Extraction
AWWA	American Water Works Association
BCT	Base Closure Team
BEI	Bechtel Environmental Services, Inc.
bls	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
°C	Degrees Celsius
CAR	Contamination Assessment Report
CCI	CH2M Hill Constructors, Inc.
cfm	Cubic Feet per Minute
CO_2	Carbon Dioxide
COCs	Contaminants of Concern
CompQAP	Comprehensive Quality Assurance Plan
CTO	Contract Task Order
DPT	Direct Push Technology
DT1	Day Tank 1
EMT	Earth-Mounded Tank
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FE^{+2}	Ferrous Iron
FID	Flame Ionization Detector
FL-PRO	Florida Petroleum Range Organics
FOL	Field Operations Leader
ft	Foot/Feet
ft^2	Square Feet/Foot
GAG	Gasoline Analytical Group
GCTL	Groundwater Cleanup Target Level
GWMR	Groundwater Monitoring Report
H_2SO_4	Sulfuric Acid
HCl	Hydrochloric Acid
HDPE	High Density Polyethylene
HLA	Harding Lawson Associates

ACRONYMS (Continued)

ID	Inside Diameter
IDW	Investigative Derived Waste
JAA	Jacksonville Airport Authority
JAJ	J.A. Jones Environmental Services
JP-5	Jet Propellant 5
KAG	Kerosene Analytical Group
µg/L	Micrograms per Liter
MB	Main Base Open Area
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MIP	Membrane Interface Probe
ml	Milliliter
MOP	Monitoring Only Plan
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MTBE	Methyl-Tert-Butyl Ether
mV	Millivolts
NADSC	Natural Attenuation Default Source Concentration
NAS	Naval Air Station
Navy	United States Navy
NFF	North Fuel Farm
NSAP	North-South Apron Plume
O&M	Operation and Maintenance
ORP	Oxidation-Reduction Potential
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbon
ppb	Parts per Billion
ppm	Parts per Million
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RAC	Remedial Action Contractor
RAP	Remedial Action Plan
ROI	Radius of Influence
RSK	Robert S. Kerr Environmental Research Laboratory
SAR	Site Assessment Report

ACRONYMS (Continued)

SO_4^{-2}	Sulfate
SOPs	Standard Operating Procedure
SFF	South Fuel Farm
SM	Standard Method
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SOW	Statement of Work
TBEC	Total Bacterial Enumeration Count
TOC	Top-Of-Casing
TOM	Task Order Manager
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOA	Volatile Organic Analyte
VOCs	Volatile Organic Compounds
VOHs	Volatile Organic Hydrocarbons
WEF	Water Environment Federation

1.0 INTRODUCTION

Tetra Tech NUS, Inc. (TtNUS) has prepared this work plan for various sites at the Naval Air Station (NAS) Cecil Field, Jacksonville, Florida, in accordance with Statement of Work (SOW) Number 266 and Revision 1 dated 19 February 2002, and SOW Number 266, Revision 1 Addendum dated 8 April 2002. This work plan was prepared for the United States Navy (Navy) Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) under Contract Task Order (CTO) 0248, for the Comprehensive Long-term Environmental Action Navy III Contract Number N62467-94-D-0888.

This work plan will address the field activities associated with the installation of additional monitoring wells at the Truck Stand; North-South Apron Plume (NSAP); and Building 46, Tanks 46R, 46D, 46SUL, and 46UL (hereafter referred to as Site 46). In addition, this plan will address the field activities required to evaluate the performance of the remedial system at the South Fuel Farm (SFF), and a proposed soil investigation at Day Tank 1 (DT1) to delineate excessively contaminated soil remaining at that site.

1.1 OBJECTIVES

1.1.1 Truck Stand

Recent groundwater monitoring at the truck stand indicates groundwater contamination is confined to a single shallow monitoring well on site. However, the North Fuel Farm (an adjacent site undergoing a site assessment due to recent source removal activities), may have also had an impact on the Truck Stand. Though the shallow zone contamination at the Truck Stand is delineated to one well, it is the intent of the proposed field investigation at the Truck Stand to determine if groundwater is adversely impacted at the next intermediate depth at the site. Also, the investigation would determine if the contamination at depth possibly originates from the adjacent site – the NFF. The data collected during the investigation will be used to prepare a brief letter report detailing the results of the well installation and laboratory analytical results. In addition, conclusions and recommendations will be presented to the Navy regarding the future courses of action for the site, which may include preparation of a Remedial Action Plan (RAP).

1.1.2 NSAP

The proposed field investigation at the NSAP follows a recent recommendation in the Fourth Quarter/First Annual Groundwater Monitoring Report (GWMR) (TtNUS, 2002) for a supplemental assessment. Since milestone objectives for natural attenuation of contaminants of concern (COCs) did not occur, the report offered three recommendations with adequate justification for conducting the first recommendation - a supplemental site assessment. Due to the extent of the plume [approximately 400 feet (ft) long], the work

is proposed to be conducted in two phases. The first phase will consist of direct push technology (DPT) groundwater sampling as recommended in the Annual GWMR (TtNUS, 2002). The second phase will be the installation of monitoring wells to confirm the DPT results. Following sampling and receipt of analytical data from the new wells, TtNUS will file a letter report to the Navy with our evaluation and recommendations for future courses of action at the site, which may include preparation of a RAP.

1.1.3 Site 46

Site 46 is currently under active remediation for highly contaminated soil and groundwater in the source area using an air sparge, vapor extraction (AS/VE) system combined with PHOSter technology and monitored natural attenuation of the downgradient groundwater plume. During monitoring of the groundwater plume, COCs were detected downgradient of the source area in an intermediate monitoring well. The concentrations of COCs exceeded the Florida Department of Environmental Protection's (FDEPs) Groundwater Cleanup Target Levels (GCTLs) and Natural Attenuation Default Source Concentrations (NADSCs). An abbreviated investigation using DPT coupled with Membrane Interface Probe (MIP) technology was conducted at the site to determine the extent of the contamination downgradient of that well. This investigation proposes to install several wells in the intermediate and deep zones, based on the DPT/MIP information, and sample those wells for applicable laboratory analyses. The results of the investigation will be used to prepare a letter report to the Navy with TtNUS's evaluation and recommendations.

1.1.4 South Fuel Farm

The SFF is also currently undergoing active remediation using a combination of bioventing to address soil contamination and biosparging to address groundwater contamination. The system has not effectively reduced the concentrations of COCs in the soil or groundwater. The objective of this investigation is to determine what design modifications are necessary to improve the system performance and achieve site cleanup. The investigation will be conducted in three phases: review site data, evaluate the system in the field, and conduct soil and groundwater sampling activities. The data will be used to prepare a RAP Addendum with suggested improvements to the site's remediation system.

1.1.5 Day Tank 1

In accordance with the May 2002 Base Closure Team (BCT) meeting, TtNUS has been directed to reaffirm the limits of soil contamination at the DT1 site. A source removal was accomplished to address the worst of the soil and groundwater contamination, and the site is undergoing active remediation. While the groundwater is currently undergoing additional assessment activities under the Installation Restoration program due to a possible co-mingling with a different contamination plume downgradient of

the site, there remains some suspected soil contamination outside the perimeter of the former source removal and active system. This soil investigation will be accomplished using a combination of soil vapor screening and confirmatory soil laboratory analyses. The data will be used to determine the limits of excavation for another source removal. Appendix A contains a copy of the presentation to the May 2002 BCT that prompted this investigation.

2.0 SITE LOCATION

NAS Cecil Field is located in southwest Duval County and partially in Clay County. The air base, operated by the Navy from approximately 1943 to 1999, consists of two primary areas – the Main Base Area and Yellow Water Weapons Range (Figure 2-1). The various sites concerned under this CTO are located within the Main Base Area. Since 1999, the City of Jacksonville and the Jacksonville Airport Authority (JAA) have taken over operation of the former air base and worked toward its reuse and redevelopment.

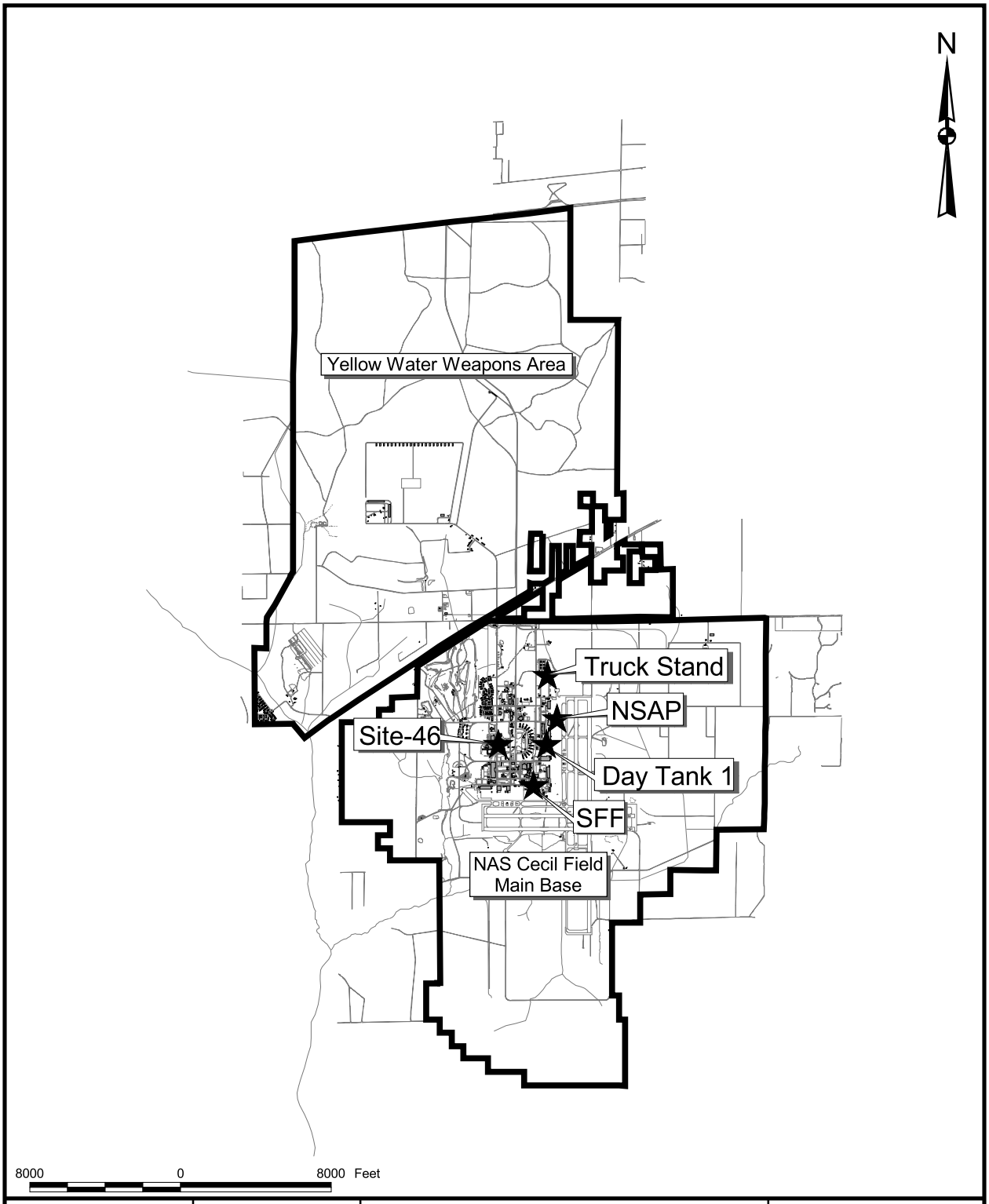
The Truck Stand site is located near the bend in Loop Road and approximately 500 ft east of one of the main roads to NAS Cecil Field – Aviation Avenue (formerly A Avenue) (Figure 2-2). The site's above-grade structures have been removed and the site is both paved and non-paved, grassy areas.

The NSAP site is located on the north-south flightline, east of Building 815, on the eastern edge of the apron (Figure 2-3). This site extends from the apron and under Taxiways D and A. The downgradient extent of the groundwater plume appears to stop before the north-south runways. Part of the site is under concrete and part of it is in a grass median between the taxiways. There are no above-grade structures at the site.

Site 46 was located on the east side of New World Avenue (former D Avenue) between Building 902 and 904 (former base housing) and opposite the former medical clinic (Building 808) (Figure 2-4). The above-grade structures associated with the site have been removed. The groundwater plume associated with the site now extends southwest and crosses New World Avenue. Most of the site east of New World Avenue is under pavement while the portion west of New World Avenue is partially paved and non-paved, grassy areas.

The SFF is located immediately south of the intersection of Crossover Street (formerly 2nd Street) and Aviation Avenue (Figure 2-5). Most of the site is between Crossover Street and the flightline boundary fence with a small portion south of the fence line. Principally, the site is a non-paved, grassy area, but some of the northern portion of the site is paved. The above-grade structures associated with the site have been removed.

DT1 is located east of Jet Road and north of Buildings 824 and 824A. A site location map of the facility is presented on Figure 2-6. The site's original structures were removed during the source removal except for the containment area on the north side of the site. The site is currently partially grass and partially paved with asphalt.



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

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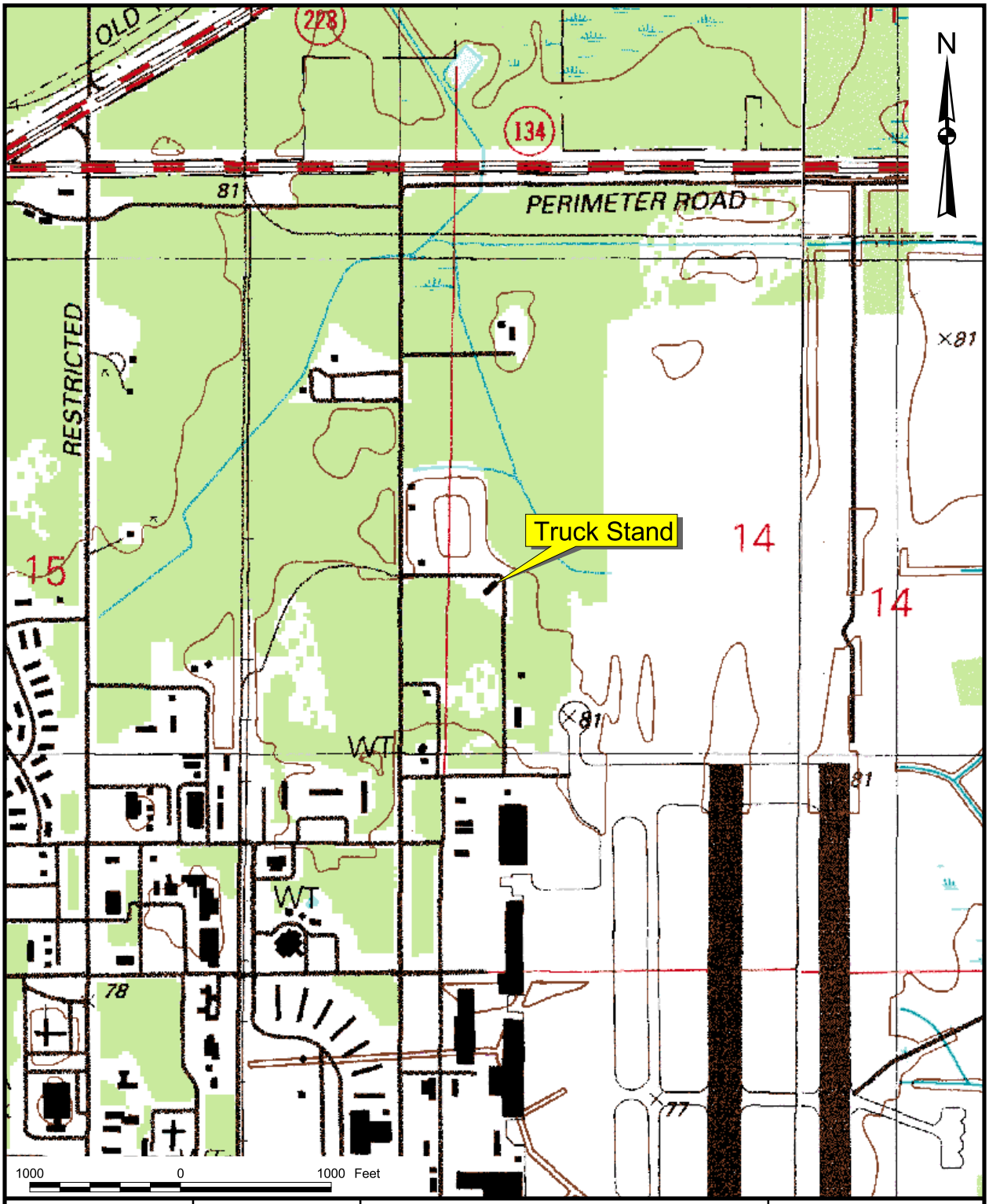

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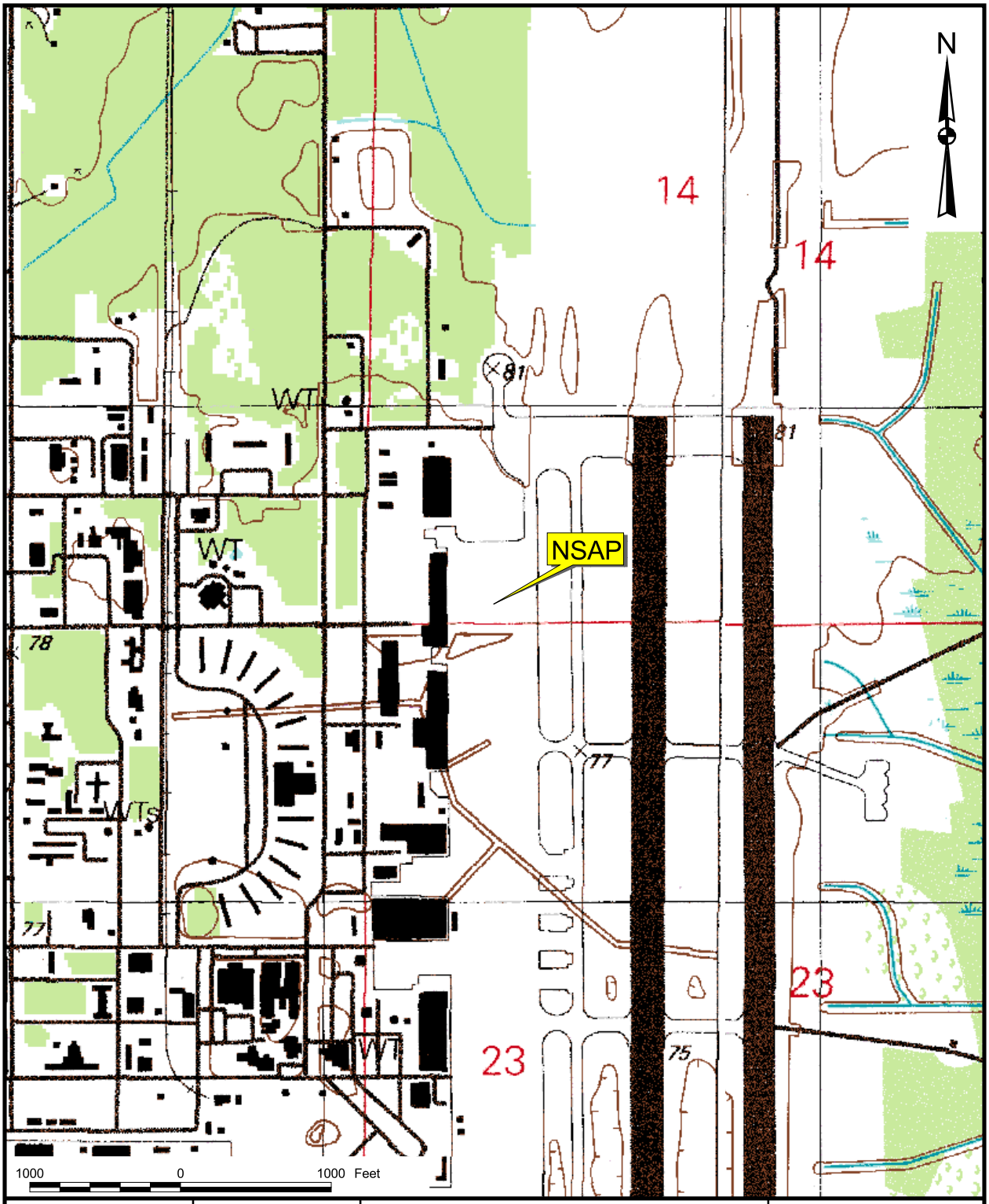

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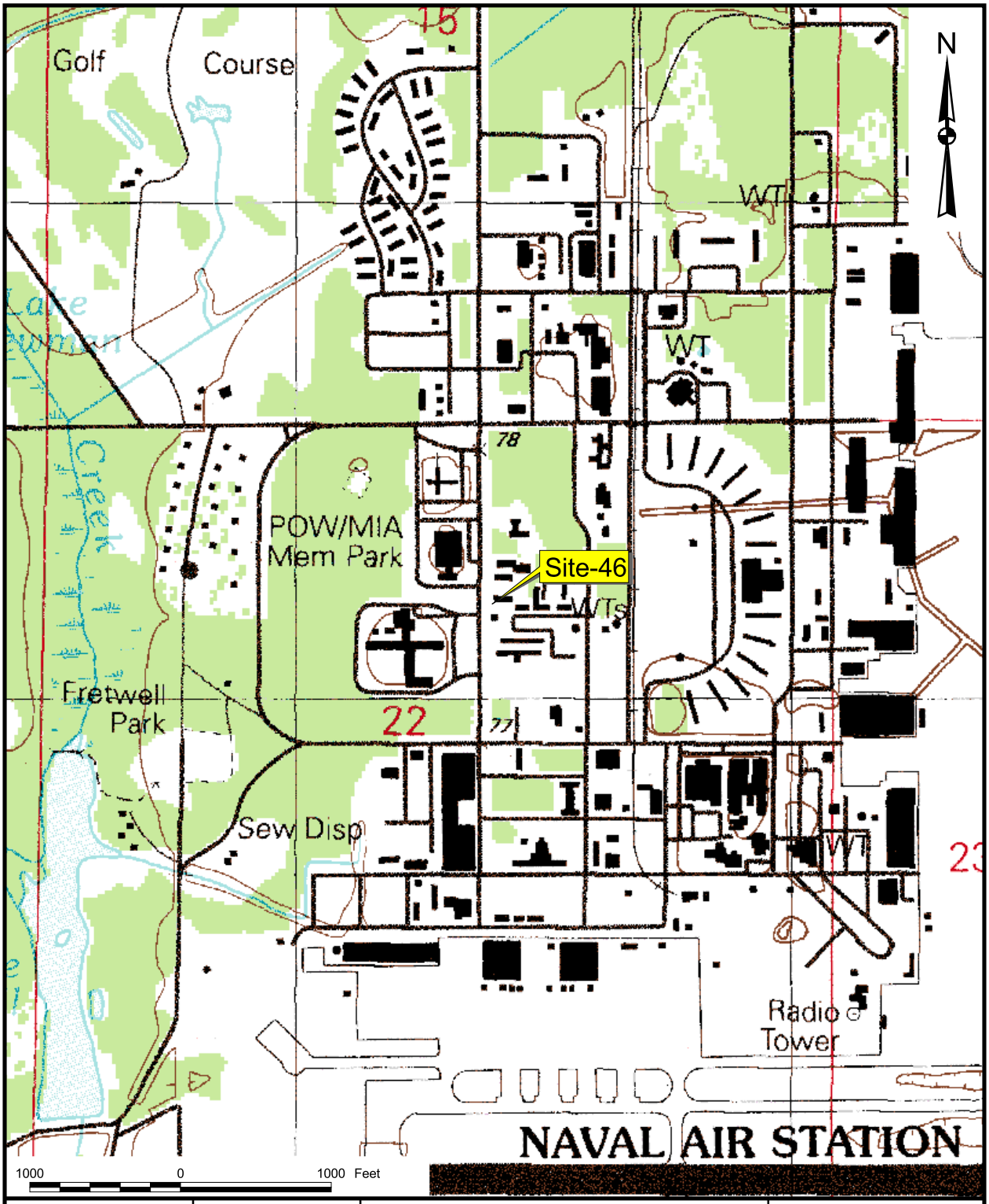

