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SECOND QUARTER NATURAL ATTENUATION GROUNDWATER MONITORING REPORT FOR OPERABLE UNIT 2 (OU 2) SITE 5 NAS CECIL FIELD FL

2/1/1999

TETRA TECH NUS INC

Second Quarter Natural Attenuation Groundwater Monitoring Report

for

Operable Unit 2, Site 5

Naval Air Station Cecil Field

Jacksonville, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0066

February 1999

019912/P

SECOND QUARTER NATURAL ATTENUATION GROUNDWATER MONITORING REPORT

FOR

OPERABLE UNIT 2, SITE 5
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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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0066

FEBRUARY 1999

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CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Tetra Tech NUS, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-94-D-0888 are complete and accurate and comply with all requirements of this contract.

DATE: _____February 1, 1999_____

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ACRONYMS

ABB-ES	ABB Environmental Services
BCT	Base Realignment and Closure Team
bls	Below Land Surface
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylene
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Chemical of Concern
COD	Chemical Oxygen Demand
CTO	Contract Task Order
FDEP	Florida Department of Environmental Protection
HLA	Harding Lawson Associates
IRA	Interim Remedial Action
MCL	Maximum Contaminant Level
msl	Mean Sea Level
NAS	Naval Air Station
OU	Operable Unit
RI	Remedial Investigation
ROD	Record of Decision
SOP	Standard Operating Procedure
SOUTHNAVFAC	Southern Division, Naval Facilities Engineering Command
SVOC	Semivolatile Organic Compound
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
µg/l	Micrograms Per Liter

1.0 INTRODUCTION

This Second Quarter Natural Attenuation Groundwater Monitoring Report has been prepared under Contract Task Order (CTO) 0066 under the Comprehensive Long-Term Environmental Action Navy III (CLEAN) Contract No. N62467-94-D-0888 for the Southern Division, Naval Facilities Engineering Command. This report presents a summary of the work performed for the second quarter (November/December 1998) groundwater monitoring event at Operable Unit (OU) 2, Site 5 at the Naval Air Station (NAS) Cecil Field, located in Jacksonville, Florida. This report evaluates and monitors natural attenuation as a groundwater remedial alternative.

Tetra Tech NUS, Inc. (TtNUS) collected and analyzed groundwater samples from five wells in accordance with the methodologies and procedures outlined in the Initial Natural Attenuation Sampling Work Plan (TtNUS, 1998a) and the Work Plan Addendum for Long-term Groundwater Monitoring at Sites 3, 5, 8, and 16 (TtNUS, 1998b). The purpose of this work was to provide information that would support a decision to further evaluate natural attenuation at the site and/or to implement an air sparging remedial system in the contaminant source area. This report summarizes the results from the second quarter (November 1998) groundwater monitoring event and provides a comparison to the results obtained from the first quarter (August 1998) groundwater monitoring event.

This report consists of four sections and one appendix as listed below:

- Section 1.0 discusses the purpose of the report.