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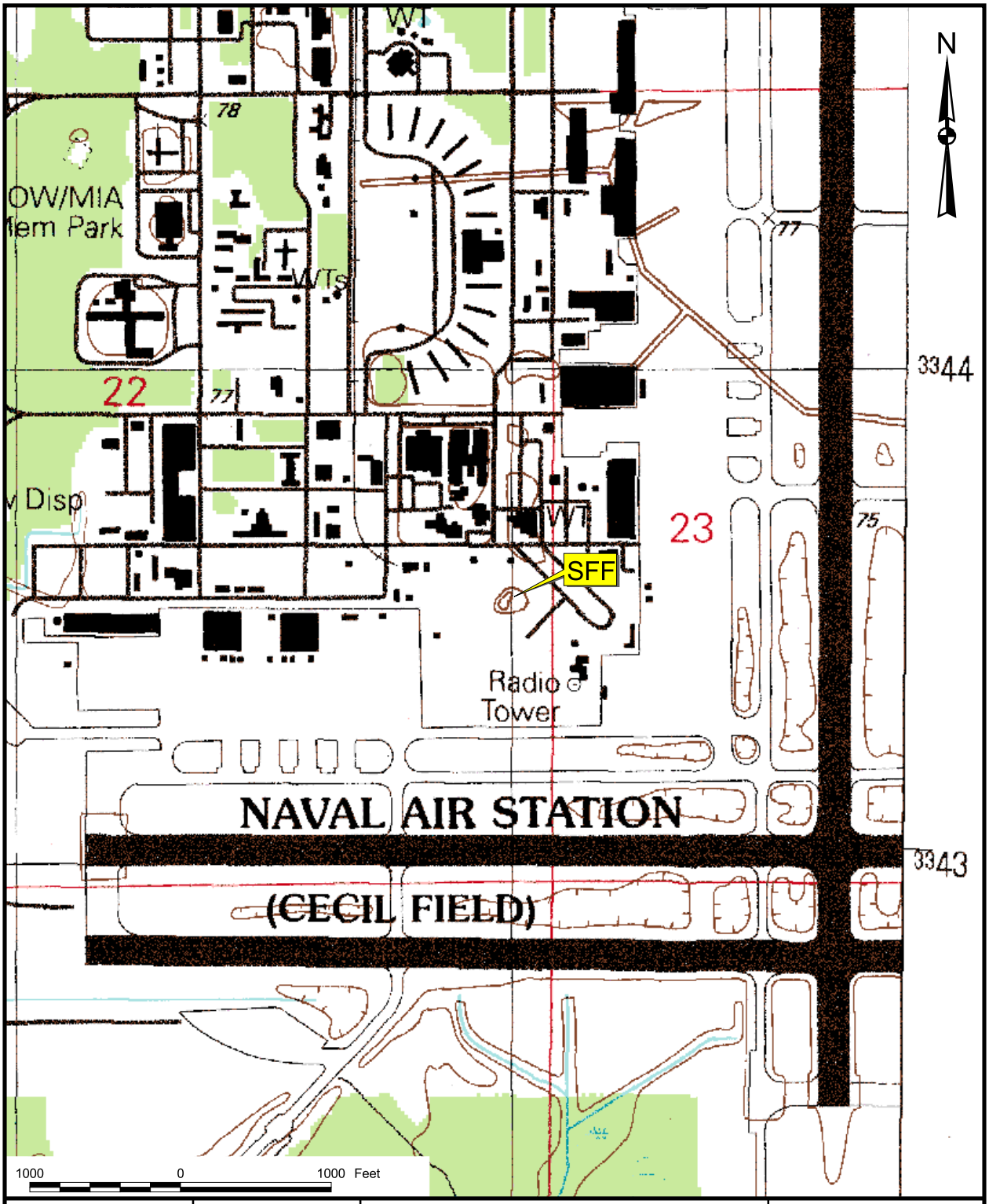

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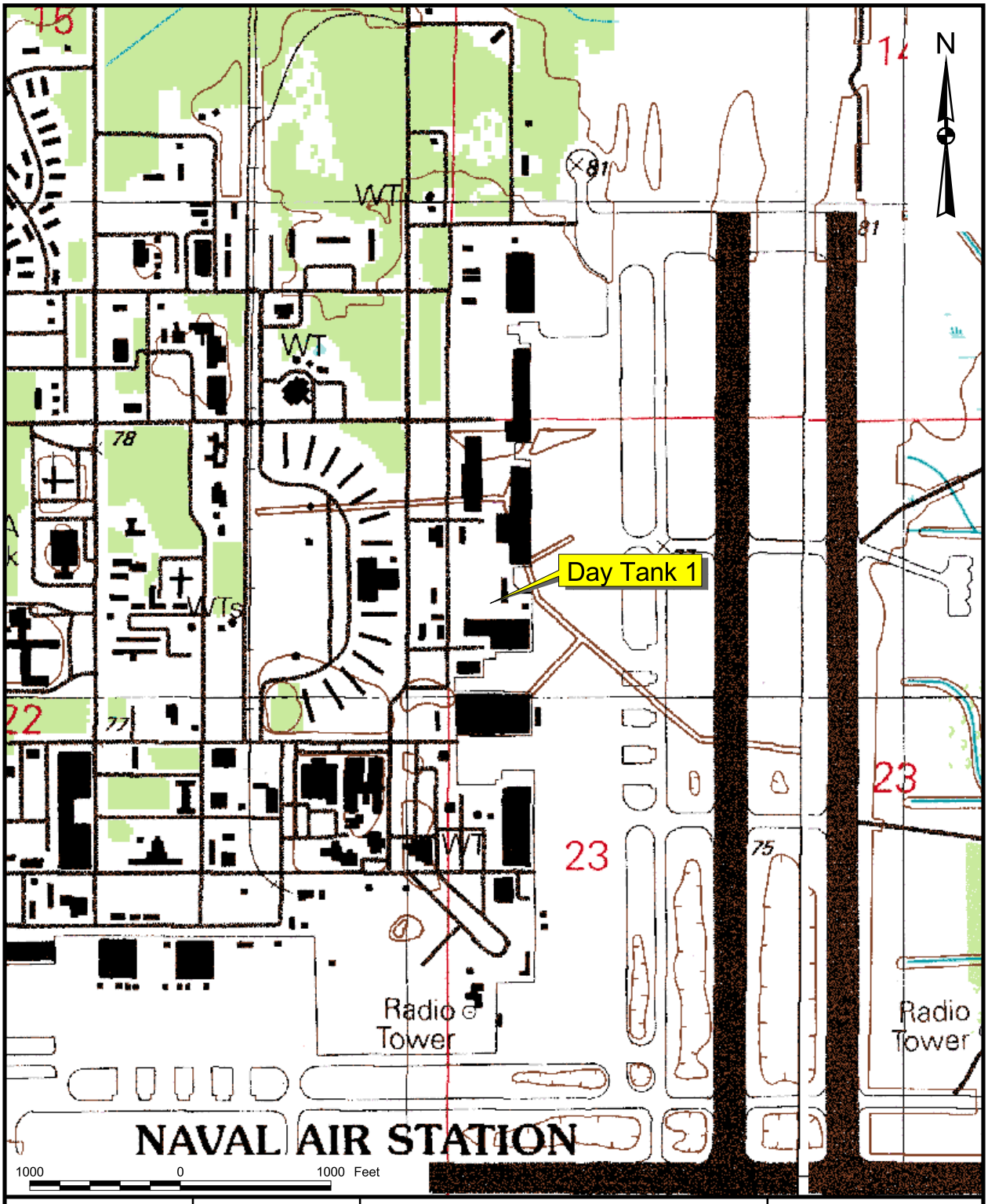

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3.0 SITE DESCRIPTION AND HISTORY

3.1 TRUCK STAND

The Truck Stand site was used as a loading station for the flightline refueling tanker trucks. The site consisted of a control building (Building 75), a pumping station (truck stand), asphalt and concrete parking area, and a detention pond (Figure 3-1). As previously mentioned, Building 75 and the Truck Stand have been removed. The site is currently unused pending the results of the investigations at this site and the NFF.

The surficial deposits at the site are composed primarily of fine-grained sand, silty sand, and clayey sand to depths of 78 ft below land surface (bls). Fine-grained sand and silty sand were encountered to a depth of 50 ft bls during a previous investigation [Harding Lawson Associates (HLA), 1998a]. Clayey sand was encountered from 50 to approximately 78 ft bls during that same investigation.

The site was assessed by HLA [formerly ABB Environmental Services (ABB-ES)] between June 1991 and August 1995 (ABB-ES, 1995). Soil and groundwater contamination was reported to a depth of 36-ft in well CEF-372-16D, and free product was detected in two monitoring wells on site. In April 1996, with the approval of the BCT, a source removal was completed. Following that remedial action, supplemental groundwater sampling indicated the remaining groundwater contamination centered on monitoring well CEF-372-13. A Monitoring Only Plan (MOP) was developed and approved for the site on February 4, 1997 by the FDEP. The MOP involved sampling five wells for volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs). The monitoring continued (with subsequent minor modifications that eventually reduced the number of wells from five to three) through March 2000. The next scheduled event in September 2000 was postponed to allow the Remedial Action Contractor (RAC) to conduct a source removal at this site and the NFF. The RAC removed any contaminated soil that was encountered during decommissioning and removal of the structures associated with the Truck Stand. Monitoring wells CEF-372-13 and CEF-372-16D were removed, and only CEF-372-13 was replaced (on February 7, 2001) and renamed CEF-372-13R. On February 9, 2001, TtNUS resumed the monitoring program and subsequently reported the results (TtNUS, 2001a). The groundwater flow direction at that time was reported toward the southeast (Figure 3-2). The report indicated that COC concentrations had not changed significantly, and it recommended preparation of a RAP. A brief summary of the COCs is provided on Figure 3-3. However, prior to preparation of a RAP, the Navy and TtNUS agreed that additional monitoring wells should be installed to better delineate the dissolved hydrocarbon plume and verify that the Truck Stand plume does not commingle with the NFF plume.

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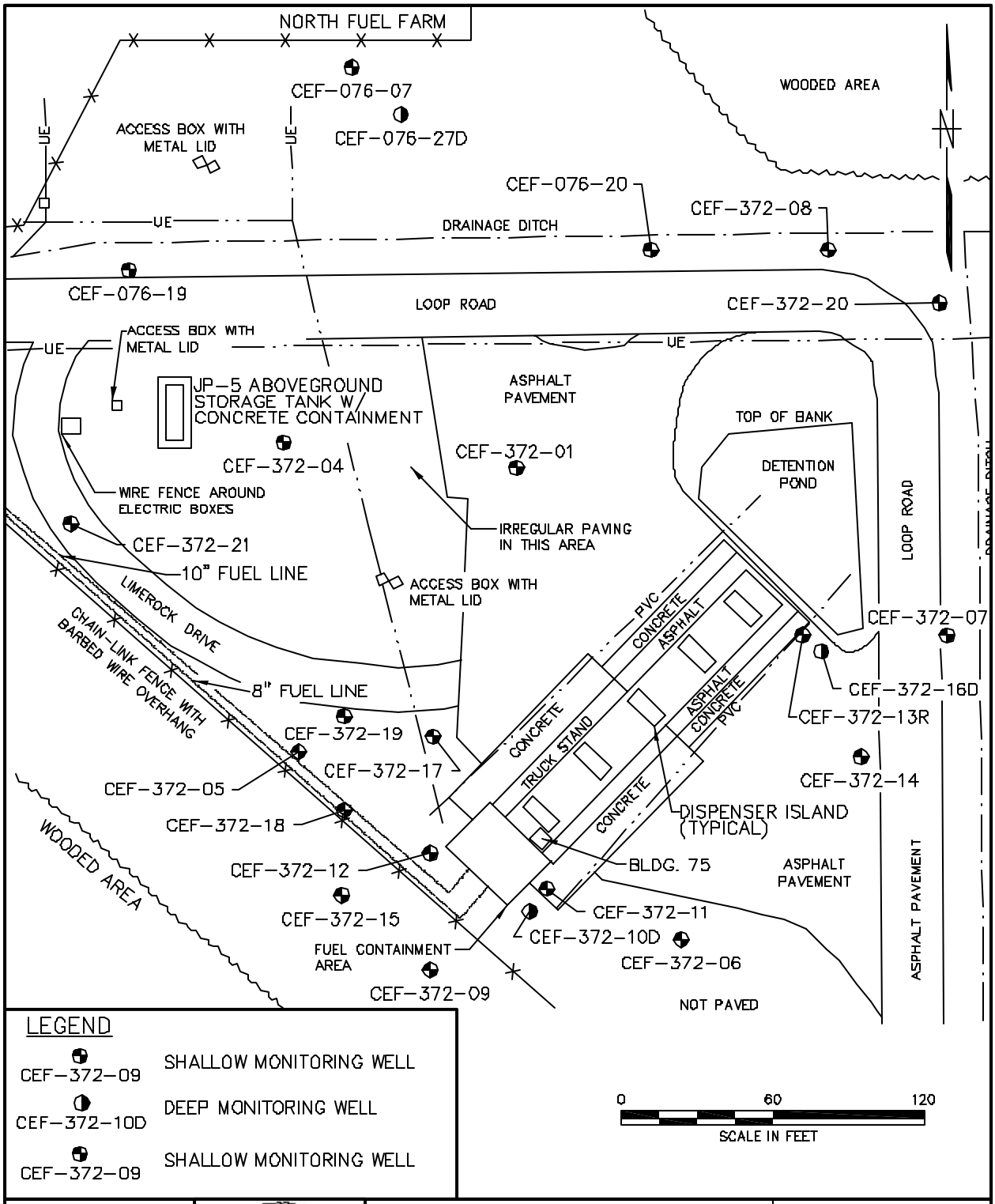

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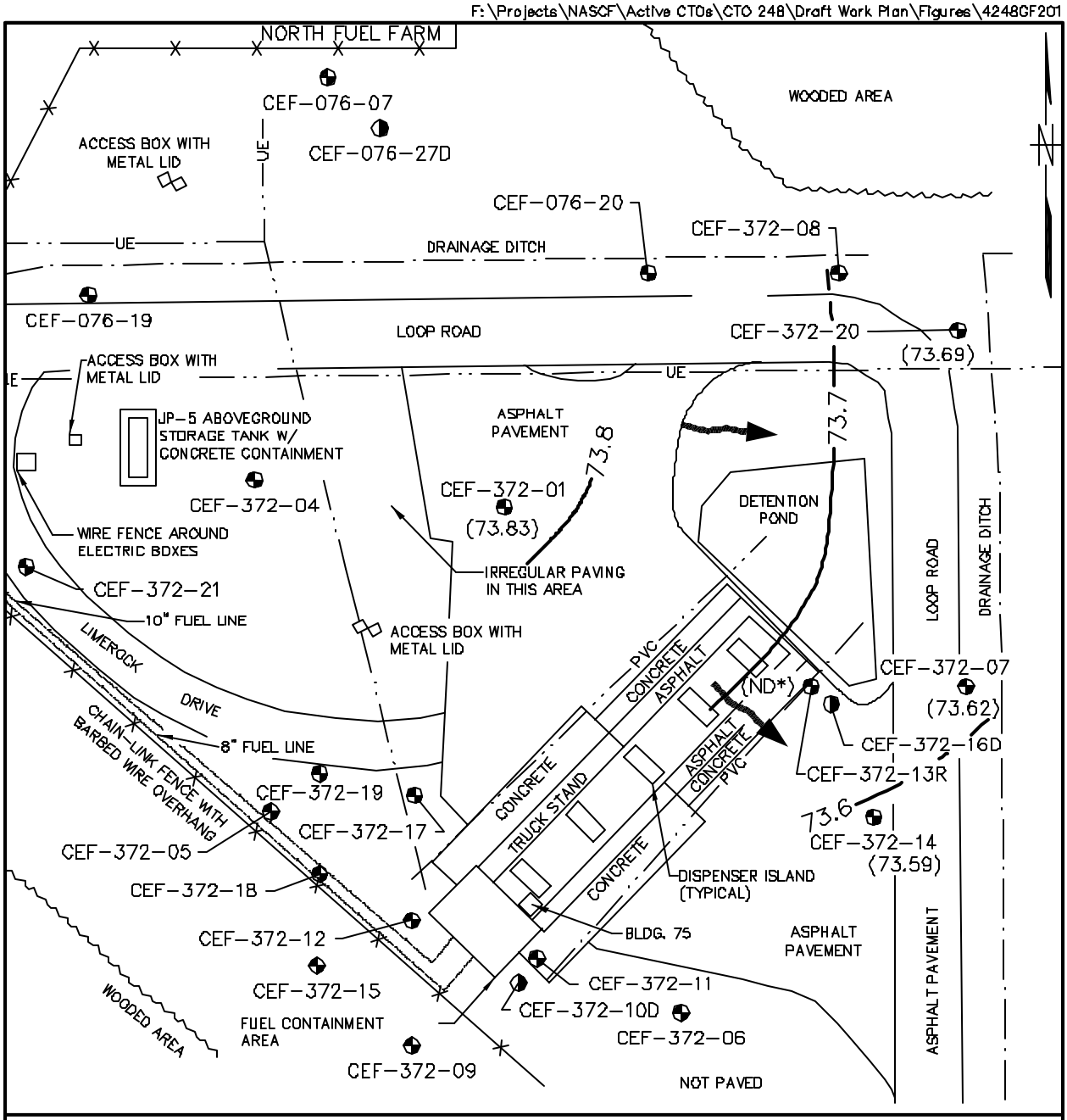

LEGEND

CEF-372-09 SHALLOW MONITORING WELL

CEF-372-10D DEEP MONITORING WELL

(73.69) WATER TABLE ELEVATION (FT MSL)

73.7 EQUIPOTENTIAL LINE (FT MSL) (DASHED WHERE INFERRED)

INFERRED DIRECTION OF GROUNDWATER FLOW

(ND*) DATA NOT USED PENDING NEW SURVEY

0 60 120

SCALE IN FEET

DRAWN BY LLK DATE 5/22/02		GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 9, 2001 TRUCK STAND, FACILITY 372 WORK PLAN NAVAL AIR STATION, CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 4248
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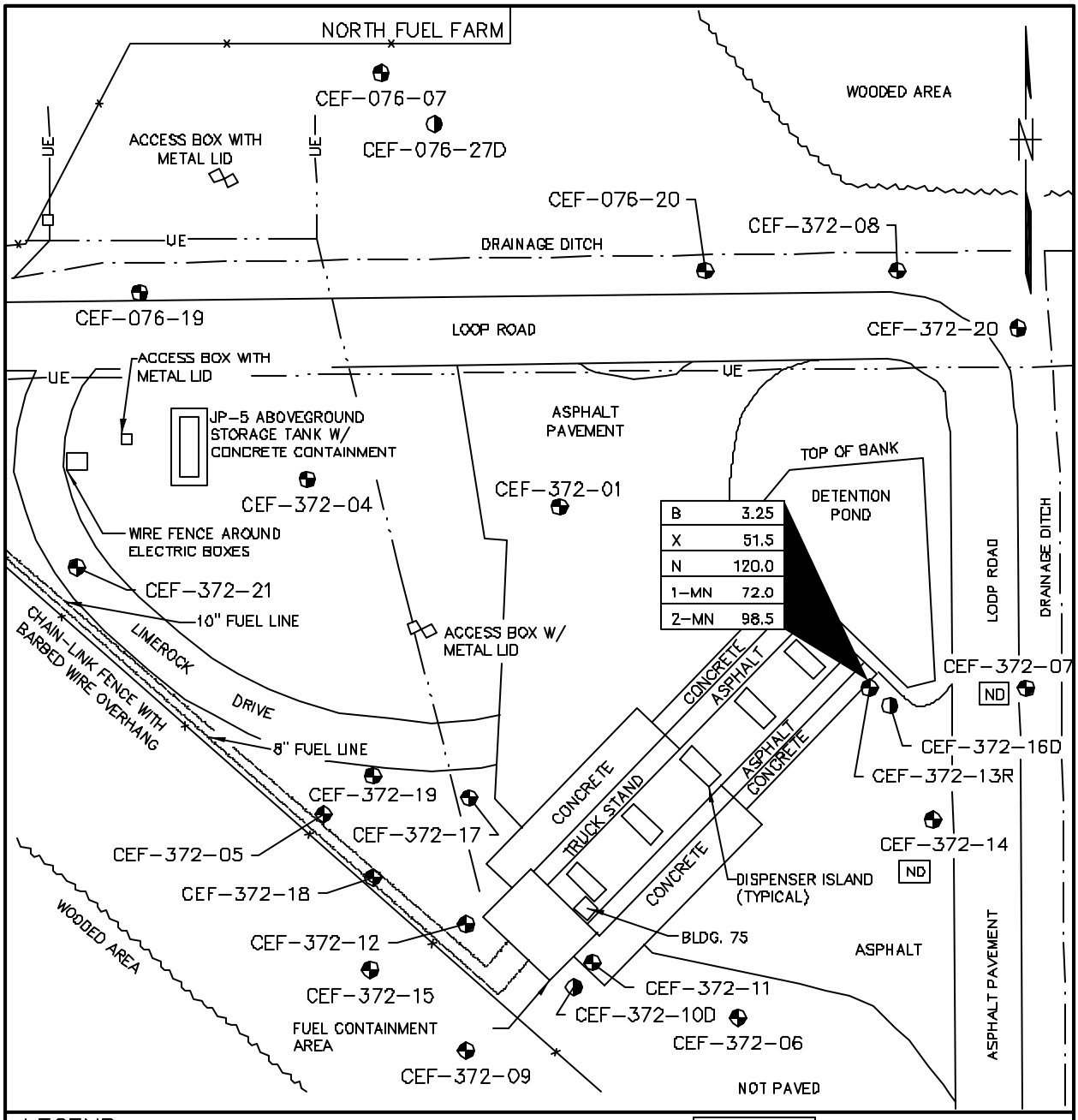

LEGEND

CEF-372-09 — SHALLOW MONITORING WELL (BOLD = SAMPLED WELL)

CEF-372-10D — DEEP MONITORING WELL

BENZENE ►	B	3.25
XYLENES ►	X	51.5
NAPHTHALENE ►	N	120.0
1-METHYLNAPHTHALENE ►	1-MN	72.0
2-METHYLNAPHTHALENE ►	2-MN	98.5

ALL VALUES REPORTED IN MICROGRAMS PER LITER (µg/L)

ND — NONE DETECTED

0 60 120

SCALE IN FEET

DRAWN BY LLK	DATE 5/22/02	DISSOLVED HYDROCARBONS FEBRUARY 9, 2001 TRUCK STAND, FACILITY 372 WORK PLAN NAVAL AIR STATION, CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 4248
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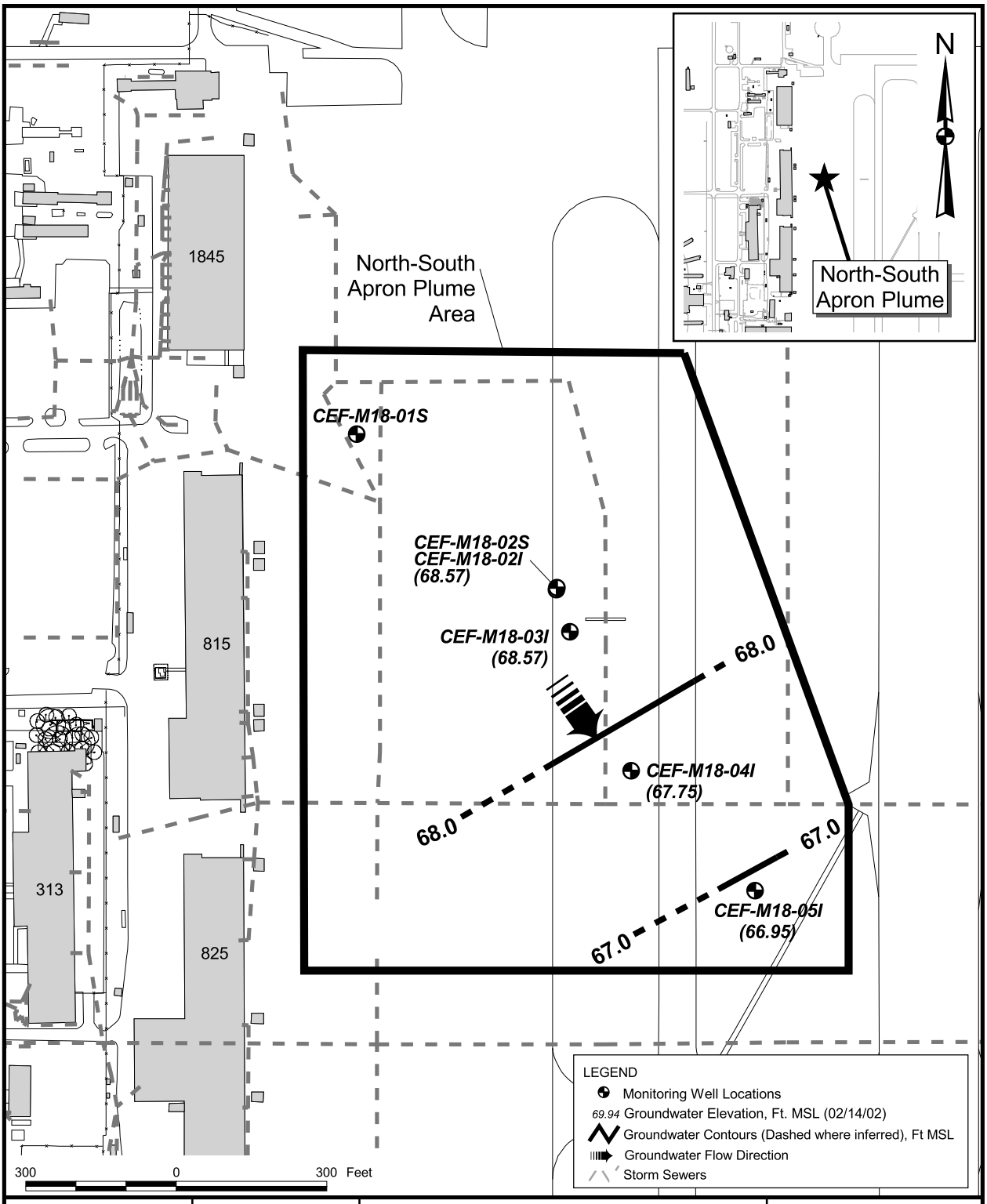
3.2 NSAP

The NSAP is located on an active flightline with the Main Base Open Area (MB) 18. According to the Sampling and Analysis Outline and Report for the MB 18 (HLA, 1999), benzene was detected in one DPT groundwater sample near the eastern edge of the north-south apron. The benzene concentration was greater than the FDEP's applicable GCTL listed in Chapter 62-777, Florida Administrative Code (FAC). Based on that result, the Navy directed TtNUS to conduct a site assessment on the nature and extent of the groundwater contamination as part of the Grey Site investigation program. The Site Assessment Report (SAR) indicated that the contamination was limited to non-chlorinated hydrocarbons, and the site was subsequently assigned under the Florida Petroleum Contamination Sites regulations, Chapter 62-770, FAC (TtNUS, 2001b). The MOP, which required the quarterly sampling of four intermediate wells for benzene, toluene, ethylbenzene, and total xylenes (BTEX), was approved on March 16, 2001. Four quarters of sampling followed during which no significant change in concentrations of COCs occurred. The groundwater flow map and groundwater analytical map are included from the last sampling event for reference (Figures 3-4 and 3-5, respectively). Results of the quarterly monitoring program indicated milestone objectives were not achieved. Since the milestone objectives were not achieved and in accordance with Chapter 62-770.690 (7)(g) FAC, three options were evaluated (supplemental assessment, additional monitoring, or preparation of a RAP) and one was recommended (supplemental assessment). Additional monitoring was not considered since the concentrations of the COCs were above applicable GCTLs and were basically static. A RAP was not deemed prudent since the plume width is unknown. Thus a supplemental assessment was recommended to determine the horizontal dimensions of the plume and determine if higher COC concentrations exist outside the current area. The last quarterly report (TtNUS, 2002) recommended that during preparation and execution of the supplemental assessment, the MOP should be suspended. On May 10, 2002, the FDEP agreed to the need for a supplemental assessment and approved suspension of the MOP.