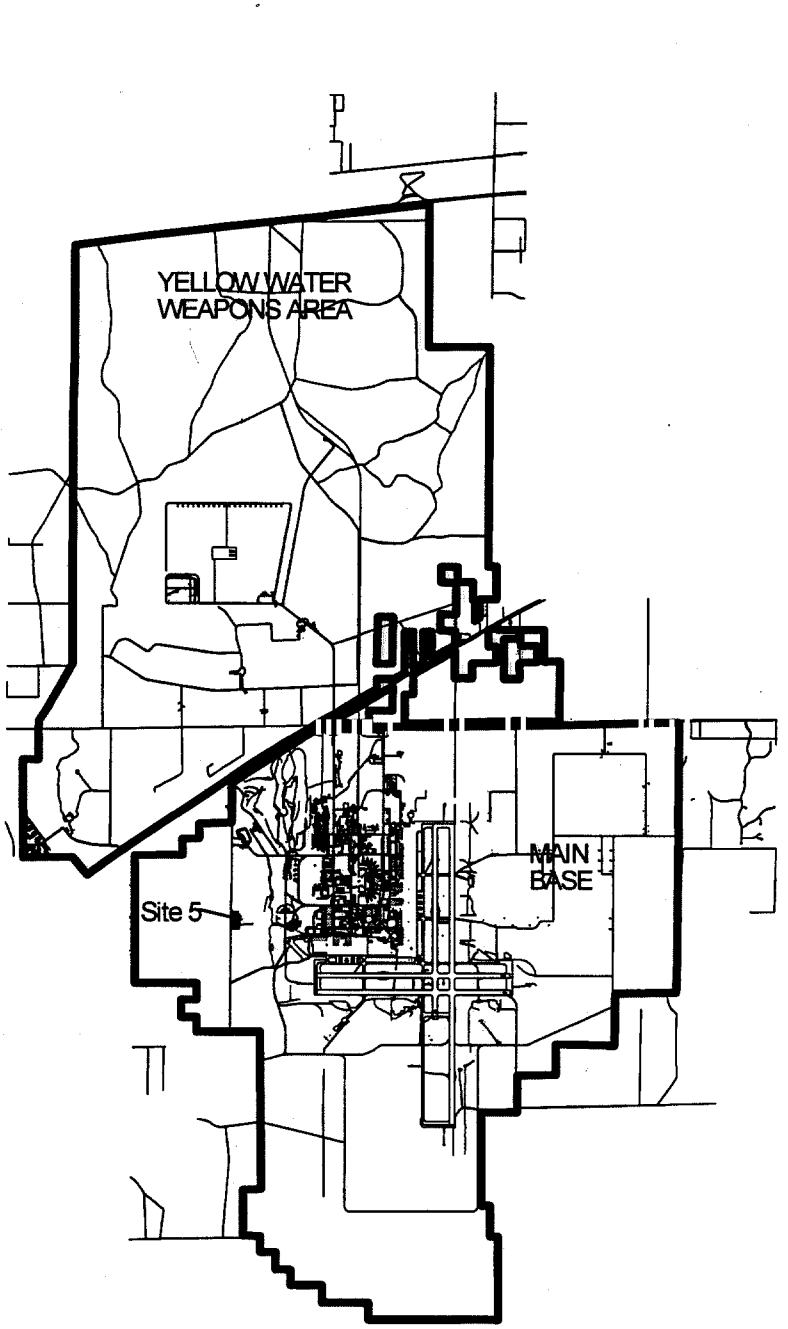
- Section 2.0 presents a summary of the analytical results at OU2, Site 5 as they existed prior to the implementation of the natural attenuation remedy (Remedial Investigation data collected in 1993/1994 and First Quarter Groundwater monitoring data collected in August 1998).

- Section 3.0 presents the analytical results from the second quarter groundwater sampling event conducted in November/December 1998.

- Section 4 presents the conclusions and recommendations for both quarterly groundwater sampling events.

- Appendix A contains a summary of the data validation performed for the November/December 1998 groundwater sample analytical results.

A description of the site history, location of waste disposal activities, site physical and geological conditions, surface soil and subsurface soil contamination, and a summary of the Record of Decision can be found in the Initial (First Quarter) Groundwater Monitoring Report for OU 2, Site 5 (TtNUS, 1998c). The site location map and site layout map are shown on Figures 1-1 and 1-2, respectively.



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CHECKED BY RD	DATE 1/30/99		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 REV 0

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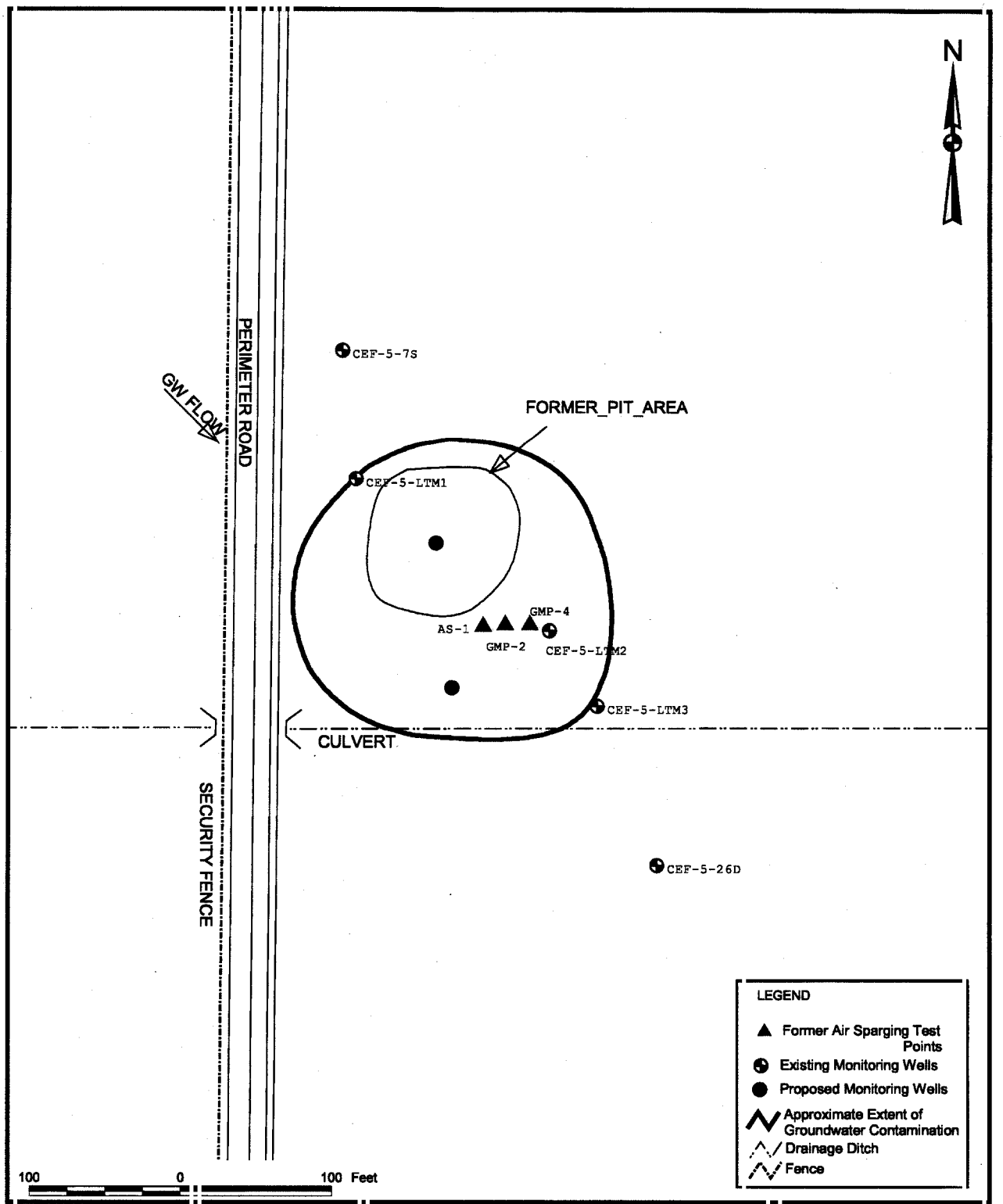

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2.0 SITE CHEMICALS OF CONCERN

The site chemicals of concern (COCs) were identified in the OU 2, Site 5 RI Report (ABB-ES, 1995) and are presented in Table 2-1 with the target cleanup levels. An Interim Remedial Action was conducted in 1995 and groundwater sampling activities were conducted during the Air Sparging Pilot Test in 1997. The results of the volatile organic compounds (VOC) and semivolatile organic compounds (SVOC) analyses from the RI are presented on Figures 2-1 and 2-2, respectively. The analytical results of the groundwater sampling activities for the RI and the Air Sparging Pilot Test are summarized on Table 2-2 and 2-3.