3.3 SITE 46

Site 46 was the former base gas station and featured eight underground storage tanks (USTs), all of which were removed in June 1988. Currently, the site is an unused parking lot. Four of the USTs were in operation before 1970. These four tanks were unidentified and their contents were unknown, but facility drawings indicate that these tanks each had a 2,000-gallon capacity and were located just south of Building 46. The remaining four tanks, identified as 46R, 46D, 46SUL, and 46UL, were installed in 1970 adjacent to Building 46 itself. Tanks 46R and 46UL both had a 10,000-gallon capacity and were used to store regular and unleaded gasoline, respectively. Tanks 46D and 46 SUL each sustained a 6,000-gallon capacity and were used to store diesel and super unleaded gasoline, respectively (TtNUS, 2000).



DRAWN BY MJJ	DATE 04Apr02	GROUNDWATER FLOW MAP NSAP WORK PLAN NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4248
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COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-4 / REV 0

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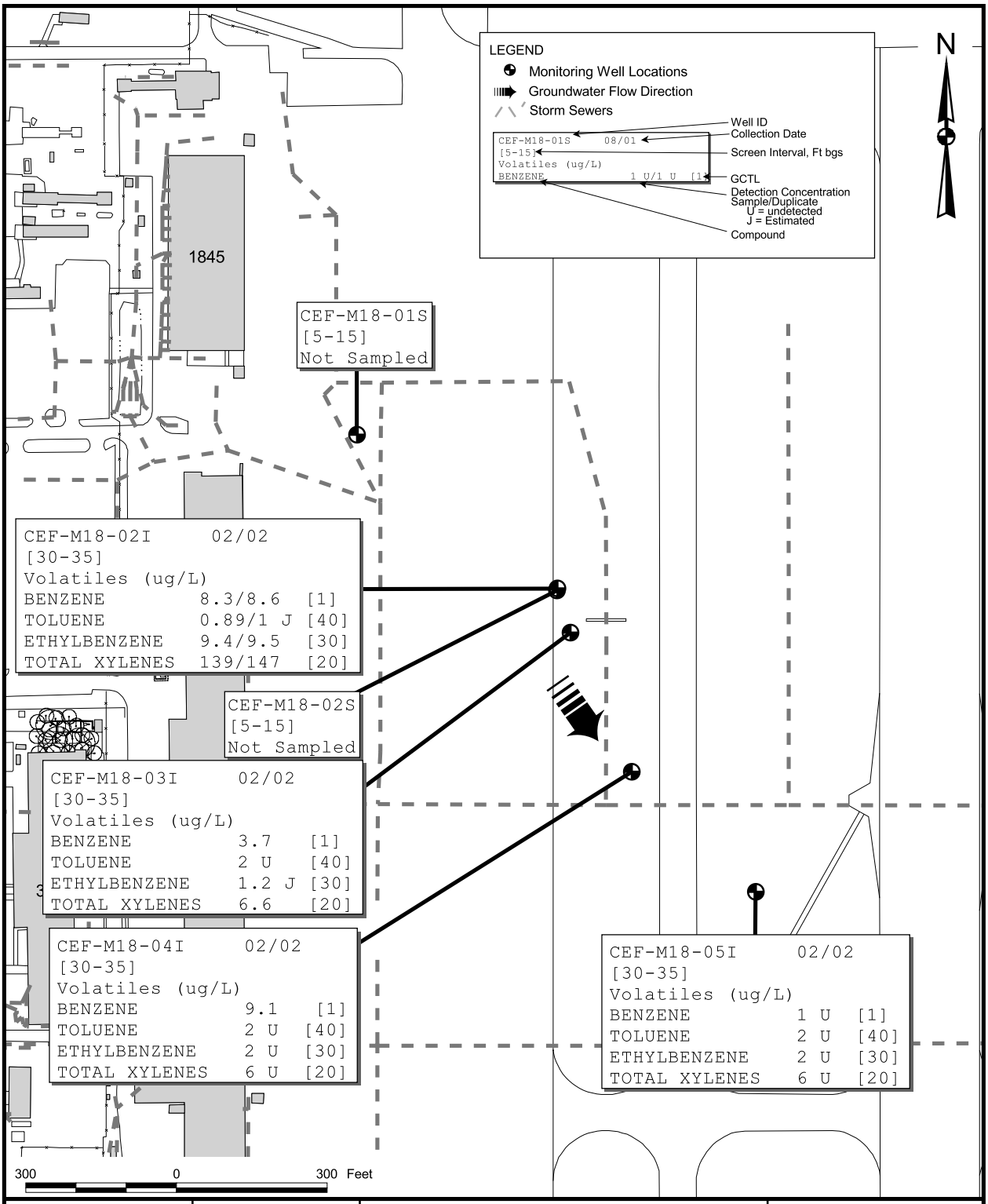

DRAWN BY MJJ	DATE 04Apr02	GROUNDWATER BTEX RESULTS NSAP WORK PLAN NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4248	
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COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-5	REV 0

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The SAR prepared for Building 46 (HLA, 1998b) concluded that operation of the USTs had resulted in contamination of soil and groundwater with fuel-related compounds, including BTEX, methyl-tert-butyl ether (MTBE), naphthalene, and total recoverable petroleum hydrocarbons (TRPH). The SAR determined that an area of soil approximately 5,500 square ft (ft^2) in size at the location of the former USTs was highly contaminated to a depth of 7 ft bls and acted as a source of groundwater contamination. The SAR also established that the areal extent of the groundwater contaminant plume in the shallow (4 to 25 ft bls), intermediate (25 to 50 ft bls), and deep (50 to 92 ft bls) zones of the surficial aquifer were approximately 25,300 ft^2, 95,700 ft^2, 31,000 ft^2, respectively. Figure 3-6 illustrates the approximate horizontal extent of groundwater contamination as reported in 1998.

The RAP for Building 46 was prepared (TtNUS, 1999a) to accomplish cleanup by two methods:

- AS/VE for remediation of highly contaminated soil and groundwater in the source area.
- Monitored natural attenuation for the remediation of the remainder of the groundwater contaminant plume.

In June 2000, TtNUS submitted a RAP Addendum to enhance the system with a nutrient injection system known as PHOSter, which stimulates the growth of petrophilic microorganisms. The RAP Addendum also recommended the addition of two intermediate and one deep monitoring well downgradient to monitor the plume and detect possible migration in that direction. The system and wells were installed between December 2000 and June 2001. Groundwater samples collected from one of the newly installed monitoring wells (CEF-46-26I) indicated BTEX concentrations that exceeded both GCTLs and NADSCs. For example, benzene concentrations reported for 10/24/01, 11/16/01 and 12/18/01 were 1300, 1700, and 1300 micrograms per liter (µg/L), respectively. The location of that well is shown on Figure 3-7.

On April 11, 2002, TtNUS investigated the extent of the groundwater contamination downgradient of CEF-46-26I with a new screening technology called DPT/MIP. Personnel with J. A. Jones Environmental Services (JAJ) indicated that the groundwater flow direction in that area remains southwesterly as indicated in the RAP Addendum (TtNUS, 2000). Three downgradient points were drilled with DPT/MIP in the southeast direction (46MIP02, 46MIP01, and 46MIP04) at distances of 25, 50 and 80 ft, respectively, from CEF-46-26I. A fourth point (46MIP03) was drilled sidegradient to the groundwater flow direction and approximately 50-ft due south of the monitoring well.

The MIP data indicated detections of volatile compounds at depths of 6 ft bls, 30 ft bls and 46 ft bls in both 46MIP01 and 46MIP02.

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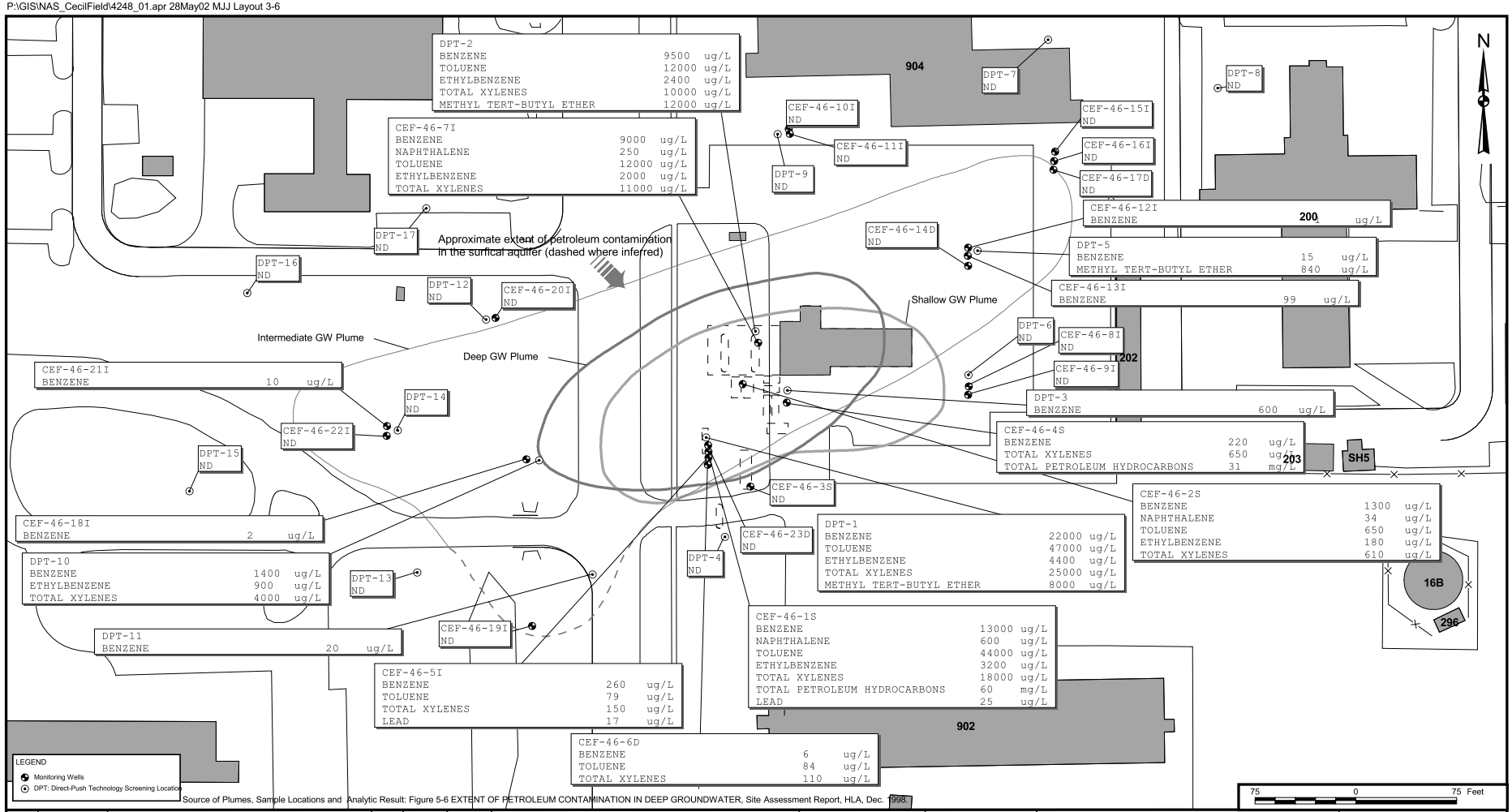

Source of Plumes, Sample Locations and Analytic Result: Figure 5-6 EXTENT OF PETROLEUM CONTAMINATION IN DEEP GROUNDWATER, Site Assessment Report, HLA, Dec. 1998

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY CPG	DATE 3/4/99
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SCALE AS NOTED	

PETROLEUM CONTAMINANTS EXCEEDING CLEANUP TARGET LEVELS IN THE SURFICIAL AQUIFER
SITE 46, WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NO. 4248	
APPROVED BY	DATE
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DRAWING NO. FIGURE 3-6	REV. 0

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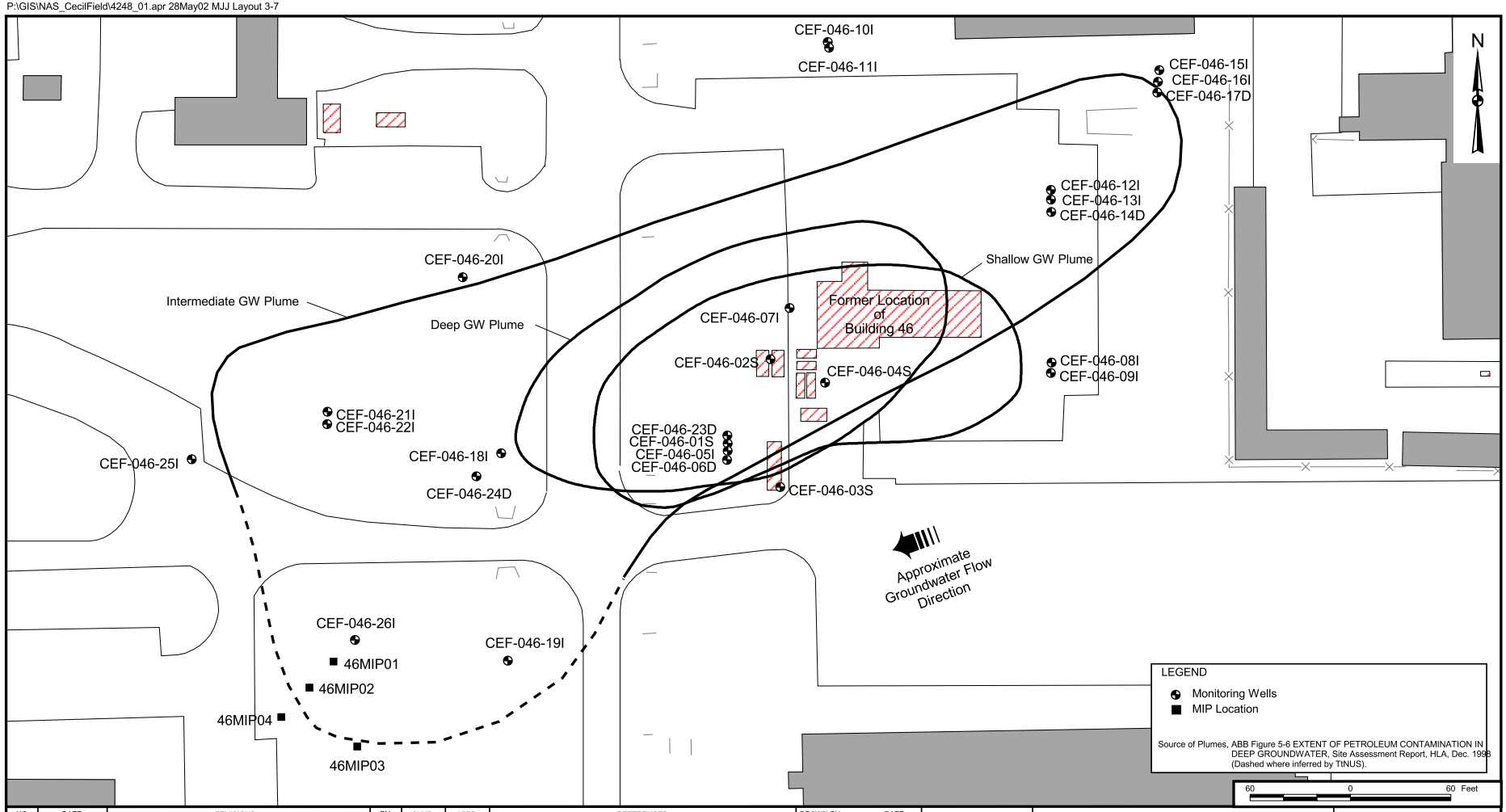

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DRAWN BY MJJ	DATE 28May02
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COST/SCHED-AREA	
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MONITORING WELL AND MIP LOCATION MAP
SITE 46, WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NO. 4248	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 3-7	REV. 0

No volatile compounds were indicated at 46MIP04 and the data for 46MIP03 appeared to indicate little to no impact from volatile compounds at that location. Figure 3-7 shows these locations relative to CEF-46-26I.

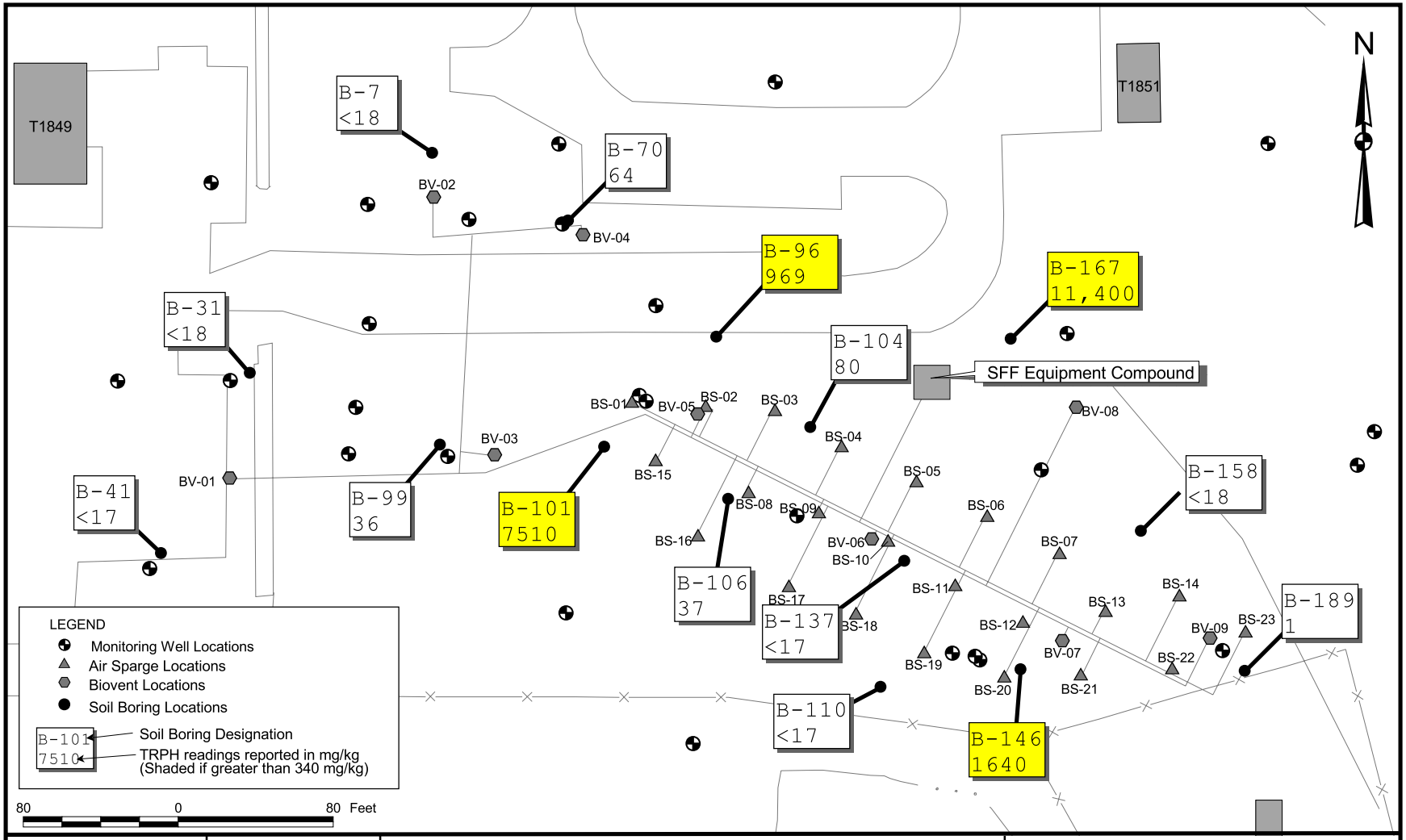
3.4 SFF

The SFF site was used as a fuel storage facility for leaded and unleaded gasoline, aviation gasoline, diesel fuel, and jet propellant 5 (JP-5). When fully operational, the facility contained three aboveground storage tanks (ASTs), four USTs, and four earth-mounded tanks (EMTs).

In 1983, the three ASTs were removed. In July 1994, the four USTs and three of the four EMTs were excavated. Excessively contaminated soil excavated during the tank removals was returned to the excavations. A contamination assessment was conducted in 1995 to determine the nature and extent of contamination as required by Chapter 62-770, FAC (ABB-ES, 1996a). This report indicated a southerly groundwater flow in the water table with a southeast component on the west side of the site. A RAP submitted in October 1996 specified the recommended remedial action as enhanced intrinsic remediation through bioventing and biosparging combined with an oxygen barrier wall (ABB-ES, 1996b). Subsequent to RAP submittal, the BCT agreed to implement remedial action activities for only the northern portion of the SFF site [Bechtel Environmental Services, Inc. (BEI), 1998a]. The southern portion of the bioventing and biosparging systems and the oxygen barrier were subsequently deleted from the RAP by the BCT. Soil excavation was chosen as the remedial alternative for the southern portion of the SFF site. CH2M Hill Constructors, Inc. (CCI)/JAJ performed the soil excavation during the period of October 1998 to February 1999 (CCI, 2001).

BEI installed the approved bioventing and biosparging systems for the northern portion of the SFF site during the period of December 1997 to March 1998. Startup of the bioventing and biosparging systems occurred on April 6, 1998 (BEI, 1998b). BEI performed the operation and maintenance (O&M) of the systems from April 1998 to April 1999. Ensafe, Inc. performed the O&M of the systems from April 1999 to May 2001. CCI/JAJ performed O&M of the systems from June 2001 to the present. It should be noted that soil screening and sampling and groundwater sampling are conducted on an annual basis.

The 4th Quarter O&M Report for SFF (CCI, 2002) reported the results of the annual soil screening and sampling as accomplished in October 2001. The results indicated that four soil borings (B-96, B-101, B-146 and B-167) exhibited TRPH concentrations in excess of the FDEP's TRPH SCTL of 340 milligrams per kilogram (mg/kg). Figure 3-8 shows the location of those borings and the TRPH data for the last reporting period from January to December 2001. Figure 4-1 (Appendix B) from the RAP (ABB-ES, 1996b) shows the bioventing layout against the zones of soil contamination.



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SOIL TRPH DATA (2001)
SFF
WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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The last available report (Ensafe, 2001) that provided groundwater analytical data indicated that six shallow wells (CEF-43-2N, CEF-43-6N, CEF-43-7N, CEF-43-9N, CEF-43-33, and CEF-43-38) are currently sampled for BTEX, PAHs, TRPH and total lead. Figure 4-5 (Appendix C) from the RAP (ABB-ES, 1996b) shows the biosparge layout and radius of influence. Figure 4-4 (Appendix D) from the RAP (ABB-EX, 1996b) shows the greatest extent of groundwater contamination and the total VOC contour for the 1000 µg/L concentration. It should be noted that the biosparge system was designed to influence only the 1000-µg/L concentration area shown on that figure. It should also be noted that there are areas north and west of the radius of influence (ROI) of the biosparge system that may continue to provide a continuing source of groundwater contamination.

The analytical data from Ensafe (Ensafe, 2001) are summarized on a table presented in Appendix E. The two upgradient, background wells (CEF-43-33 and CEF-43-38) were reported without detections of COCs except for lead. Except for source well CEF-43-7N, lead concentrations for the six wells exceeded the GCTL. This result may indicate a natural background component for lead or turbidity issues with the sampling effort. Three out of the four source wells were reported with VOC concentrations that exceeded a GCTL, and two PAHs exceeded GCTLs in one well. A comparison of total VOC concentrations from the 1995 sampling event report in the RAP (ABB-ES, 1996b) to the table in Appendix E is provided below.

Monitoring Well	Total VOCs [parts per billion (ppb)], 1995	Total VOCs (ppb), April 2000
CEF-43-2N	2,530	770
CEF-43-6N	10,980	1161
CEF-43-7N	4,300	17.8
CEF-43-9N	396.4	105.2

The first three wells indicate a range of reduction from 70 percent to about 99 percent of VOCs in 5 years in the treatment area. Well CEF-43-9N is upgradient of and outside the treatment area and it has experienced a 74 percent reduction of COCs. It appears that natural attenuation is keeping pace with the current system.

3.5 DT1

DT1 consisted of one 200,000-gallon, EMT with associated piping that was installed in 1956. The EMT was designed to hold JP5 fuel. The EMT and associated equipment were enclosed by a barbed-wire and chainlink fence. Appendix F contains a figure from the RAP by ABB-ES (ABB-ES, 1997) that shows the site prior to the source removal. The fuel containment area was installed in 1990, and it was designed to contain any overflows from fuel spills. An 8-inch polyvinyl chloride (PVC) pipe extended from DT1 to the containment area. The containment area is equipped with overflow catch basins and a 10-inch PVC pipe that extends from the containment area to a 15-inch PVC storm drain line located directly east. A former

containment pond located in the northeast corner inside the fenced area of the site was backfilled and abandoned in place in 1990. Fuel pumps were located directly on top of the EMT, and fuel was pumped from DT1 using an underground pipeline to the North-South High Speed Refuelers on the flightline (ABB-ES, 1997).