A detailed description of the nature and extent of contamination can be found in the RI and has been summarized in the Initial (First Quarter) Groundwater Monitoring Report for OU 2, Site 5 (TtNUS, 1998c).

TABLE 2-1

TARGET CLEANUP LEVELS FOR GROUNDWATER CHEMICALS OF CONCERN
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical of Concern	Target Cleanup Level[1] (µg/l)
Volatile Organic Compounds	
Acetone	700[2]
Benzene	1
Trichloroethene	3
Ethylbenzene	30
Toluene	40
Total Xylenes	20
Semivolatile Organic Compounds	
4-Methylphenol	4[2]
bis(2-Ethylhexyl)phthalate	6[2]
Naphthalene	20[2]
2,4-Dimethylphenol	140[2]
Petroleum Hydrocarbons	
Total Recoverable Petroleum Hydrocarbons	5,000[2]
Pesticides	
Alpha-Chlordane	2
beta-HCH	0.02[2]
Inorganics	
Antimony	44.5[3]
Arsenic	50
Beryllium	4
Cadmium	6[3]
Chromium	100
Manganese	96.15[3]
Vanadium	49[2]

1 Groundwater criteria listed in chapters 62-550 or 62-520, F.A.C. unless otherwise stated.
2 Brownfields Cleanup Criteria Rule, 62-785, F.A.C.
3 NAS Cecil Field Inorganic Background Data Set.

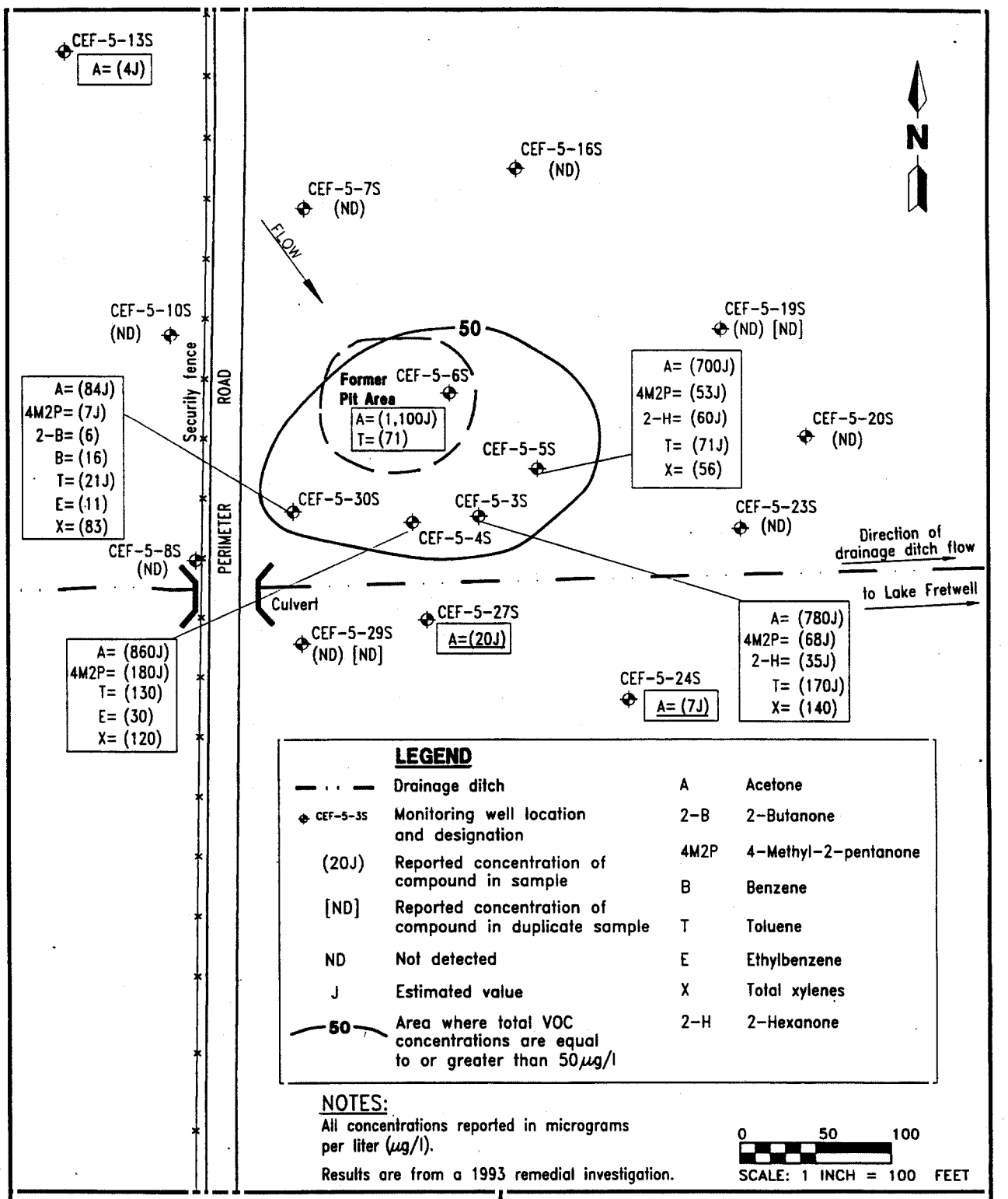

FIGURE 2-1
VOLATILE ORGANIC COMPOUNDS (VOCs) IN GROUNDWATER, UPPER SURFICIAL WELLS

SITE 5
GROUNDWATER REMEDIAL DESIGN

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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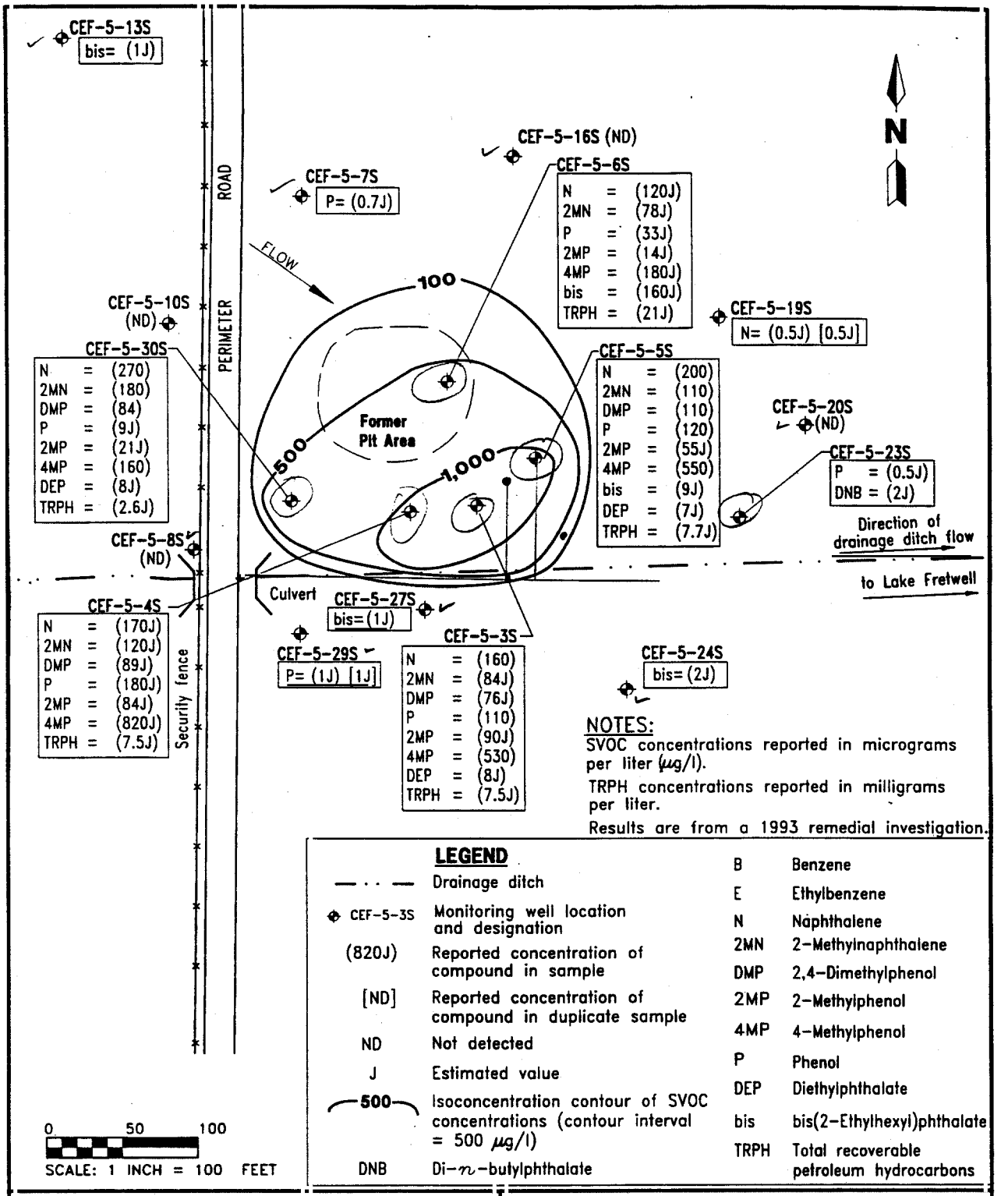