According to ABB-ES (ABB-ES, 1997) numerous spills occurred at the site with the largest being a 497,000 gallon JP-5 spill in 1981. Base personnel reported that approximately half of that spill was recovered. The preliminary investigation of the spill concluded that the fuel was only in the unsaturated zone and had not entered the groundwater. Therefore, the report recommended allowing natural degradation of the fuel. In accordance with the 1989 Release Detection Program for Naval Activities in Florida, ABB-ES began an assessment in 1990 of the soil and groundwater that were reported in 1993 in a Contamination Assessment Report (CAR). A CAR Addendum was submitted later to address additional items of concern. A RAP was submitted in 1994, but the FDEP required additional assessment activities and interim remedial actions to address the free product. These activities covered the years 1994 to 1996 until ABB-ES was directed to update the RAP and resubmit it in 1997. The RAP was designed for the excavation of approximately 20,000 tons of petroleum-contaminated soil in the area of known free-product contamination and the installation of a biosparging and vapor capture system treatment system to address the contaminated groundwater at the site (ABB-ES, 1997).

Appendix A indicates the course of events since the implementation of the RAP was approved. The figure in Appendix F indicates the last available data on the extent of soil contamination at the site. Figure 3-9 is provided to show the estimated area of remaining soil contamination to be addressed by this work plan.

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ESTIMATED AREA OF SOIL CONTAMINATION
DAY TANK 1, WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NO. 4248	
APPROVED BY	DATE
APPROVED BY	DATE
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4.0 SCOPE OF WORK

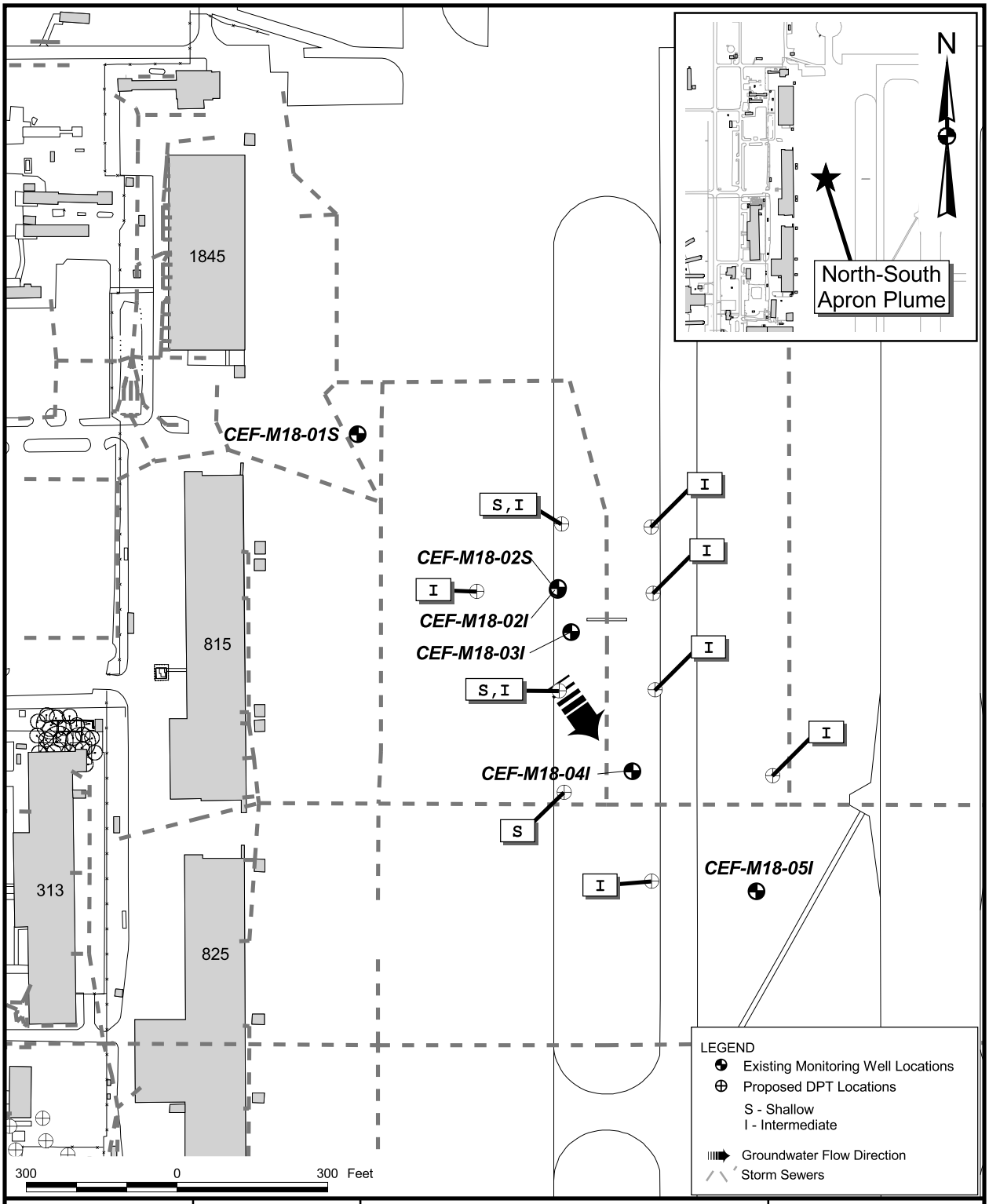
The work in the following sections will be completed in accordance with TtNUS' Comprehensive Quality Assurance Plan (CompQAP) (TtNUS, 1999b) and FDEP Standard Operating Procedures (SOPs).

At the end of each day in the field, the Field Operations Leader (FOL) will complete a Daily Activities Record for any subcontractor activities (Appendix G).

4.1 DPT GROUNDWATER SCREENING

This section applies only to the NSAP site. DPT groundwater screening activities are not required for the other four sites.

As indicated in the GWMR (TtNUS, 2002), TtNUS proposes to conduct a DPT groundwater investigation to determine the location for the necessary monitoring wells to delineate the sidegradient extent of the NSAP plume. A site plan showing the nine proposed DPT locations is presented as Figure 4-1. In a typical DPT investigation, the investigator would step out further from the initial borings until contamination is no longer encountered. However, since the reported concentrations of benzene for the existing wells is low (generally below 10 ppb) and most of the proposed locations are on the edge of the readily accessible flightline, TtNUS intends to utilize the analytical data from these borings alone to estimate the well locations. Shallow groundwater samples from the upper water table will be collected at three locations sidegradient to the "source" area around CEF-M18-2I to confirm the absence of petroleum contamination in the shallow zone as reported in the SAR (TtNUS, 2001b). Eight groundwater samples will be collected from the same zone as the other intermediate wells, which is approximately 30 to 35 ft bls, to delineate the contamination sidegradient to the long axis of the plume. Groundwater samples will be collected for screening-level analysis of the COCs, which are BTEX, as stipulated in the MOP. A field duplicate will be collected, and no lab duplicate will be collected. Information on the number of samples and laboratory methods for this effort are provided on Table 4-1. The samples will be placed on ice and shipped to a fixed-based laboratory.



DRAWN BY MJJ	DATE 04Apr02	SUPPLEMENTAL ASSESSMENT DPT LOCATIONS NSAP WORK PLAN NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4248
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TABLE 4-1
ANALYTICAL SAMPLE SUMMARY
NORTH SOUTH APRON PLUME

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Proposed Method (1)	Environmental Samples (2)	Screening Samples (3)	Duplicate Samples (4)	MS/MSD (5)	Equipment Blanks (Aqueous)	Trip Blanks (Aqueous)	Total Samples
GROUNDWATER								
BTEX	SW-846 USEPA 8021B or 8260B	8	11	2	1	0	0	21

(1) Method referenced reflects FDEP requirements.
(2) These are the estimated numbers of samples to be collected from permanent wells.
(3) These are screening-level only samples to be collected during the DPT investigation.
(4) One duplicate is screening level only and the other duplicate is for the permanent well data.
(5) MS/MSD = Matrix Spike/Matrix Spike Duplicate. This duplicate is proposed only for the permanent well sampling phase.

Groundwater analytical data will be used to determine the appropriate disposal method of the development and purge water.
USEPA = United States Environmental Protection Agency.

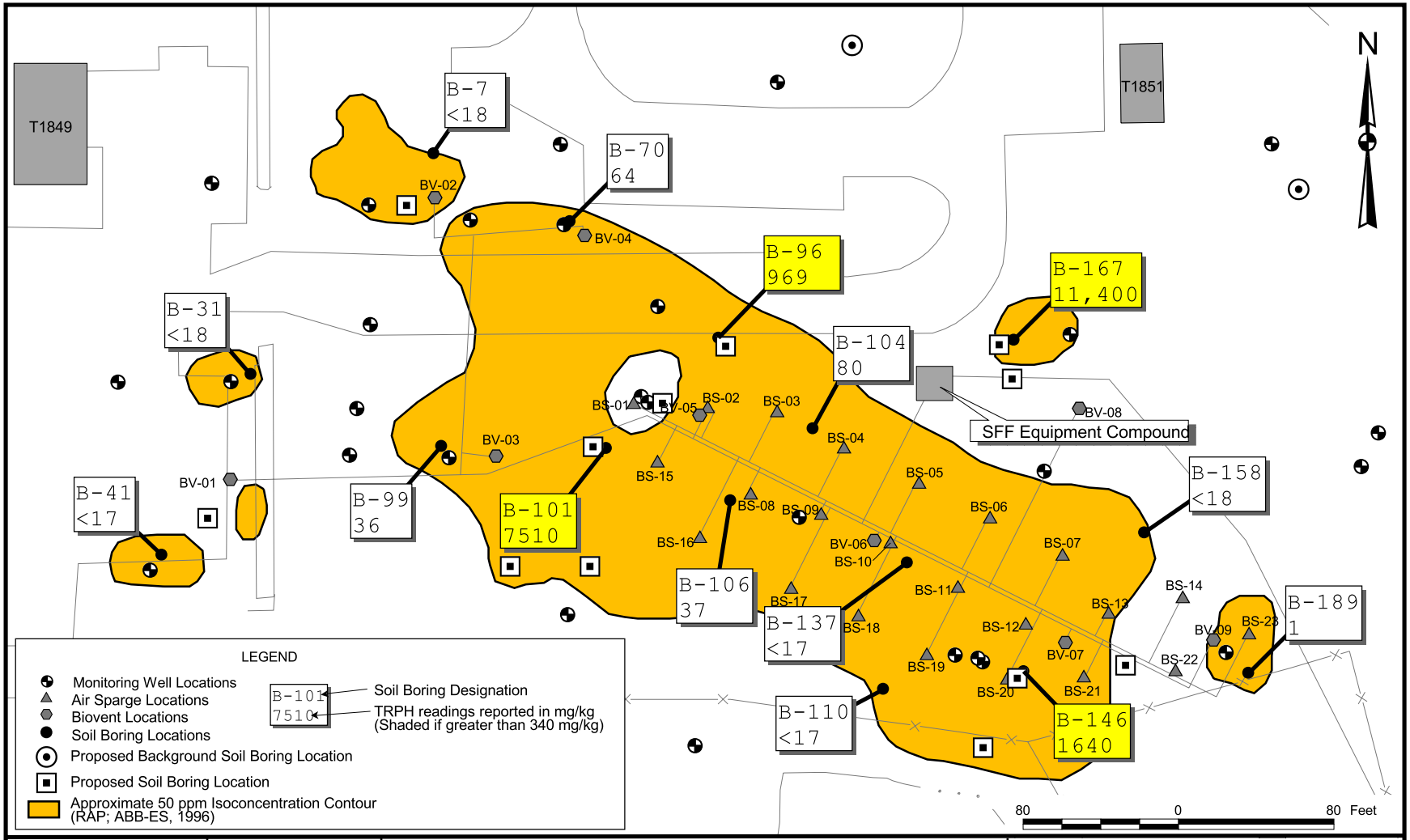
4.2 SOIL ASSESSMENT ACTIVITIES

This section applies only to the SFF and DT1 sites. Soil sampling activities are not required for the other three sites.

4.2.1 SFF

The bioventing system works to improve intrinsic bioremediation of the contaminated soil by delivering oxygen to the aerobic bacteria in the vadose zone. This effort is achieved via subgrade wells at a low flow rate to minimize volatilization and stimulate subgrade indigenous microbial activity (ABB-ES, 1996b). Appendix B (Figure 4-1 from the RAP) (ABB-ES, 1996b) shows the bioventing layout against the zones of soil contamination.

TtNUS intends to sample soils with stainless steel hand auger from approximately 15 locations as shown on Figure 4-2. Soil samples will be collected beginning at approximately 1 ft bls and continue at 1-ft intervals until approximately 1 ft into the saturated zone. Samples collected during this effort will be field screened using an organic vapor analyzer with flame ionization detector (OVA-FID), and a sample with the highest OVA reading will be submitted to the fixed-based laboratory for analysis. Excess soil not used for the laboratory samples will be returned to the borehole. The soil samples will be analyzed for total bacterial enumeration count (TBEC) by Standard Method (SM) 9215C, BTEX using USEPA Method



DRAWN BY MJJ	DATE 28May02	PROPOSED SOIL BORINGS AND SOIL TRPH DATA (2001) SFF WORK PLAN NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 4248
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SCALE AS NOTED			DRAWING NO. FIGURE 4-2 / REV 0

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SW846 8260B, BTEX and MTBE using USEPA Method SW846 8260B, PAHs using USEPA Method SW846 8310, and TRPH using Florida Petroleum Range Organics (FL-PRO).

The soil sample locations can be classified into four categories and were chosen to determine the following:

- Contaminated soil within the Radius of influence of the treatment system. Up to four soil samples will be collected from these locations. These locations are defined as areas inside the treatment zone of the bioventing system that continue to remain contaminated. Some of these locations have been previously determined during O&M sampling activities. Sampling at these locations is necessary to determine if soil contamination continues to be widespread or remains only in "pockets". The sampling at these locations will also be used to correlate OVA readings to analytical data, and also determine if contaminated soil is a continuing source to groundwater. The samples will also be analyzed for TBEC to determine if contaminated soil remains at the site due to the lack of bacteria in large enough quantities to remediate petroleum compounds.

- Uncontaminated soil within the ROI of the treatment system. Up to five soil samples will be collected from these locations. These locations are defined as areas inside the treatment zone of the bioventing system that have been determined to be clean based on OVA readings during O&M sampling activities. Sampling at these locations is necessary to determine if soil in the treatment zone has been remediated to some degree. These soil samples will also provide a correlation between OVA readings and analytical data, as well as a useful comparison of the bacterial population in "clean" areas compared to contaminate areas.

- Contaminated soil outside the ROI of the bioventing system. Up to three soil samples will be collected at these locations. A review of historical documents indicates that contaminated soil may be present at locations outside of the treatment zone of the bioventing system. These samples will provide information as to whether a continuing source to groundwater is present and if additional bioventing wells are necessary.

- Uncontaminated background samples outside of the ROI of the bioventing system. Up to two samples will be collected to provide background information for comparison purposes of bacterial populations.

The analyses for these samples will be used to evaluate the effectiveness of the bioventing system to actually enhance the indigenous microbial activity. Information on the number of samples and laboratory methods for this effort are provided on Table 4-2. The investigative derived waste (IDW) soil sample

TABLE 4-2
ANALYTICAL SAMPLE SUMMARY
SOUTH FUEL FARM

Work Plan
Navail Air Station Cecil Field
Jacksonville, Florida
Page 1 of 2

Analyte	Proposed Method (1)	Environmental Samples (2)	IDW Samples (3)	Duplicate Samples	MS/MSD (4)	Equipment Blanks	Total Samples
Groundwater							
BTEX, MTBE	SW846 USEPA 8021B or 8260B	12	0	1	1	1	15
PAH (5)	SW846 USEPA 8310	12	0	1	1	1	15
TRPH	FL-PRO	12	0	1	1	1	15
Total Lead	SW846 6010B	12	0	1	1	1	15
Total Organic Carbon	USEPA 415.1	12	0	1	1	1	15
Sulfate	USEPA 300	12	0	1	1	1	15
Methane	RSK SOP 147 & 175	12	0	1	1	1	15

See notes at end of table.

TABLE 4-2
ANALYTICAL SAMPLE SUMMARY
SOUTH FUEL FARM

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida
Page 2 of 2

Analyte	Proposed Method (1)	Environmental Samples (2)	IDW Samples (3)	Duplicate Samples	MS/MSD (4)	Equipment Blanks	Total Samples
Soil							
BTEX, MTBE	SW846 USEPA 8021B or 8260B	14	0	2	1	1	18
PAH (5)	SW846 USEPA 8310	14	0	2	1	1	18
TRPH	FL-PRO	14	0	2	1	1	18
TBEC	SM 9215C	14	0	2	1	1	18
VOH	SW846 8021B	0	1	0	0	0	1
Metals (6)	SW846 6010B	0	1	0	0	0	1

(1) Method referenced reflects FDEP requirements for petroleum contaminants of concern.
(2) Environmental samples include X groundwater samples and Y confirmatory soil samples.
(3) Investigative derived waste (IDW) sample numbers based on disposal of approximately Z 55-gallon drums (one composite sample) of soil. Groundwater analyticals will be used to determine the appropriate disposal method of the development and purge water. Soil analytical for VOCs, PAHs, and TRPH (collected from environmental samples) will be used to characterize soil for proper disposal. In accord with Chapter 62-713, FAC, an additional discrete and composite sample will be collected for volatile organic halocarbons and metals, respectively, from the soil IDW generated in order to complete the soil characterization for proper disposal.
(4) MS/MSD = Matrix Spike/Matrix Spike Duplicate (a laboratory quality assurance requirement).
(5) Includes 1-methylnaphthalene, 2-methylnaphthalene and the 16-method listed PAHs included in Table A of Chapter 62-770, FAC.
(6) Total arsenic, cadmium, chromium, and lead.
RSK = Robert S. Kerr Environmental Research Laboratory

listed on that table is intended solely for disposal of soils generated during monitor well installation. The soil samples will be collected, placed on ice and submitted to a fixed-based laboratory in general accord with the CompQAP. A soil and sediment sample log sheet will be maintained as each sample is collected (Appendix G).

4.2.2 DT1

TtNUS personnel will field screen soil samples at each proposed location (Figure 4-3) with an OVA-FID beginning at the 1-ft interval and continuing at 1-ft intervals until approximately 1 ft into the saturated zone of the water table. It is anticipated that the locations are either in grass or asphalt; therefore, TtNUS personnel will use a core drill to remove sufficient diameter asphalt cores prior to advancing the soil borings. The borings will be advanced with a stainless steel hand auger with extensions. A soil-boring log will be maintained for each location (Appendix G). The locations shown on Figure 4-3 may be field-adjusted to locate the current 50 ppm zone of soil contamination. Once the initial round of 31 borings is complete, the data will be evaluated to determine if additional borings are necessary to delineate the extent of soil contamination. Since this is a JP5 site, the 50 ppm guideline for excessively contaminated soils will be used to delineate. Following completion of the soil screening, TtNUS personnel will evaluate and determine the limits for soil excavation. Where OVA data indicates that additional delineation is necessary for excavation purposes, the limits of excavation will be defined with confirmatory lab samples.

The analytical methods that will be used will conform to the gasoline analytical group (GAG)/KAG list in Chapter 62-770, FAC. Excess soil not used for the laboratory samples will be returned to the borehole.

4.3 MONITORING WELL INSTALLATION

The drilling subcontractor, prior to initiation of drilling activities at each site, will obtain well installation permits. The wells will be installed and constructed in general accord with applicable guidelines from the following sources: SOUTHNAVFACENGCOM (1997), St. Johns River Water Management District (1995), and the USEPA (1996).

4.3.1 Shallow and Intermediate Monitoring Wells – General Details

Permanent shallow and intermediate-depth monitoring wells will be installed using hollow stem auger drilling techniques. These monitoring wells will be single-cased. Primary casing and screens of the monitoring wells will be constructed of 2-inch inside diameter (ID), Schedule 40, flush-joint PVC riser and flush-joint 0.010-inch factory-slotted well screen. The monitoring well screen sections will be either 5 or 10 ft in length depending on the depth and site conditions. After the borings are drilled to the desired

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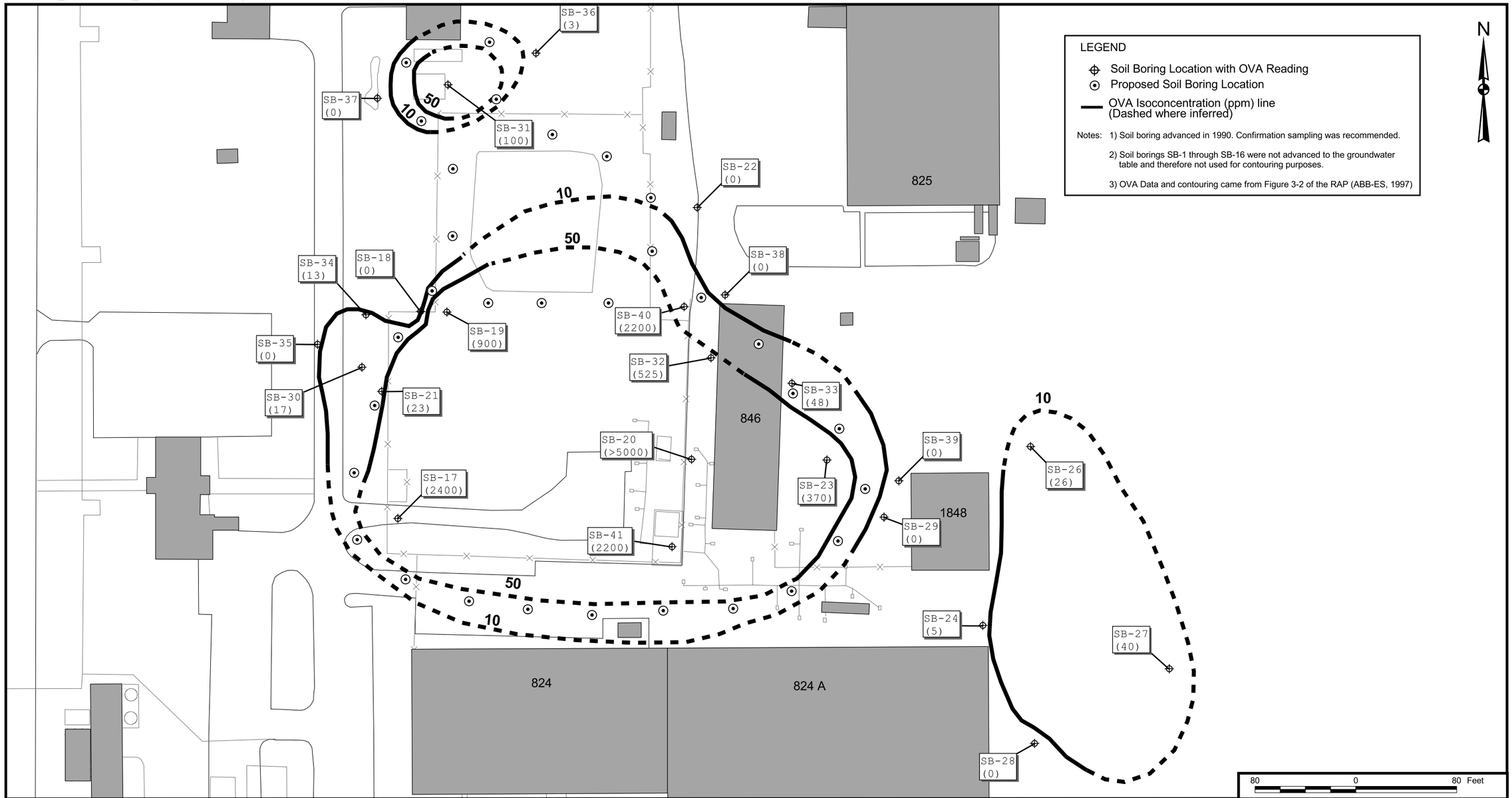


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MJJ DATE 28May02
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

PROPOSED SOIL BORING LOCATION MAP
DAY TANK 1, WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NO. 4248
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 4-3
REV. 0

depth, wells will be installed through the augers. The wells will be flush mount with bolt-down covers. A diagram showing typical well construction design is presented as Figure 4-4. A boring log, monitoring well sheet, and certificate of conformance will be maintained for each well installation (Appendix G).