FIGURE 2-2
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs) AND TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH) IN GROUNDWATER, UPPER SURFICIAL WELLS

SITE 5
GROUNDWATER REMEDIAL DESIGN

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

TABLE 2-2

REMEDIAL INVESTIGATION AND AIR SPARGING PILOT TEST RESULTS WITH TARGET CLEANUP LEVELS FOR GROUNDWATER CHEMICALS OF CONCERN OPERABLE UNIT 2, SITE 5 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA

Chemical of Concern	Frequency of Detection[1]	Maximum Concentration (µg/L)	Target Cleanup Level[2] (µg/l)
VOLATILE ORGANIC COMPOUNDS			
Acetone	14/30	1,100	700[3]
Benzene	3/30	16	1
Trichloroethene[5]	3/9	4.3	3
Ethylbenze	5/30	41	30
Toluene	9/30	180	40
Total Xylenes	8/30	200	20
SEMIVOLATILE ORGANIC COMPOUNDS			
4-Methylphenol	9/30	820 J	4[3]
bis(2-Ethylhexyl)phthalate	9/30	130 J	6[3]
Naphthalene	10/30	270	20[3]
2,4-Dimethylphenol	6/30	110	140[3]
PETROLEUM HYDROCARBONS			
Total Recoverable Petroleum Hydrocarbons	---	160,000[6]	5,000[3]
PESTICIDES			
alpha-Chlordane	1/30	0.15	2
beta-HCH	2/30	0.18	0.02[3]
INORGANICS			
Antimony	2/30	29.4 J	44.5[4]
Arsenic	21/30	79 J	50
Beryllium	4/30	12.5	4
Cadmium	4/30	5.9	6[4]
Chromium	27/30	583 J	100
Manganese	23/30	263	96.15[4]
Vanadium	27/30	489	49[3]

1 Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed (excluding rejected values).
2 Groundwater criteria listed in chapters 62-550 or 62-520, F.A.C. unless otherwise stated.
3 Brownfields Cleanup Criteria Rule, F.A.C. 62-785.
4 NAS Cecil Field Inorganic Background Data Set.
5 Trichloroethere (TCE) was not detected in the RI. TCE was detected in the air sparging pilot-scale test.
6 From