4.3.2 Deep Monitoring Wells – General Details

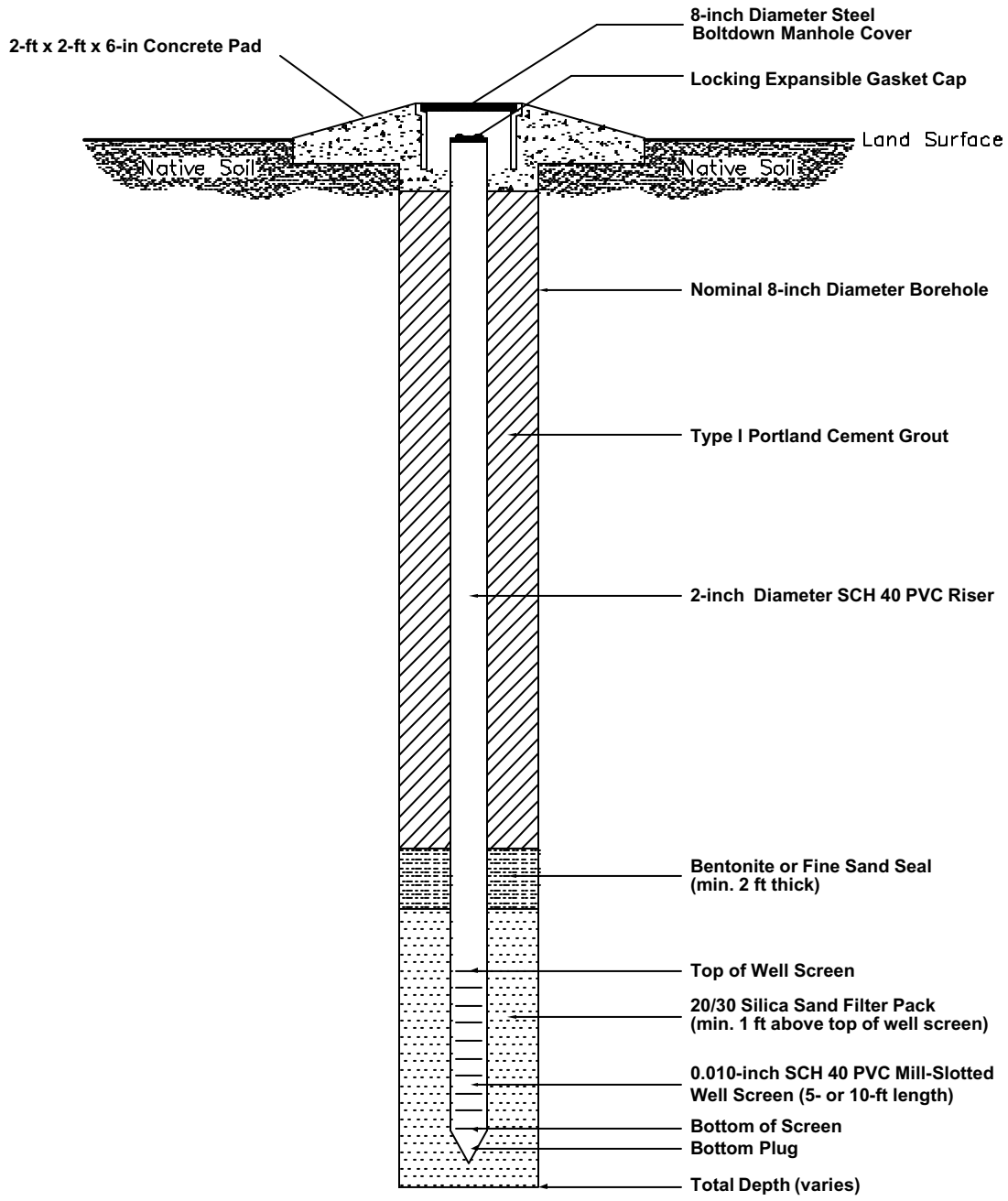
Only Site 46 will receive additional deep monitoring wells in accordance with SOW number 266. The deep monitoring well intended for Site 46 adjacent to the source well, CEF-46-26I, will be double-cased. Even though there is no confining unit for the outer casing, it will be set just below the contamination reported at the 40 to 50 ft interval to avoid carryover to the next interval. This well will be installed using mud rotary techniques. The outer casing will be 6-inch ID, Schedule 40 PVC. The other two proposed deep wells will be single-cased wells since they are intended for perimeter monitoring, and they will also be installed using mud rotary techniques. The primary casing and screen for these deep wells will be 2-inch ID, Schedule 40, flush-joint PVC riser and flush-joint 0.010-inch factory-slotted well screen. The screen lengths for each deep well will be 10 ft. These wells will also be flush mount with bolt-down covers. The single-cased wells will be of similar construction to that shown on Figure 4-4. Figure 4-5 shows the intended construction for the double-cased well. A boring log, monitoring well sheet, and certificate of conformance will be maintained for each well installation (Appendix G).

4.3.3 Truck Stand Wells

Two shallow monitoring wells and one intermediate monitoring well are proposed for the site. The shallow wells will be constructed with 10-ft screens that will be set to intercept the water table. The depth interval for the intermediate well will use a 5-ft screen set at 30 to 35 ft bls. It will be set to replace CEF-372-16D in the source area. It will be renamed CEF-372-16DR. The proposed locations for the wells are shown on Figure 4-6 based on a southeasterly flow direction estimated from the ABB-ES report (ABB-ES, 1995). The shallow wells are intended to better define the horizontal extent of the plume upgradient of the source well to within 50 ft of that well since the existing upgradient wells are approximately 120 ft upgradient. The intermediate well is intended to vertically define the extent of the plume below the source area.

4.3.4 NSAP Wells

As indicated in the SOW Number 266, eight intermediate monitoring wells are proposed for the site. The planned depth interval will use 5-ft screens at 30 to 35 ft bls. The well locations will be determined following the DPT groundwater screening previously mentioned. Prior to well installation, the proposed well installations will be approved with the consent of the BCT.



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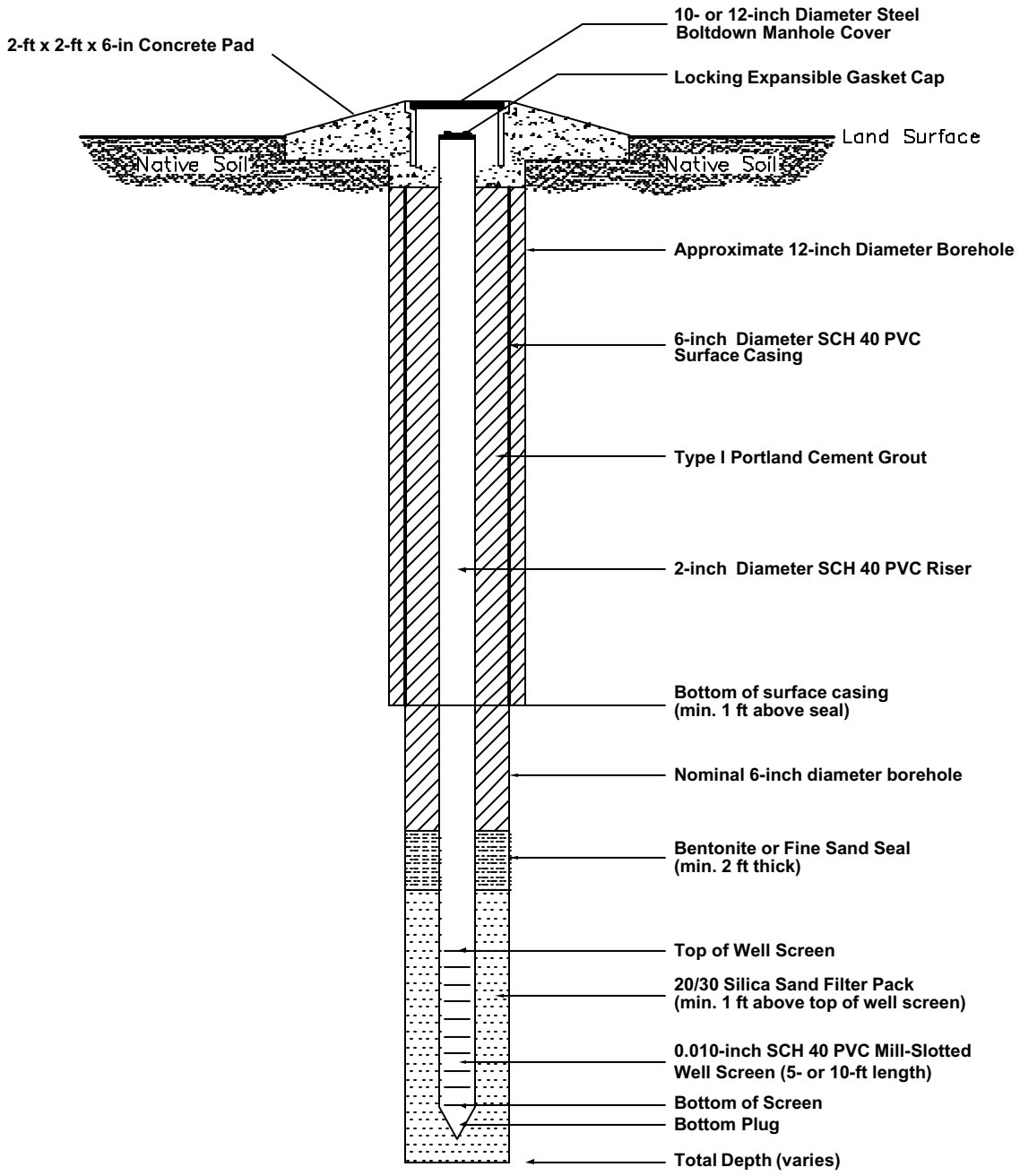
CHECKED BY DATE	TYPICAL MONITORING WELL DESIGN WORK PLAN NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY DATE	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE NOT TO SCALE		DRAWING NO. FIGURE 4-4	REV. 0



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COST/SCHED-AREA		APPROVED BY DATE	
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TYPICAL DOUBLE-CASED MONITORING WELL DESIGN
WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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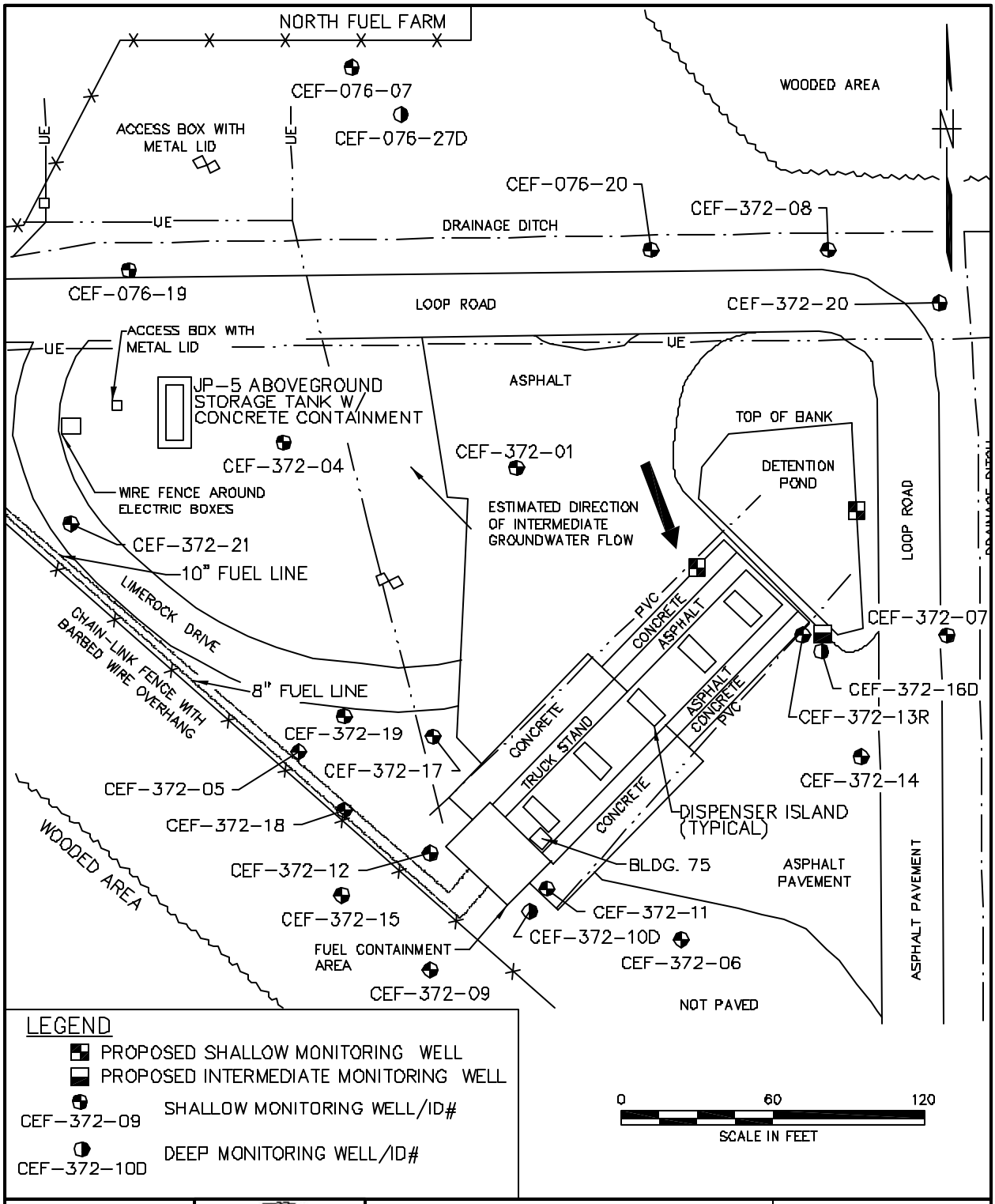

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CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 4-6 / REV. 0

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4.3.5 Site 46 Wells

In general accord with the SOW Number 266, TtNUS will supervise installation of one to two intermediate wells with 10-ft screens at 40 to 50 ft bls, which is the approximate screen interval of CEF-46-26I. The proposed well locations are shown on Figure 4-7 based on a southwesterly flow direction. The intermediate well proposed to the southwest of CEF-46-26I will be installed at the location of 46MIP04. The other proposed intermediate well will only be installed, where shown on Figure 4-6, if the sampling of CEF-46-19I indicates that petroleum products above GCTLs impact the groundwater at that well. As previously indicated, a deep well will be set adjacent to existing well CEF-46-26I to affirm the vertical extent of the contamination at that well (Figure 4-7). This deep well will be screened similar to the other deep wells that are set at approximately 80 to 90 ft bls. Prior to setting the other two deep wells, this well will be sampled. If it is found that the petroleum COCs have not impacted this new well, then the additional deep wells will not be needed. If the wells are needed, then they will be set adjacent to the other two intermediate wells.

4.3.6 SFF Wells

Following groundwater sampling and system evaluation, additional wells will be considered. If they are necessary, a recommendation for amendment of this work plan will be made to the BCT.

4.4 MONITORING WELL DEVELOPMENT

The monitoring wells will be developed no sooner than 24 hours after placement of grout to remove fine sediment from around the screened interval of the well. Wells will be developed by bailing and surging, or by pumping, as determined by the field geologist. Field parameters (pH, temperature, turbidity, and specific conductance) will be measured at equally spaced time intervals during well development. Wells will be developed a maximum of one hour or until the field measurements become stable and the development water is visibly clear. Water quality stabilization will be determined using the following criteria:

- Temperature, plus or minus 0.5 degrees Celsius (ºC)
- pH, plus or minus 0.1 unit
- Specific conductivity, plus or minus 10 microsiemens

These data will be recorded on a monitoring well development record (Appendix G). No sooner than 24 hours after development, groundwater samples will be collected from monitoring wells in accord with SOPs.

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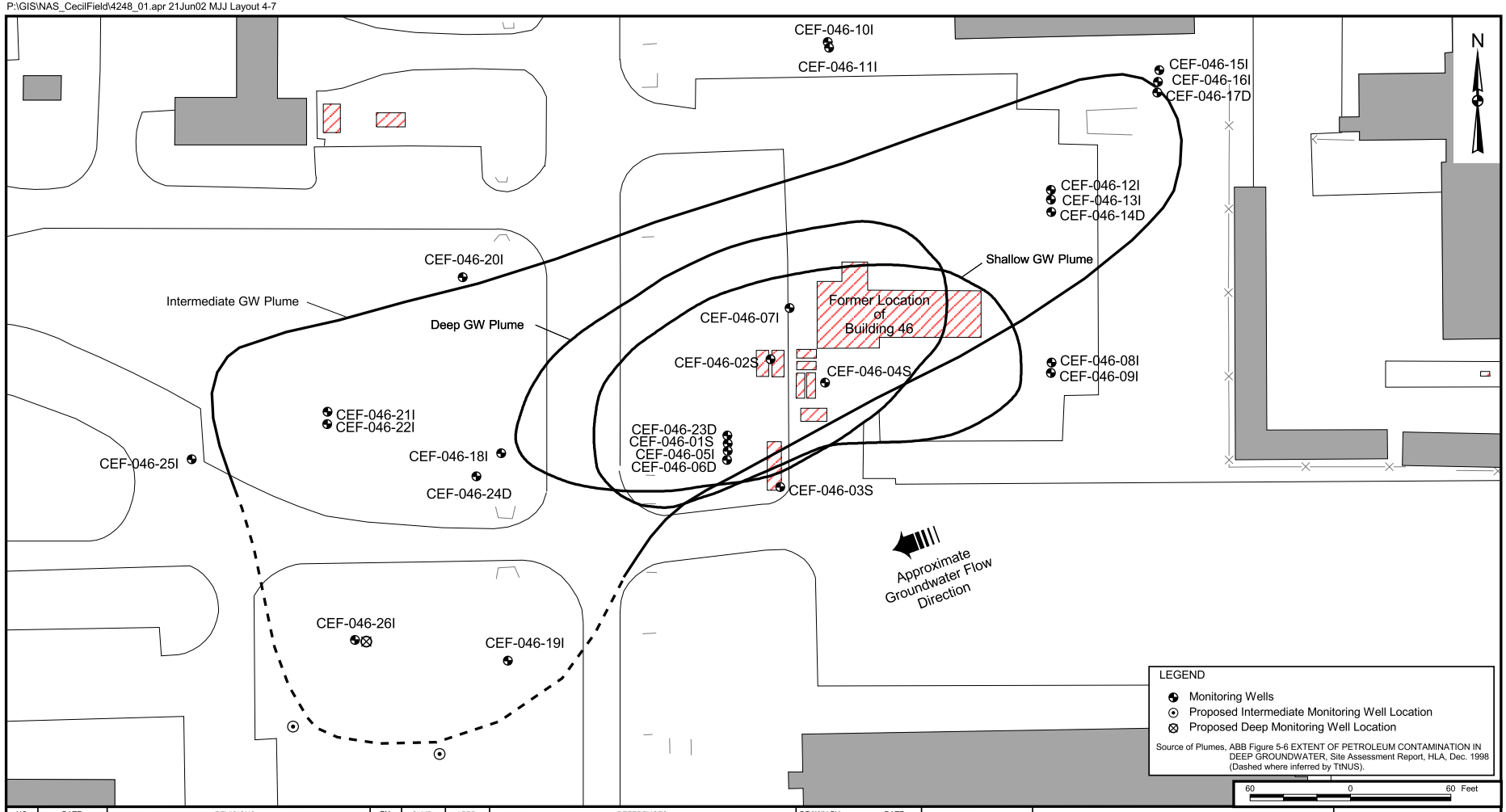

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DRAWN BY MJJ	DATE 28May02
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COST/SCHED-AREA	
SCALE AS NOTED	

PROPOSED MONITORING WELL LOCATION MAP
SITE 46, WORK PLAN
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NO. 4248	
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4.5 GROUNDWATER ASSESSMENT ACTIVITIES

4.5.1 Groundwater Levels and Surveying

Prior to obtaining samples, synoptic water levels and total well depths will be measured and recorded on site-specific groundwater level measurement sheets (Appendix G). A second round of water levels will be collected approximately one month later on the same data sheet. Prior to collecting groundwater levels and/or sampling at the SFF and Site 46, the RAC will be contacted to temporarily deactivate the remediation system.

A registered surveyor will survey the permanent monitoring wells installed during the site assessment. Horizontal positioning will be measured and plotted with respect to the Florida State Plane Coordinate System and the North American Datum of 1983. The top of casing (TOC) elevation of each permanent monitoring well will be surveyed with respect to the North American Vertical Datum of 1988 and referenced to site features (building corners, etc.). The TOC elevations will be used with the depth-to-water data previously mentioned to determine groundwater flow direction and gradient.

4.5.2 Laboratory Analyses

4.5.2.1 Truck Stand

In accord with the MOP, the groundwater at the Truck Stand will be analyzed for BTEX, MTBE and PAHs. The specific associated methods and number of samples are shown on Table 4-3. Only the three new monitoring wells will be sampled.

4.5.2.2 NSAP

In accord with the MOP, the groundwater at the NSAP will be analyzed for BTEX. The specific associated methods and number of samples are shown on Table 4-1. This sampling event will involve the original, MOP wells (CEF-M18-2I, CEF-M18-3I, CEF-M18-4I and CEF-M18-5I) and the eight new wells for a total of 12 wells to be sampled.

4.5.2.3 Site 46

In accord with the current O&M plan at Site 46, this site will be sampled for BTEX, MTBE, PAHs, and TRPH. Since these wells are outside the ROI, sampling for nutrient analyses will not be accomplished. The specific associated methods and number of samples are shown on Table 4-4. Prior to initiating new

TABLE 4-3
ANALYTICAL SAMPLE SUMMARY
TRUCK STAND

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Proposed Method (1)	Environmental Samples (2)	IDW Samples (3)	Duplicate Samples	MS/MSD (4)	Equipment Blanks	Total Samples
Groundwater							
BTEX, MTBE	SW846 USEPA 8021B or 8260B	3	0	1	1	0	5
PAH (5)	SW846 USEPA 8310	3	0	1	1	0	5

(1) Method referenced reflects FDEP requirements for petroleum contaminants of concern.
(2) Environmental samples include X groundwater samples and Y confirmatory soil samples.
(3) IDW sample numbers based on disposal of approximately Z 55-gallon drums (one composite sample) of soil. Groundwater analyticals will be used to determine the appropriate disposal method of the development and purge water. Soil analytical for VOCs, PAHs, and TRPH (collected from environmental samples) will be used to characterize soil for proper disposal. In accord with Chapter 62-713, FAC, an additional discrete and composite sample will be collected for volatile organic halocarbons and metals, respectively, from the soil IDW generated in order to complete the soil characterization for proper disposal.
(4) MS/MSD = a laboratory quality assurance requirement.
(5) Includes 1-methylnaphthalene, 2-methylnaphthalene and the 16 method-listed PAHs included in Table A of Chapter 62-770, FAC.

well installation, existing well CEF-46-19I will be sampled for the COCs. If the results for this well are below GCTLs, then the proposed intermediate well closest to CEF-46-19I will not be installed. This sampling event will involve only CEF-46-19I and any newly installed wells.

4.5.2.4 SFF

In accord with the current O&M plan at SFF, this site will be sampled for BTEX, MTBE, PAHs, TRPH and total lead. In addition, lab samples will be collected for the following natural attenuation parameters: total organic carbon, sulfate, and methane. These parameters are typically used for petroleum sites to evaluate the effectiveness of natural attenuation. Table 4-5 provides information about the use of these parameters. The specific associated laboratory methods and number of samples for the COCs are shown on Table 4-2. Table 4-6 indicates other natural attenuation parameters that will be measured in the field. The field crew will maintain a log of the natural attenuation field measurements for each well sampled on the sheets supplied in Appendix G.

The sampling will take place on 10 existing wells. Figure 4-7 from the RAP (ABB-ES, 1996b) is included as Appendix H to show these well locations. Though six of the 10 wells have been recently sampled, they were not investigated for natural attenuation parameter comparison. This information will help to determine if the system is effectively working with microbes to remediate the contamination. It should be noted that water table groundwater flow at the site is generally to the south with a south-southeast component on the west side of the site. The wells and the rational for sampling them follow:

Monitoring Well	Relation to plume	Currently Sampled
1. CEF-43-33	Background	Yes
2. CEF-43-38	Background	Yes
3. CEF-43-23	Downgradient Possible Contaminated Area	No
4. CEF-43-12	Downgradient Possible Contaminated Area	No
5. CEF-43-36	Possible Upgradient Source Area	No
6. CEF-43-1N	Possible Upgradient Source Area	No
7. CEF-43-2N	Known Source Area	Yes
8. CEF-43-6N	Known Source Area	Yes
9. CEF-43-7N	Known Source Area	Yes
10. CEF-43-9N	Known Source Area	Yes

TABLE 4-4
ANALYTICAL SAMPLE SUMMARY
SITE 46

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Proposed Method (1)	Environmental Samples (2)	IDW Samples (3)	Duplicate Samples	MS/MSD (4)	Equipment Blanks	Total Samples
Groundwater							
BTEX	SW846 USEPA 8021B or 8260B	4	0	1	1	0	6
PAH (5)	SW846 USEPA 8310	4	0	1	1	0	6
TRPH	FL-PRO	4	0	1	1	0	6

(1) Method referenced reflects FDEP requirements for petroleum contaminants of concern.
(2) Environmental samples include X groundwater samples and Y confirmatory soil samples.
(3) IDW sample numbers based on disposal of approximately Z 55-gallon drums (one composite sample) of soil. Groundwater analyticals will be used to determine the appropriate disposal method of the development and purge water. Soil analytical for VOCs, PAHs, and TRPH (collected from environmental samples) will be used to characterize soil for proper disposal. In accord with Chapter 62-713, FAC, an additional discrete and composite sample will be collected for volatile organic halocarbons and metals, respectively, from the soil IDW generated in order to complete the soil characterization for proper disposal.
(4) MS/MSD a laboratory quality assurance requirement.
(5) Includes 1-methylnaphthalene, 2-methylnaphthalene and the 16-method listed PAHs included in Table A of Chapter 62-770, FAC.

TABLE 4-5
NATURAL ATTENUATION PARAMETERS
FIXED-BASED LABORATORY METHODS[1]
SOUTH FUEL FARM

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Parameter	Method[2]/ Reference	Data Use	Sample Volume, Container, & Preservation
Sulfate (SO_4^{-2})	USEPA 300	Potential substrate for microbial respiration. May compete as an electron acceptor if present at moderate concentrations (>20 mg/L).	250 mL in plastic container. Cool to 4°C. Analyze within 28 days.
Methane	RSK SOP-147 & 175	Presence of methane indicates biological degradation via an anaerobic pathway utilizing CO_2 as an electron acceptor.	40 mL in volatile organic analyte (VOA) vial with Teflon lined septum. HCl to pH <2. Cool to 4°C. Analyze within 14 days.
Total Organic Carbon	E 415.1	Indicates if the groundwater has a sufficient supply of carbon to act as the primary substrate. Collect from well located upgradient of site.	125 mL HDPE. H_2SO_4 to pH < 2.0. Cool to 4°C. Analyze within 28 days.

NOTES:

1 Table adapted from overview of the Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (USEPA, 1998).
2 Method refers to USEPA test methods. Standard Methods are based on Standard Methods for the Examination of Water and Wastewater (APHA, AWWA, and WEF, 1998)
mg/L = milligrams per liter
ml = milliliter
CO_2 = Carbon Dioxide
HCl = Hydrochloric Acid
HDPE = High Density Polyethylene
H_2SO_4 = Sulfuric Acid
APHA = American Public Health Association
AWWA = American Water Works Association
WEF = Water Environmental Federation

TABLE 4-6
NATURAL ATTENUATION PARAMETERS
FIELD METHODS[1]
SOUTH FUEL FARM

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Parameter	Method[2]/ Reference	Data Use	Sample Volume, Container, & Preservation
Temperature	Direct-reading thermometer	Biological processes are temperature dependent.	100-250 ml in glass or plastic container. Analyze immediately.
Dissolved oxygen	CHEMetrics ampoule kits 0-1 mg/L and 1-12 mg/L	Concentration of less than 1 mg/L indicates anaerobic conditions.	Follow test kit instructions. Analyze immediately to nearest 0.2 mg/L.
pH	Direct-reading meter	Biological processes are pH sensitive.	100-250 ml in glass or plastic container. Analyze immediately.
Conductivity	Direct-reading meter	General water quality parameter used to verify that site samples obtained from the same groundwater system.	100-250 ml in glass or plastic container. Analyze immediately.
Alkalinity	HACH Test Kit Number AL-DT - Digital Titration - Phenolphthalein and Total Method (HACH Method 8203)	Total alkalinity provides an indication of the amount of CO_2 generated during aerobic or anaerobic reduction of a hydrocarbon.	Follow test kit instructions. Analyze immediately to determine carbonate, bicarbonate, and hydroxide ions to the nearest 10 mg/L.
Ferrous Iron (Fe^{+2})	HACH Test Kit Number IR-18C - Color Disc - 1,10 Phenanthroline Method	Presence of ferrous iron may indicate presence of an anaerobic degradation process due to depletion of oxygen, nitrate, and manganese.	Follow test instructions. Analyze immediately to nearest 0.2 mg/L.
Oxidation-Reduction Potential (ORP)	Direct-reading meter	ORP provides information on reduction/oxidation conditions and to interpret the nature and state of chemical compounds and biological conditions. ORP typically ranges from +200 mV in normal aerobic, oxidizing conditions to –400 mV in strongly anaerobic, reductive conditions.	100-250 mL in glass container filling from the bottom. Do not aerate or agitate. Analyze immediately.
CO_2	HACH Test Kit Number CA-DT - Digital Titration - Sodium Hydroxide & Phenolphthalein Method (HACH Method 8205)	May be compared with background values as an indication of aerobic and anaerobic process. It is produced during aerobic respiration as well as anaerobic processes. It is utilized during methanogenesis.	Follow test kit instructions. Do not aerate or agitate. Analyze immediately to nearest 0.1 mg/L.

NOTES:
1 Table adapted from overview of the Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (USEPA, 1998).
2 Method refers to USEPA test methods. Standard Methods are based on Standard Methods for the Examination of Water and Wastewater (APHA, AWWA, and WEF, 1998)
mV = millivolts

4.5.3 General Sampling Protocols

The wells will be purged with a peristaltic pump using low flow quiescent purging techniques. The data will be recorded on a low flow purge data sheet (Appendix G). Three to five well volumes will be purged. If wells are purged dry with less than three well volumes removed, the water level in the well will be allowed to recover at least 80 percent, then a sample will be collected. Field measurements of pH, temperature, turbidity, and specific conductance will be taken after each well volume of water is purged, or at 5- or 10-minute intervals, depending on the flow rate. Stabilization will be defined according to criteria stated in the previous paragraph. If stabilization is not achieved after three volumes, up to five volumes will be removed, after which samples will be collected in the appropriate (lab preserved) sample containers. Samples to be analyzed for volatile constituents will be collected first and immediately sealed in 40-ml vials so that no headspace exists. The data acquired during sampling will be recorded on a groundwater sample log sheet (Appendix G).

4.5.4 Aquifer Testing

Aquifer testing will not be necessary to determine aquifer characteristics, since extensive aquifer data for NAS Cecil Field has been obtained and documented by the United States Geological Survey and since many of these sites have been investigated and reported in SARs. This data will be referenced and used if appropriate.

4.6 OTHER TASKS - SFF

Prior to the field work at SFF, the following tasks will be accomplished:

- Review RAP, Remediation Work Plan, and Completion Report to determine if the system was installed as designed.

Then, coinciding with the soil and groundwater sampling tasks, the following tasks will be conducted:

- Perform site visit to inspect the system to determine if the system is operating as designed. Approximately, one to two days will be spent interviewing JAJ personnel, reviewing the system, and adjusting the system to determine its operating range.

- Collect flow, pressure, and temperature measurements along the flow pathways of the bioventing/biosparging system. This effort is intended to provide information on preferred pathways and to determine if the system is operating as designed.

- Install three monitoring points at specified intervals from a current bioventing well and perform a permeability test with the system. Details of the permeability test are discussed below.

4.6.1 Permeability Test

A review of engineering documents for SFF indicates a ROI of 60 ft was selected for the bioventing system. Based on the lithology of the site and other bioventing systems, the ROI of 60 ft for the bioventing system at SFF appears to be high. The lack of soil remediation in an efficient timeframe may be a result of bioventing well placement based on an ROI of 60 ft. To verify, TtNUS will install three monitoring points and perform a permeability test to determine if the ROI of 60 ft is accurate.

4.6.1.1 Monitoring Point Locations for Permeability Test

The permeability test at SFF will be conducted at bioventing well BV-8. BV-8 was selected based on its location near the system compound, but isolation from other bioventing and biosparging lines, which may act as air conduits. A bioventing well adjacent to the system compound is necessary so that the blower pressure and flow rate can be monitored during the test and to remove other factors such as friction loss.

The screened interval and horizontal spacing of the monitoring points has been based on the design and installation of the current system. Air injection and monitoring points will be screened from 3 to 8 ft bls (the same screen depth as the bioventing wells at the site). Horizontal spacing of the monitoring points from bioventing well BV-8 is based on the system design of a ROI of 60 ft. The monitoring points will be horizontally spaced 15, 30, and 60 ft away from BV-8 in a series.

4.6.1.2 Soil Borings for Monitoring Point Installation

Soil borings will be advanced using a DPT rig capable of installing ½ inch ID monitoring wells. Soil samples will be collected using 4-ft soil samplers. A lithological description will be made of each sampler and/or grab sample collected and the on-site geologist will maintain a completed log of each boring (Appendix G). At a minimum, the boring log will contain information on the sample number, sample depth, soil density or cohesiveness, soil color, and United Soil Classification System (USCS) material description. In addition, depths of changes in lithology, sample moisture observation, depth to water, FID readings, drilling methods, and total depth of each borehole, as well as any other pertinent observations, will be included on each log.

4.6.1.3 Monitoring Point Installation

A monitoring point will be installed at each of the soil boring locations. The monitoring points will be screened from 3 to 8 ft bls. Each of the monitoring points will be constructed of ½ inch ID, Schedule 80 PVC or equivalent. Each monitoring point will have 0.020 inch slot well screen from 3 to 8 ft bls. The monitoring points will be backfilled with 6-20 filter pack material to a depth of 1 ft above the well screen. A minimum of 1 ft of 30-65 fine sand will be placed above the top of the filter pack to act as a seal. The remainder of the borings will be grouted to ground surface.

Each monitoring point will stick up 3 ft above ground surface for easy access during the permeability test. Caps will be made for each of the monitoring points with connectors to allow pressure monitoring and soil vapor measurements during the soil permeability tests.

4.6.1.4 Soil Permeability Test

Before the soil permeability test begins, the site will be inspected for structures, including monitoring wells, which may act as air conduits during the test. A brief system check will be conducted on the bioventing system blower to ensure proper operation of the blower and monitoring equipment. Following the system check, the valves for the other bioventing wells will be closed. This will allow for airflow only to bioventing well BV-8, and thus removing influences from other wells in the system. Following the system check, and manipulation of the system, soil permeability tests will be run for the site. The soil permeability tests will be conducted in accordance with the Principles and Practices of Bioventing (Leeson and Hinchee, 1996).

During the soil permeability test, the injection pressure and airflow to bioventing well BV-8 will be monitored. The first permeability test will be run at current system setting of 4 cubic ft per minute (cfm) airflow. The pressure changes in each of the monitoring points will be measured and recorded. Barometric pressure will be monitored onsite during the soil permeability test intervals or may be obtained from JAA.

Each soil permeability test will be run until pressure changes at the outermost monitoring point are less than 10 percent over a one-hour interval, approximately two to four hours. Several tests may be necessary to determine an accurate ROI, with the airflow rate to BV-8 adjusted upwards on consecutive tests if the first test at 4 cfm does not produce conclusive data.

The airflow rate and pressure data recorded from the soil permeability tests will be entered into a software program to calculate the ROI of the bioventing system.

4.7 EQUIPMENT DECONTAMINATION

The equipment involved in well installation and well sampling activities will be decontaminated prior to and during the respective field activities in accordance with the FDEP SOPs and the TtNUS CompQAP.

4.8 WASTE HANDLING

Drill cuttings from the DPT screening survey and well installations and water from the well development and purging and sampling will be collected and containerized in Department of Transportation approved (17-E or 17-H) 55-gallon drums. Each drum will be sealed, labeled, and maintained on site, pending IDW analytical results. For this investigation, a single, composite soil IDW sample will be collected for each site to characterize the soil IDW for disposal except at SFF where the soil analytical data will be used to partially characterize the soil IDW. In addition, to satisfy the requirements of Chapter 62 713, FAC, one discrete and one composite soil sample will be collected for each site from the drums of soil IDW for the remaining analytical. Tables 4-1 through 4-4 list and describe the sample requirements for the soil IDW samples. Groundwater analytical results from the mobile and fixed-based laboratories will be used for aqueous IDW disposal. The method of off-site disposal will be determined by these analytical results.

A lined decontamination pad will be constructed and used to collect the water from steam cleaning of drilling equipment. Decontamination materials generated during the site investigation will be containerized for proper disposal.

4.9 SAMPLING HANDLING

Sample handling includes the selection of sample containers, preservatives, allowable holding times, and analytical methods. In addition, sample identification, packaging, and shipping will be addressed. Sample handling procedures will be in accordance with TtNUS' FDEP approved CompQAP Number 980038.

4.10 SAMPLE PACKAGING, SHIPPING, AND NOMENCLATURE

Samples will be packaged and shipped in accordance with TtNUS's CompQAP. The FOL will be responsible for completing the following forms when samples are collected for shipping:

- Sample labels
- Chain-of-Custody labels
- Appropriate labels applied to shipping coolers

- Chain-of Custody Forms
- Federal Express Air Bills

Each site will be assigned a unique facility number as follows: Truck Stand = 372, NSAP = M18, Site 46 = 46, and SFF = 43. Each sample will be assigned a unique sample identification number. The unique label system established for this sampling event is as follows:

1	2	3	4
General Site Name	**Facility Number**	**Sample Identifier**	**Sequence Number**

Where:

1	General Site Name	CEF
2	Facility Number	372, M18, 46, or 43
3	Sample Identifier	DPT groundwater location number; monitoring well identification number, and soil boring identification number
4	Sequence number	See below

Special note regarding monitoring well numbering: Monitoring well numbers for NAS Cecil Field will be coordinated with the Geographic Information System specialists at TtNUS Pittsburgh when assigning the next set of well numbers at each site to prevent replicate numbers.

TtNUS personnel will assign identification numbers to DPT locations, specifically for groundwater samples (e.g., DP01, etc.). They will also assign identification numbers to monitoring wells (e.g., 1S for first shallow well, 2S for second shallow well, 1I for intermediate well, etc.). Soil borings associated with this effort will begin at SB01 and continue numbering in a consecutive fashion (e.g., SB02, SB03, etc.).

For soil samples, the sequence number will be representative of the lower depth of the soil sample (e.g., a soil sample collected from the 1- to 3-ft interval of a soil boring will have a sequence number of 3, a sample from the 3- to 5-ft interval will have a sequence number of 5). For groundwater samples collected with the DPT equipment, the sequence number will be representative of the lower depth of the groundwater sample (e.g., a groundwater sample collected from the 6- to 10-ft interval would have a sequence number of 10). Groundwater samples collected from permanent monitoring wells will have a sequence number beginning at 01 and continuing consecutively, based on the sampling round. This assumes that if permanent wells are located during the screening effort, the samples collected for field screening will have a sequence number 01 and the samples collected during the second phase of this investigation will have the sequence number 02.

For example, a groundwater sample collected from intermediate monitoring well number one at the Truck Stand site during the first groundwater sampling round would have the following nomenclature:

CEF-372-1I-01

A soil sample collected from the 3- to 5-ft interval at boring SB02 at the SFF would have the following nomenclature:

CEF-43-SB02-05

4.11 SAMPLE CUSTODY

The chain-of-custody begins with the release of the empty sample bottles from the laboratory and must be documented and maintained from that point forward. To maintain custody of the sample bottles or samples, they must be in someone's physical possession, in a locked room or vehicle, or sealed with an intact custody seal. When the possession of the bottles or samples is transferred from one person to another it will be documented in the field logbook and on the chain-of-custody.

4.12 QUALITY CONTROL (QC) SAMPLES

The FDEP UST rule Chapter 62-770.400, FAC, Quality Assurance (QA) Requirements, stipulates that all sampling and analyses under this rule will be performed in accordance with Chapter 62-160, FAC, QA. Formerly, that rule indicated that UST sites under Chapter 62-770, FAC belonged to Category 3. Category 3 was an FDEP QA category that required all parties involved with sample collection and analysis to have an FDEP-approved CompQAP that addressed all the sampling protocols and analytical tests required by the specific activity. That requirement changed in May 2002, but sites that began under the old rule are allowed to continue under that rule. Therefore, TtNUS' CompQAP Number 980038 will be followed for guidance regarding sampling protocols and analytical tests. In addition to periodic calibration of field equipment and appropriate documentation on a field calibration sheet (Appendix G), QC samples will be collected or generated during environmental sampling activities. QC samples will be collected in accordance with the requirements established during the Plan of Action negotiations.

QC samples will be collected in accordance with the "Proposal for Reduction of QA Sample Collection and Data Validation" from the NASC Cecil Field Installation Restoration and Base Realignment and Closure programs, which is summarized in Table 4-7.

TABLE 4-7
QUALITY CONTROL SAMPLE FREQUENCY

Work Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Type of samples	Number of samples	Frequency
Field Duplicate	10+	1/10 samples/matrix
Field Duplicate	5 to 9	1 per matrix
Field Duplicate	Less than 5	Not required
Lab MS/MSD	Less than 20	At least 1
Lab MS/MSD	20+	1/20 samples
Field Blank	Not Applicable	1 every 6 months or if source changes

(1) MS/MSD is a laboratory QA/QC requirement, separate sample not required, only additional volume.
(2) Rinsate blanks (or equipment blanks) and trip blanks have been eliminated from the QA program.
(3) See HLA QA reduction memo or CompQAP for explanations of QC sample types.

As agreed upon by the BCT, formal data validation has been eliminated from the installation restoration program at NAS Cecil Field; however, TtNUS personnel will review the analytical data packages generated by the analytical laboratory to eliminate false positive and false negative results.

4.13 SITE MANAGEMENT AND BASE SUPPORT

TtNUS will perform this project with support from the Navy. This section of the work plan describes the project contacts, support personnel, project milestones, and time frames of all major events.

Throughout the duration of the investigation activities, work at NAS Cecil Field (now known as Cecil Commerce Center) will be coordinated through SOUTHNAVFACENGCOM, FDEP, and Cecil Commerce Center/Jacksonville Airport Authority personnel. The primary contacts are as follows:

1. SOUTHNAVFACENGCOM Engineer in Charge
   Mr. Wayne Hansel
   (843) 820-5624

2. FDEP
   Mr. David Grabka
   (850) 488-3693

3. Cecil Commerce Center
   Mr. Mark Roberts
   (904) 573-0336

4. JAA
   Mr. Roy Craigue
   (904) 573-1607

SOUTHNAVFACENGCOM personnel will provide the following support functions:

- Provide existing engineering plans, drawings, diagrams, files, etc. to facilitate evaluation of the sites under investigation.

- Provide all historical data, background geological and hydrogeological information, and initial site investigation documents.

JAA personnel will aid in arranging the following:

- Personnel identification badges, vehicle passes, and/or entry permits.
- Provide areas for storage of IDW as necessary.

The project will be staffed with personnel from the TtNUS' Jacksonville, Florida office. During field activities, TtNUS will provide an FOL, who is familiar with the scope of work to be completed and requirements of working at NAS Cecil Field. Additionally, TtNUS will supply one DPT rig with mobile laboratory, one hollow stem drill rig, one mud rotary rig, and a TtNUS field crew to supervise drilling activities and sample the groundwater monitoring wells.

Mr. Paul Calligan, is the Task Order Manager (TOM) for CTO 0248 and will be the primary point of contact for the base and the FOL. He is responsible for cost and schedule control as well as technical performance. Mr. Calligan will provide senior level review and oversight during field activities.

4.14 CONTINGENCY PLAN

In the event of problems that may be encountered during site activities, the SOUTHNAVFACENGCOM point of contact will be notified immediately, followed by the TtNUS TOM and the Cecil Commerce Center/JAA point of contact. The TOM will determine a course of action designed not to interfere with the schedule or budget. All contingency plans will be approved through the SOUTHNAVFACENGCOM point of contact before being enacted.

5.0 PROPOSED LABORATORY ANALYSIS

Tables 4-1 through 4-5 contain the basic information for each site's soil and/or groundwater fixed-based analytical requirements. The aqueous IDW components will be characterized for proper disposal based on the groundwater analytical data collected for each site.

At the other three sites where soil cuttings will be generated but no soil analytical data is planned for collection, a composite soil sample will be collected for the COCs, VOHs and metals (total arsenic, cadmium, chromium, and lead). This data will be used to characterize the soil IDW for proper disposal.

Analyses for VOHs and total metals (arsenic, cadmium, chromium, and lead) is required to comply with the soil thermal treatment and disposal regulations in Chapter 62-713, FAC.

During the DPT field-screening portion of the supplemental assessment at NSAP, a fixed-based laboratory will analyze groundwater samples for BTEX.

At the SFF, the soil analytical data will be supplemented with composite analytical data of the VOH and metals (total arsenic, cadmium, chromium, and lead) fractions to characterize any soil IDW for proper disposal.

6.0 LEVEL OF EFFORT

Field activities including DPT soil and groundwater screening, monitoring well installation and development, sampling, surveying, aquifer testing, and IDW management at these five sites are proposed to begin in June 2002 and take approximately ten months to complete. The following is the anticipated level of effort for the activities associated with this investigation:

- Utility Clearances 2 weeks
- DPT and Mobile Lab Mobilization 1 day
- DPT and Mobile Lab Investigation 3 days
- Driller Coordination and Mobilization 2 days
- Monitoring Well Installation and Development 8 days
- Monitoring Well Sampling 4 days
- Monitoring Well Re-sampling (if needed) 2 days
- Off-site Laboratory Analyses 30 days
- IDW Management/Disposal 4 days

It is currently anticipated that tasks for this project will be completed with limited delays occurring during transition between tasks. However, delays during task transition are possible.

Assuming that nothing unusual is found during this scope of work, once the fieldwork is complete and the laboratory analytical data is received and processed, a letter report will be prepared for each site except SFF. TtNUS will prepare a RAP Addendum for that site. Prior to final submittal of these documents, TtNUS will present the results to the BCT.

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APPENDIX A

CONTAMINATED SOIL EVALUATION
DAY TANK 1

Contaminated Soil Evaluation

Day Tank 1

BCT Meeting

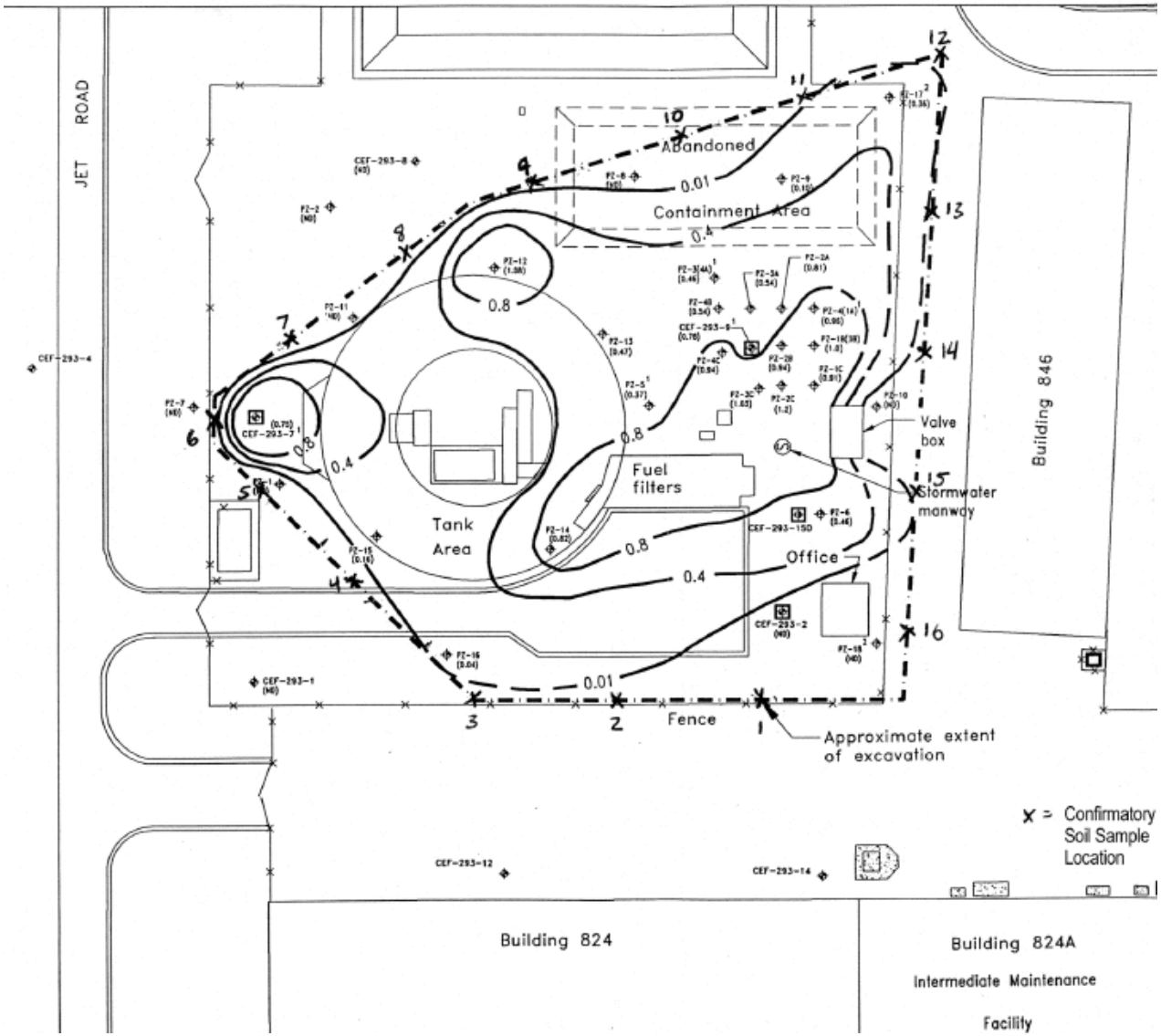
May 2002

Day Tank 1 Contaminated Soil Evaluation

- The Day Tank 1 site formerly contained a 200,000-gallon aboveground storage tank (AST), piping, and associated equipment to supply jet propellant fuel to the high-speed refuelers located on the flightline.
- A Remedial Action Plan (RAP) was developed by ABB-ES in 1997 for the excavation of 20,000 tons of petroleum-contaminated soil and the installation of a biosparging and VCS treatment system to address the contaminated groundwater at the site.

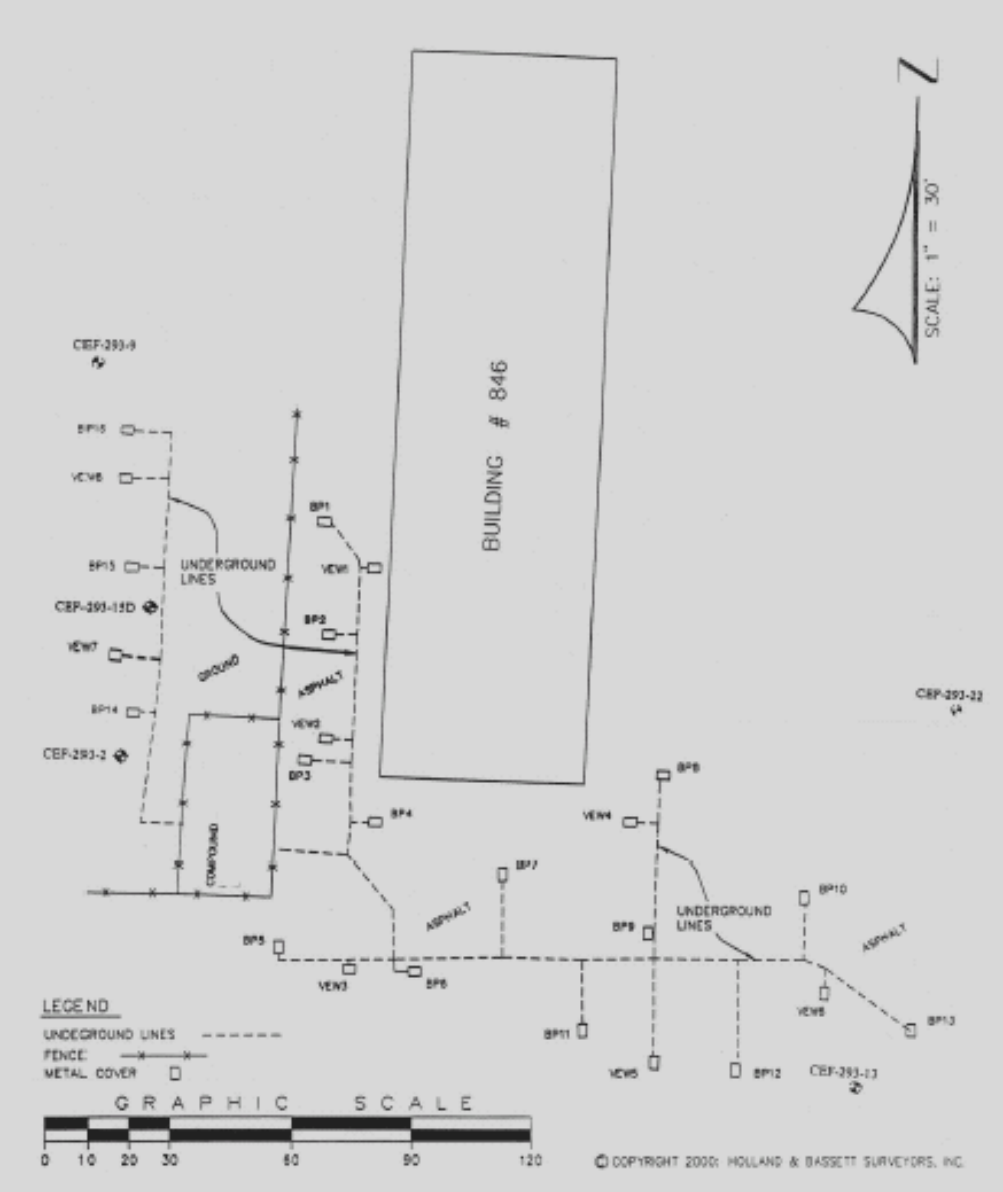
Day Tank 1 Contaminated Soil Evaluation

The AST was removed and 24,000 tons of contaminated soil was excavated in November 1999 by CCI/J.A. Jones.



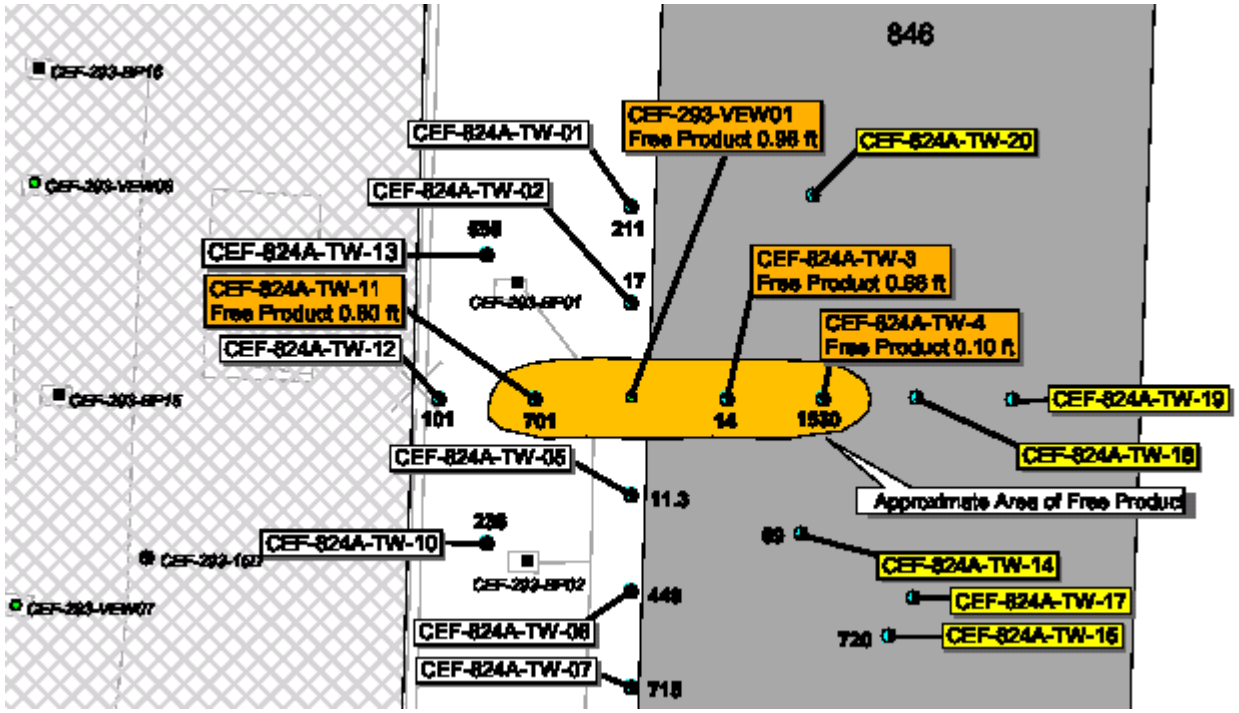
Day Tank 1 Contaminated Soil Evaluation

The remediation system was constructed by CCI/J.A. Jones from January 2000 to February 2000 and start-up was performed on February 29, 2000. The system has operated continuously to date since start up.



Day Tank 1 Contaminated Soil Evaluation

A free product plume measuring approximately 50 feet long by 15 feet wide by 2 feet thick (maximum) has been present at the site since the remediation system was started up.



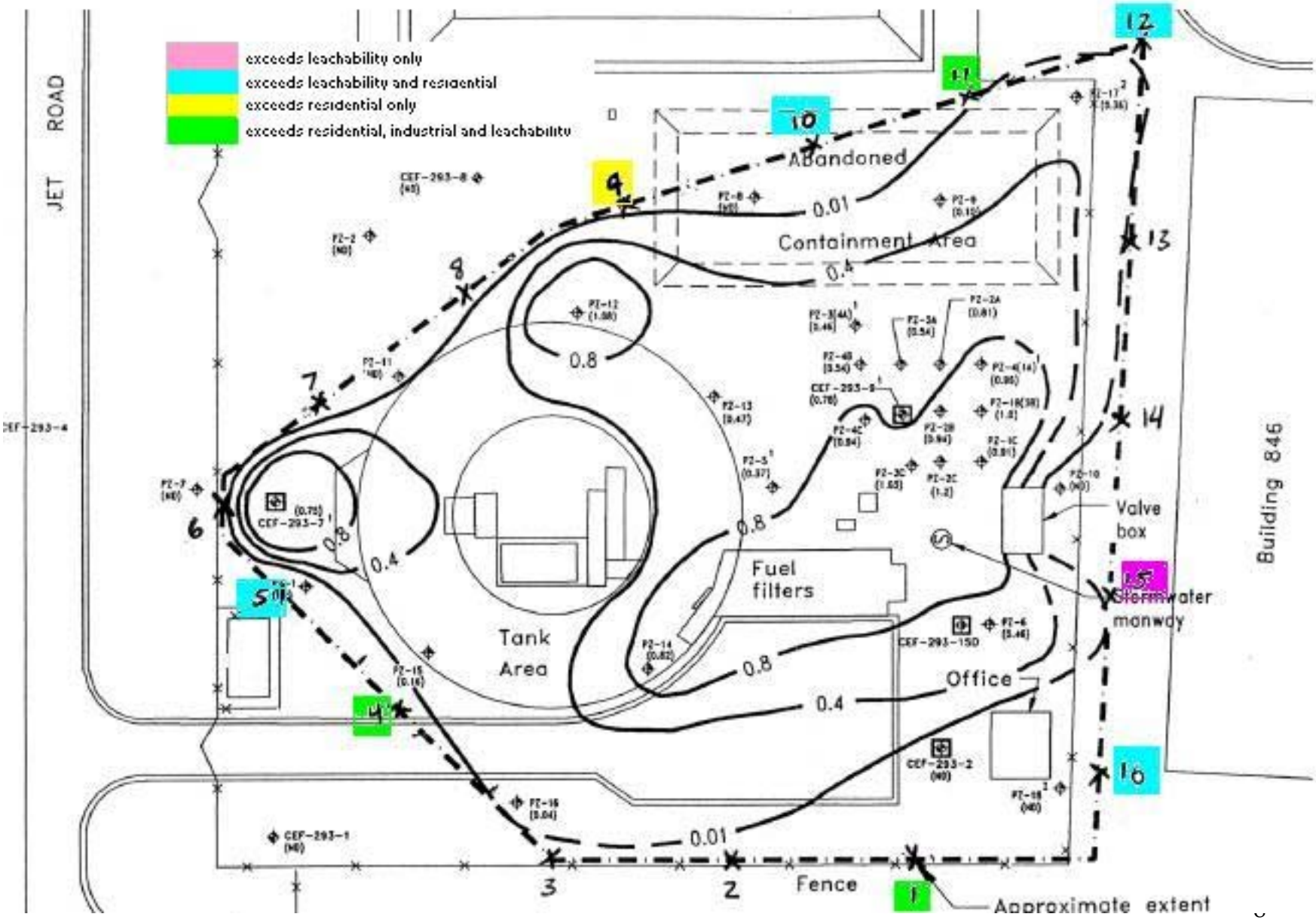
Day Tank 1 Contaminated Soil Evaluation

- Seven of sixteen confirmatory soil samples that were collected during the Source Removal exceeded industrial, residential, and/or leachability SCTLs.
- Two of the locations are within the radius of influence of the existing remediation system.
- The remaining five locations would require additional measures to remediate.

Day Tank 1 Source Removal
Summary of KAG Analyses for Soil

Sample Location	Depth	Sample ID	Date	TRPH	Dibenzo (a,h) Anthracene	Naphthalene	1- Methylnaphthalene	2- Methylnaphthalene	Ethylbenzene	Toluene	Xylenes
South Wall	7'	293 C-1	10/06/99	8,400	0.02	13	51	36	10	1.7	35
South Wall	7'	293 C-2	10/06/99	<2.8	ND	ND	ND	0.02	ND	0.0013	ND
South Wall	9'	293 C-3	10/06/99	<2.7	ND	ND	ND	ND	ND	0.0014	0.0006
Southwest Wall	5'	293 C-4	10/06/99	7,200	ND	5.4	25	18	ND	ND	9.4
Southwest Wall	7'	293 C-5	10/06/99	350	0.24	0.036	ND	ND	0.062	ND	0.25
West Wall	7'	293 C-6	10/07/99	15	ND	0.03	ND	0.02	0.002	0.002	0.006
Northwest Wall	5'	293 C-7	10/07/99	9.4	0.03	0.045	ND	0.04	0.0002	0.0009	0.0006
Northwest Wall	5'	293 C-8	10/07/99	100	0.02	ND	1.4	ND	ND	0.0031	0.0018
North Wall	5'	293 C-9	10/07/99	20	0.33	0.085	0.69	0.38	ND	ND	0.09
North Wall	7'	293 C-10	10/07/99	490	ND	0.075	1.2	0.54	ND	0.13	0.33
North Wall	7'	293 C-11	10/07/99	11,000	ND	11	50	37	ND	ND	13
North East Corner	8'	293 C-12	10/07/99	2,400	0.29	1.6	10	6.8	ND	ND	3.4
East Wall	5'	293 C-13	11/05/99	ND	ND	ND	ND	ND	0.0006	0.0011	0.0022
East Wall	5'	293 C-14	11/05/99	2.7	ND	ND	ND	ND	0.0003	0.0006	0.0011
East Wall	5'	293 C-15	11/05/99	120	ND	5.9	35	21	1.3	ND	4.7
East Wall	5'	293 C-16	11/05/99	480	ND	6.9	36	24	3.7	0.16	11
RAP Specified Target				380	NA	1,400	NA	NA	1,400	450	12,000
SCTL (Industrial)				2,500	0.5	270	470	560	8,400	2,600	40,000
SCTL (Residential)				340	0.1	40	68	80	1,100	380	5,900
SCTL (Leachability)				340	30	1.7	2.2	6.1	0.6	0.5	0.2

exceeds leachability only
exceeds leachability and residential
exceeds residential only
exceeds residential, industrial and leachability

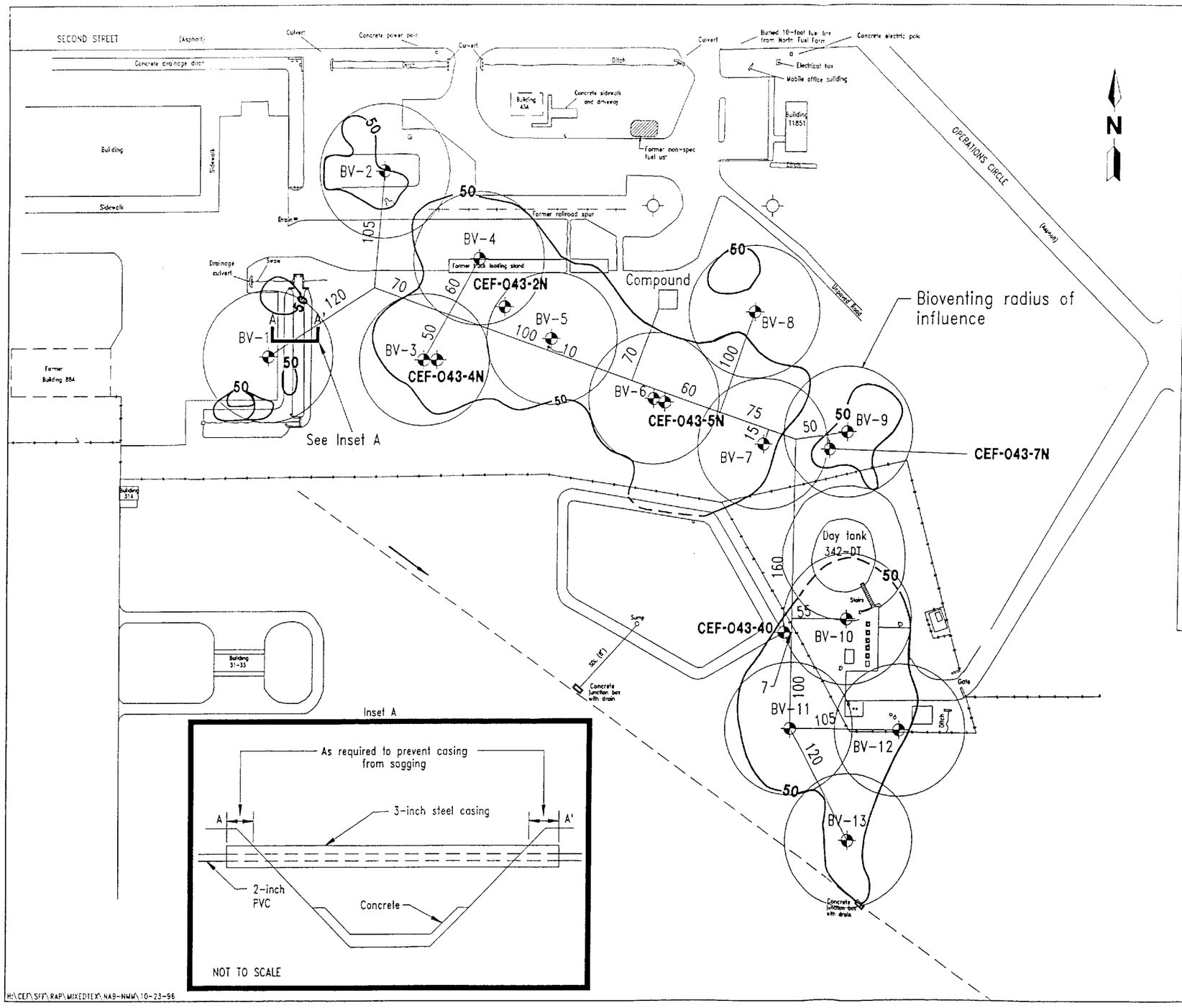

exceeds leachability only
exceeds leachability and residential
exceeds residential only
exceeds residential, industrial and leachability
JET ROAD
Abandoned
Containment Area
Tank Area
Fuel filters
Office
Valve box
Stormwater manway
Building 846
Fence
Approximate extent
0.01
0.4
0.8
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

Day Tank 1 Contaminated Soil Evaluation

- An excavation has been planned to remove the free product plume.
- Contaminated soil is still present at the site.
- Options include: 1) Institutional Controls; 2) Excavation; 3) Remediation System Expansion; 4) Other.
- Further delineation and determination of goals will be required before a complete comparison and evaluation can be performed.

APPENDIX B

FIGURE 4-1 – BIOVENTING LAYOUT
FROM ABB-ES REMEDIAL ACTION PLAN (1996b)



LEGEND

CEF-043-4N	Existing shallow monitoring well and designation
BV-1	Bioventing well (radius of influence of 60 feet)
SDL	Stormwater drainline
	Existing power pole
	Fence
	Stormwater flow direction
50	Soil contamination contour (OVA > 50 ppm) (dashed where inferred)
PVC	Polyvinyl chloride
55	Distance between header line and well or between branches along the header line (feet)

NOTES:
1. All piping is 2-inch Schedule 40 PVC. Clean and glue all joints.
2. Use 18-inch minimum cover on all piping.
3. Repair all asphalt cuts to precut conditions.
4. Supply compound with power from existing power poles.
5. See Figure 4-2 for well vault details.
6. See Figure 4-3 for compound details.
7. Use existing monitoring wells as reference points to locate header.

0 50 100
SCALE: 1 INCH = 100 FEET

FIGURE 4-1
BIOVENTING LAYOUT

REMEDIAL ACTION PLAN
SOUTH FUEL FARM SITE
FACILITY 43

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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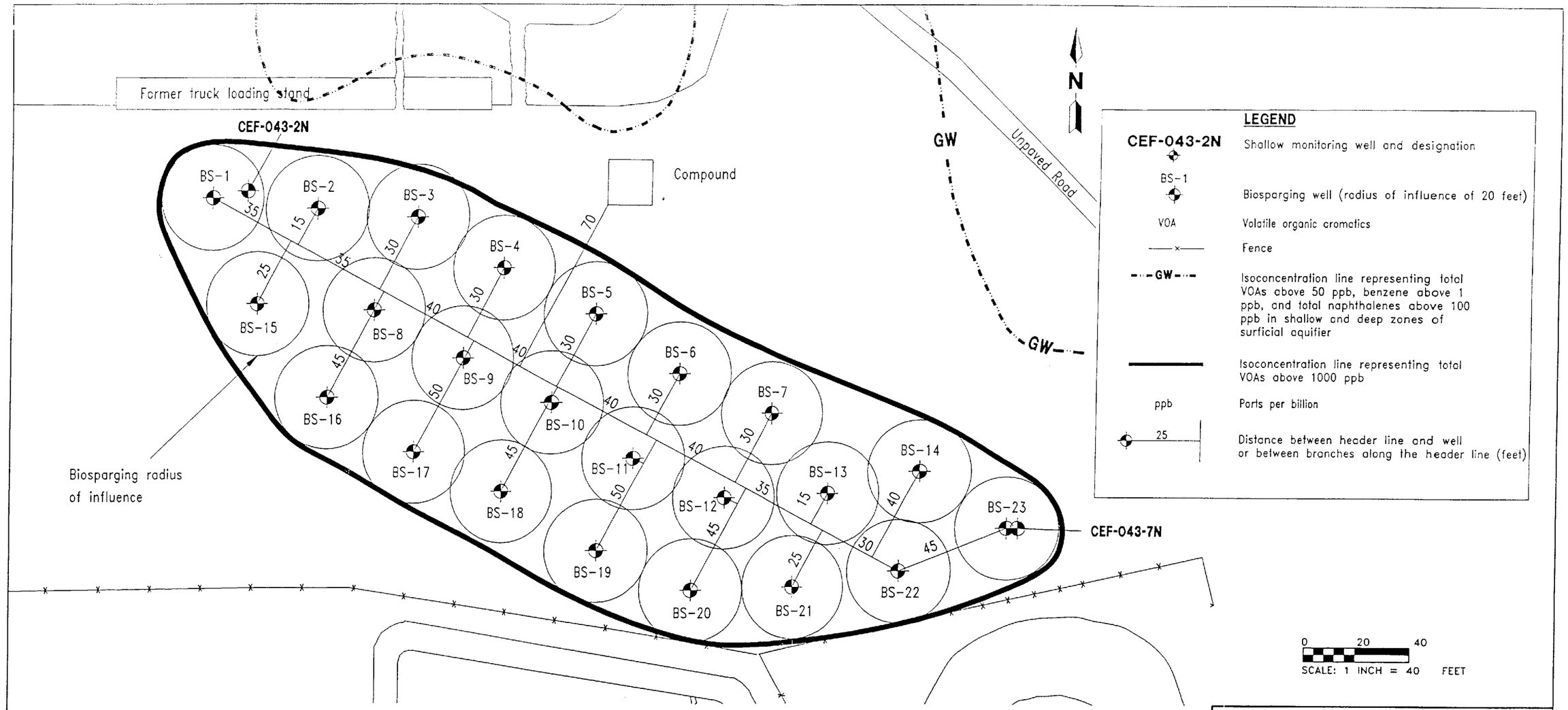
APPENDIX C

FIGURE 4-5 – BIOSPARGING LAYOUT
FROM ABB-ES REMEDIAL ACTION PLAN (1996b)



NOTES:
1. All piping is 3/4-inch schedule 40 polyvinyl chloride.
2. Use 18-inch minimum cover.
3. See Figure 4-6 for well vault details.
4. See Figure 4-3 for compound details.
5. Use existing monitoring wells as reference points to locate header.

FIGURE 4-5
BIOSPARGING LAYOUT

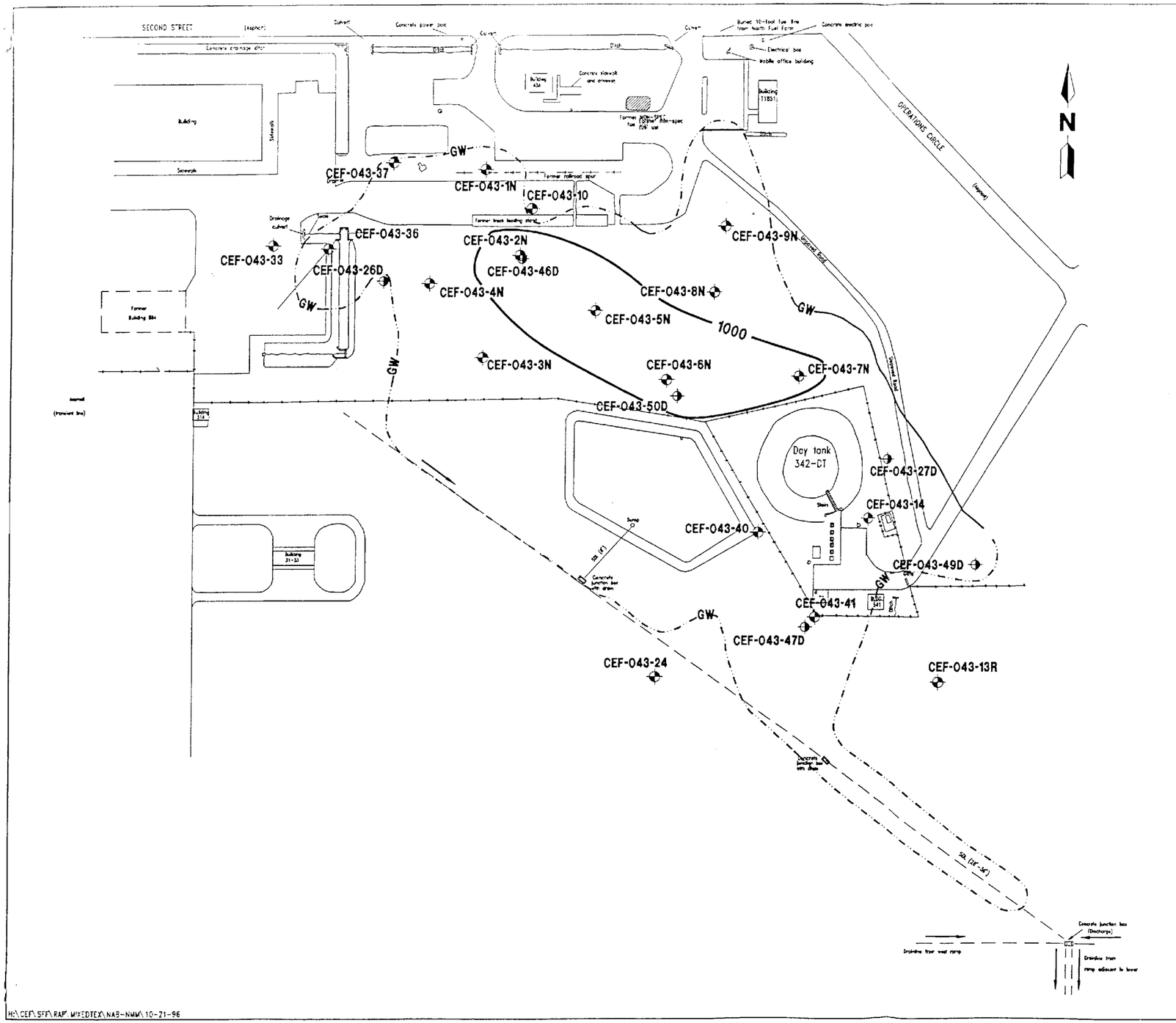
REMEDIAL ACTION PLAN
SOUTH FUEL FARM SITE
FACILITY 43

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

H:\CEF\SFF\RAP\MIXEDTEX\NAB-NMM-NP\10-28-96

APPENDIX D

FIGURE 4-4 – EXTENT OF GROUNDWATER CONTAMINATION FROM ABB-ES REMEDIAL ACTION PLAN (1996b)



LEGEND

CEF-043-44	Shallow monitoring well and designation
CEF-043-27D	Deep monitoring well and designation
1000	Groundwater contamination contour (total VOA concentration ≥ 1000 ppb)
ppb	Parts per billion
VOA	Volatile organic aromatics
SDL	Stormwater drainline
UST	Underground storage tank
	Fence
	Stormwater flow direction
GW	Isoconcentration line representing total VOAs above 50 ppb, benzene above 1 ppb, and total naphthalenes above 100 ppb in shallow and deep zones of surficial aquifier

0 60 120
SCALE: 1 INCH = 120 FEET

FIGURE 4-4
EXTENT OF GROUNDWATER CONTAMINATION (TOTAL VOA CONCENTRATION GREATER THAN OR EQUAL TO 1000 ppb)

REMEDIAL ACTION PLAN
SOUTH FUEL FARM SITE
FACILITY 43

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

H:\CEF\SFF\RAP_MXEDTEX\NAS-NMM\10-21-96

APPENDIX E

TABLE 2 – SUMMARY OF ANNUAL GROUNDWATER SAMPLING DETECTIONS FROM ENSAFE SOIL AND GROUNDWATER MONITORING REPORT (2001)

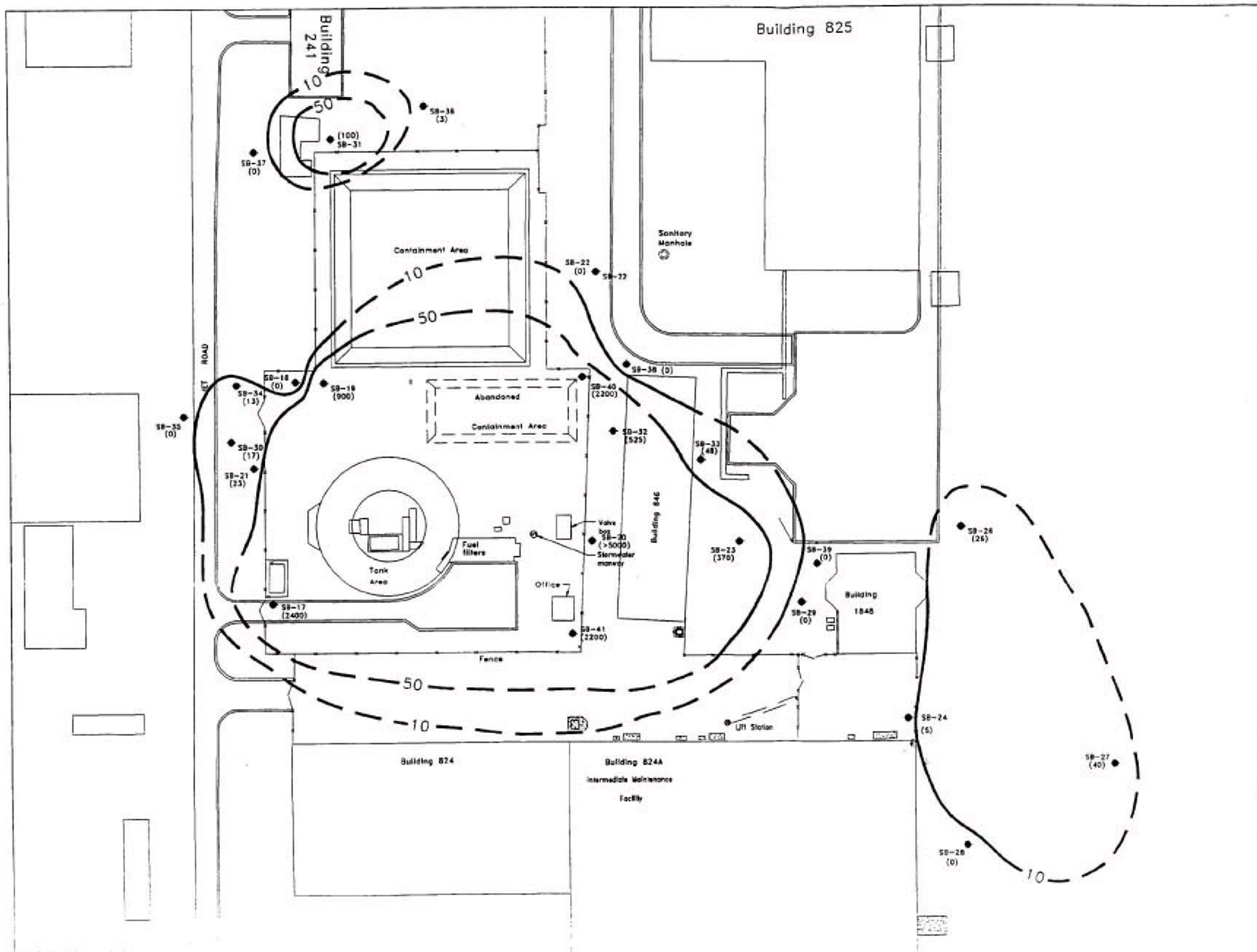
Table 2
Summary of Annual Groundwater Sampling Detections
(μg/L, except as noted)

	SCTL*	CEF-043-9N	CEF-043-6N	CEF-043-7N	CEF-043-2N	CEF-043-38	CEF-043-33
EPA Method 602 — Volatile Aromatics							
Benzene	1	BDL	11	BDL	BDL	BDL	BDL
Toluene	40	4.2	80	2.2	380	BDL	BDL
Ethylbenzene	30	23	190	3.0	100	BDL	BDL
m-Xylene & p-Xylene	20	40	630	4.4	180	BDL	BDL
o-Xylene	20	38	250	8.2	110	BDL	BDL
EPA Method 610 — Poly aromatic Hydrocarbons							
Naphthalene	20	18	BDL	BDL	56	BDL	BDL
2-Methylnaphthalene	20	13	BDL	BDL	28	BDL	BDL
1-Methylnaphthalene	20	BDL	BDL	BDL	14	BDL	BDL
EPA Method FLPRO — Petrol Residual Organics							
Hydrocarbons (mg/L)	5,000	1.5	14	0.60	30	BDL	BDL
EPA Method 200.7 — Lead							
Lead (mg/L)	0.015	0.020	0.048	0.013	0.019	0.049	0.020

Notes:
BDL = Below Detection Limits - refer to lab summary for detection limits used
μg/L = microgams per liter
mg/L = milligrams per liter
VOHs = all analytes were below detection limits.
* = Groundwater Cleanup Target Level for Petroleum Products Contaminants of Concern (Chapter 62-777, FAC, August 5, 1999)
Shaded backgrounds indicate exceedance of target level.

APPENDIX F

FIGURE 3-2 – SOIL CONTAMINATION DISTRIBUTION MAP FROM ABB-ES REMEDIAL ACTION PLAN (1997)



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Notes:

1. Soil boring advanced in 1990; confirmation sampling recommended.
2. Soil borings SB-1 through SB-16 were not advanced to the groundwater table and therefore not used for contouring purposes.

LEGEND

SB-23 (370) — Soil boring location and designation with OVA reading (parts per million)

— 50 — OVA Isoconcentration (ppm) line (Dashed where inferred)

0 40 80

SCALE: 1 INCH = 80 FEET

FIGURE 3-2
SOIL CONTAMINATION DISTRIBUTION MAP
2-7 FEET BELOW LAND SURFACE
DECEMBER 1990 THROUGH SEPTEMBER 1996

REMEDIAL ACTION PLAN
DAY TANK 1, FACILITY 293

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

APPENDIX G

FIELD FORMS

Tetra Tech NUS, Inc.

DAILY ACTIVITIES RECORD

PROJECT NAME:	SFF, Truck Stand, Site 46, NSAP, DT1	**PROJECT NUMBER:**	N4248MW0050
CLIENT:	U.S. NAVY	**LOCATION:**	Cecil Field
DATE:		**ARRIVAL TIME:**	
Tt NUS PERSONNEL:		**DEPARTURE TIME:**	
CONTRACTOR:		**VENDOR:**	

Item	Description	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

LOCATION	FOOTAGE	IDW Drum Labels		

COMMENTS:

APPROVED BY:

Tt NUS REPRESENTATIVE

VENDOR

DATE:

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SFF, Truck Stand, Site 46, NSAP, DT1
Project No.: N4248MW0050

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: NA				
Method: NA				
Monitor Readings (Range in ppm): NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SFF, Truck Stand, Site 46, NSAP, DT1
PROJECT NUMBER: N4248MW0050
DRILLING COMPANY: ______
DRILLING RIG: ______
BORING NUMBER: ______
DATE: ______
GEOLOGIST: ______
DRILLER: ______

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			U S C S *	Remarks	PID/FID Reading (ppm)			
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ______

Drilling Area Background (ppm): ______

Converted to Well: Yes ______ No ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

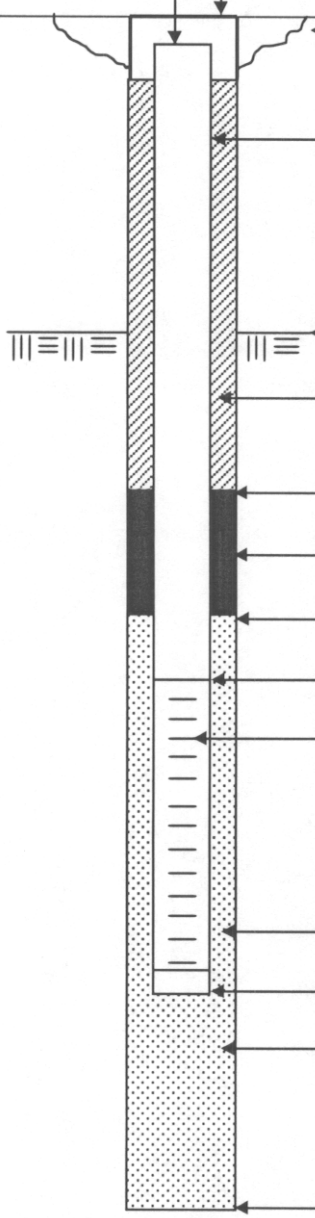
WELL No.: _____

MONITORING WELL SHEET (SINGLE-CASED)

PROJECT:		DRILLING Co.:		BORING No.:	
PROJECT No.:	N4248	DRILLER:		DATE COMPLETED:	
SITE:		DRILLING METHOD:		NORTHING:	
GEOLOGIST:		DEV. METHOD:		EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: /

Elevation / Height of Top of Surface Casing: /

I.D. of Surface Casing: 8"

Type of Surface Casing: Steel

Type of Surface Seal: _____

I.D. of Riser: _____

Type of Riser: PVC

Borehole Diameter: _____

Elevation / Depth Top of Rock: /

Type of Backfill: _____

Elevation / Depth of Seal: /

Type of Seal: 30/65 Sand

Elevation / Depth of Top of Filter Pack: /

Elevation / Depth of Top of Screen: /

Type of Screen: PVC

Slot Size x Length: _____

I.D. of Screen: _____

Type of Filter Pack: _____

Elevation / Depth of Bottom of Screen: /

Elevation / Depth of Bottom of Filter Pack: /

Type of Backfill Below Well: _____

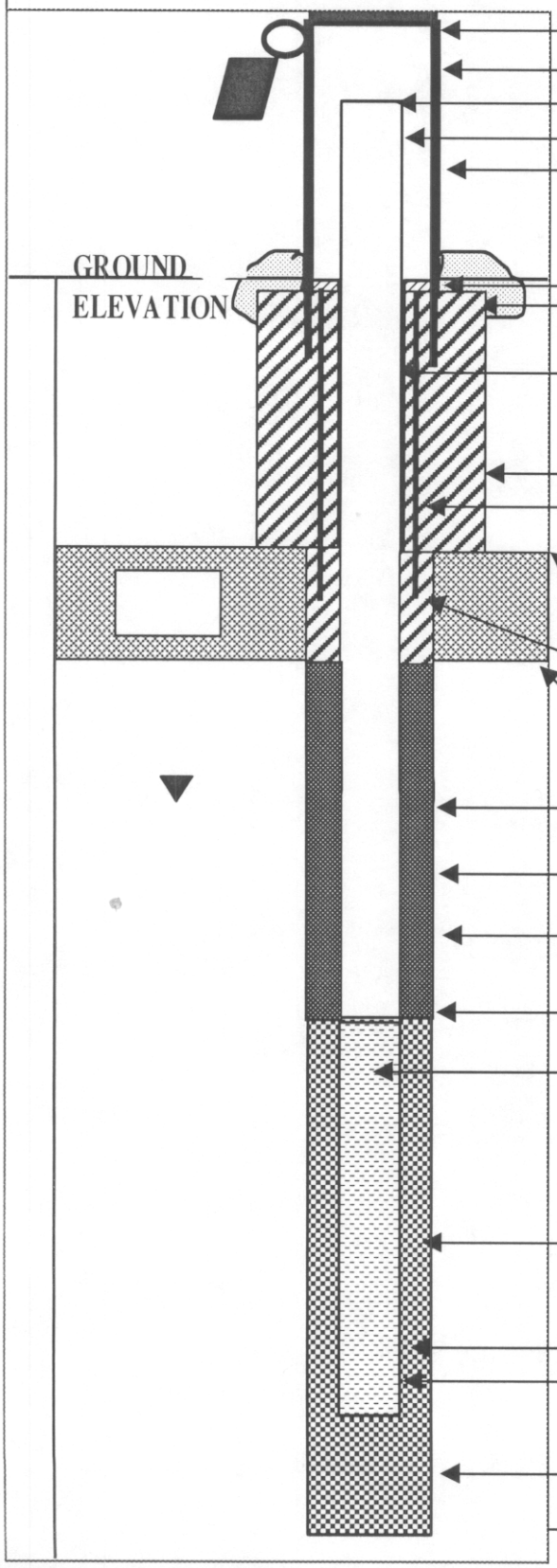
Elevation / Total Depth of Borehole: /

BORING NO.: _____

Tetra Tech NUS, Inc. **DOUBLE-CASED MONITORING WELL SHEET**

PERMIT No. Not Req'd

PROJECT:	NAS Cecil Field	DRILLING Co.:		BORING No.:	
PROJECT No.:	N4248	DRILLER:		DATE COMPLETED:	
SITE:		DRILLING METHOD:		NORTHING:	
GEOLOGIST:		DEV. METHOD:		EASTING:	



ELEVATION OF TOP OF SURFACE CASING: _____

STICK -UP TOP OF SURFACE CASING: FLUSH

ELEVATION OF TOP OF RISER PIPE: _____

RISER STICK-UP ABOVE GROUND SURFACE: NONE

I.D. OF SURFACE CASING: _____

TYPE OF SURFACE CASING: STEEL, BOLTDOWN

GROUND ELEVATION: _____

TYPE OF SURFACE SEAL: 2 X 2 X 6" CONC. PAD

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: _____

PERM. CASING I.D. : 6"

TYPE OF CASING & BACKFILL: PVC, SCHEDULE TYPE I PORTLAND CEMENT

ELEVATION / DEPTH TOP CONFINING LAYER ____/____

ELEVATION / DEPTH BOTTOM OF CASING ____/____

ELEVATION / DEPTH BOT. CONFINING LAYER ____/____

ELEVATION / DEPTH OF SEAL: ____/____

TYPE OF SEAL: MEDIUM SAND (30/65)

ELEVATION / DEPTH TOP OF FILTER PACK: ____/____

ELEVATION / DEPTH TOP OF SCREEN: ____/____

TYPE OF SCREEN: PVC SCHEDULE 40

SLOT SIZE X LENGTH: 0.010" X 5'

I.D. OF SCREEN: 2"

TYPE OF FILTER PACK: COARSE SAND (20/30)

BOREHOLE DIAMETER BELOW CASING: _____

ELEVATION / DEPTH BOTTOM OF SCREEN: ____/____

ELEVATION / DEPTH BOTTOM OF FILTER PACK: ____/____

TYPE OF BACKFILL BELOW WELL: _____

ELEVATION / DEPTH OF BOREHOLE: ____/____

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: _____ Depth to Bottom (ft.): _____ Responsible Personnel: _____
Site: _____ Static Water Level Before (ft.): _____ Drilling Co.: _____
Date Installed: _____ Static Water Level After (ft.): _____ Project Name: NAS CECIL FIELD
Date Developed: _____ Screen Length (ft.): _____ Project Number: 4248MW0050
Dev. Method: _____ Specific Capacity: _____
Pump Type: _____ Casing ID (in.): _____

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units _____)	Turbidity (NTU)	Remarks (odor, color, etc.)

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: _____ **Project No.:** N4248MW0050

Location: _____ **Personnel:** _____

Weather Conditions: _____ **Measuring Device:** _____

Tidally Influenced: Yes ___ No _X__ **Remarks:** _____

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments

* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: Truck Stand, Facility 372 **Project No.:** N4248MW0050

Location: Cecil Field **Personnel:**

Weather Conditions: **Measuring Device:**

Tidally Influenced: Yes ___ No _X__ **Remarks:**

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
CEF-372-01								
CEF-372-07								
CEF-372-13R								
CEF-372-14								
CEF-372-20								
CEF-372-16DR^								
CEF-372-22^								
CEF-372-23^								

* All measurements to the nearest 0.01 foot ^Proposed wells.

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: NSAP **Project No.:** N4248MW0050

Location: Cecil Field **Personnel:**

Weather Conditions: **Measuring Device:**

Tidally Influenced: Yes ___ No _X__ **Remarks:**

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
CEF-M18-01S			75.89	15				
CEF-M18-02S			76.02	15				
CEF-M18-02I			75.78	35				
CEF-M18-03I			75.13	35				
CEF-M18-04I			74.66	35				
CEF-M18-05I			73.42	35				

* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: Building 46, Supp. Assessment
Project No.: N4248MW0050
Location: Cecil Field
Personnel:
Weather Conditions:
Measuring Device:
Tidally Influenced: Yes ___ No _X__
Remarks:

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
CEF-46-18I								
CEF-46-19I								
CEF-46-20I								
CEF-46-21I								
CEF-46-22I								
CEF-46-25I								
CEF-46-26I								
CEF-46-27I^								
CEF-46-28I^								
CEF-46-29D^								

* All measurements to the nearest 0.01 foot ^Proposed wells.

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: South Fuel Farm-Supp. Ass. **Project No.:** N4248MW0050

Location: Cecil Field **Personnel:**

Weather Conditions: **Measuring Device:**

Tidally Influenced: Yes ___ No _X__ **Remarks:**

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
CEF-43-12								
CEF-43-33								
CEF-43-23								
CEF-43-36								
CEF-43-38								
CEF-43-1N								
CEF-43-2N								
CEF-43-6N								
CEF-43-7N								
CEF-43-9N								

* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: _____
Project No.: N4248MW0050

[ ] Domestic Well Data
[X] Monitoring Well Data
[ ] Other Well Type: _____
[ ] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____
Type of Sample:
[ ] Low Concentration
[ ] High Concentration

SAMPLING DATA

Date: / Time:	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV	Other
Method: Low Flow Peristaltic								

PURGE DATA

Date:	See Low Flow Purge Data Sheet
Method: Low Flow Peristaltic	
Air Monitor Reading (ppm):	
Well Casing Diameter:	
Well Casing Material:	
Total Well Depth (TD):	
Static Water Level (WL):	
One Casing Volume(gal/L):	
Start Purge (hrs):	
End Purge (hrs):	
Total Purge Time (min):	
Total Vol. Purged (gal/L):	

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: _____ WELL ID.: _____

PROJECT NUMBER: N4248MW0050 DATE: _____

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments

SIGNATURE(S): _____

PAGE___OF___

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: _____

Project No.: N4248MW0 050

Sampled By: _____

Field Analyst: _____

Field Form Checked as per QA/QC Checklist (initials): _____

Sample ID No.: _____

Sample Location: _____

Duplicate: ☐

Blank: ☐

SAMPLING DATA:

Date: / Time:	Color (Visual)	ORP (Eh) (+/- mv)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	Sal. (%)	pH (SU)
Method:								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment:

CHEMetrics (Range: _____mg/L)

Analysis Time: _____

CHEMetrics: _____mg/L

Notes:

Alkalinity:

Analysis Time: _____

Equipment: HACH Digital Titrator AL-DT

Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	= mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	= mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	= mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	= mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	= mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	= mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT

Analysis Time: _____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
_____	x 0.1	= mg/L
_____	x 0.2	= mg/L
_____	x 1.0	= mg/L
_____	x 2.0	= mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name:

Project No.: N4248MW0 050

Sampled By:

Field Analyst:

Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.:

Sample Location:

Duplicate: ☐

Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 _ _ IR-18C Color Wheel Other: _____ Analysis Time: _____

Program/Module: 33 500nm

Concentration: _____ mg/L Filtered: ☐

Notes:

QA/QC Checklist:

All data fields have been completed as necessary: ☐

Correct measurement units are cited in the SAMPLING DATA block: ☐

Mulitplication is correct for each *Multiplier* table: ☐

Final calulated concentration is within the appropriate *Range Used* block: ☐

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☐

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☐

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☐

Title block is initialized by person who performed the QA/QC Ckecklist: ☐

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : _____ PROJECT NAME :

MANUFACTURER : _____ PROJECT NUMBER : N4248MW0 050

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation:_____

Site Name: _____

Date Installed: _____

Project Name: _____

Site Geologist: _____

Drilling Company: _____

Driller:_____

Project Number: _____

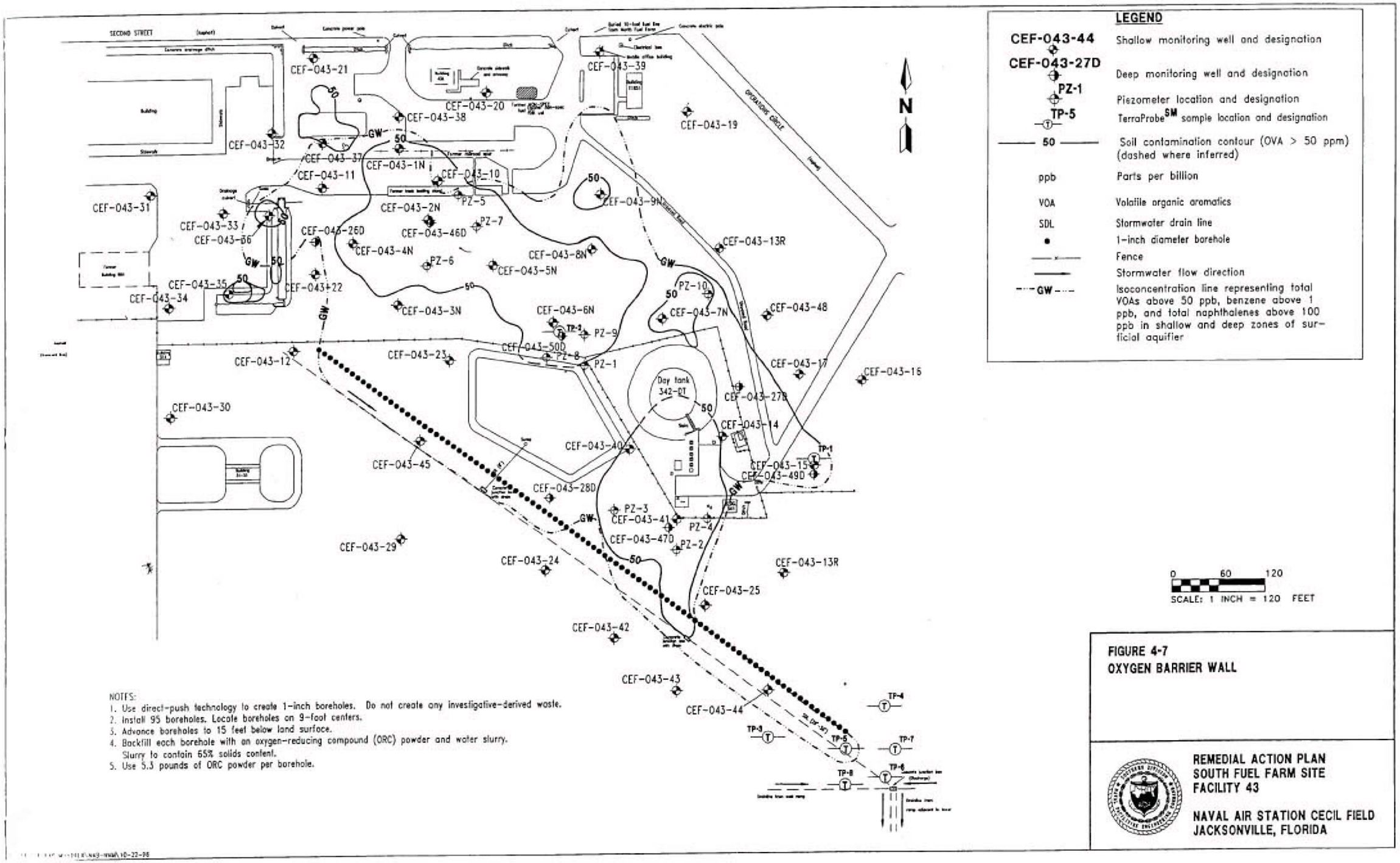
Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing			
Well Screen			
End Cap			
Drilling Fluid			
Drilling Fluid Additives			
Backfill Material			
Annular Filter Pack			
Bentonite Seal			
Annular Grout			
Surface Cement			
Protective Casing			
Paint			
Rod Lubricant			
Compressor Oil			

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist:_____

APPENDIX H

FIGURE 4-7 OXYGEN BARRIER WALL



LEGEND

CEF-043-44	Shallow monitoring well and designation
CEF-043-27D	Deep monitoring well and designation
PZ-1	Piezometer location and designation
TP-5	TerraProbe℠ sample location and designation
—— 50 ——	Soil contamination contour (OVA > 50 ppm) (dashed where inferred)
ppb	Parts per billion
VOA	Volatile organic aromatics
SDL	Stormwater drain line
•	1-inch diameter borehole
—x—	Fence
———	Stormwater flow direction
---GW---	Isoconcentration line representing total VOAs above 50 ppb, benzene above 1 ppb, and total naphthalenes above 100 ppb in shallow and deep zones of surficial aquifier

0 60 120
SCALE: 1 INCH = 120 FEET

NOTES:
1. Use direct-push technology to create 1-inch boreholes. Do not create any investigative-derived waste.
2. Install 95 boreholes. Locate boreholes on 9-foot centers.
3. Advance boreholes to 15 feet below land surface.
4. Backfill each borehole with an oxygen-reducing compound (ORC) powder and water slurry. Slurry to contain 65% solids content.
5. Use 5.3 pounds of ORC powder per borehole.

FIGURE 4-7
OXYGEN BARRIER WALL

REMEDIAL ACTION PLAN
SOUTH FUEL FARM SITE
FACILITY 43

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA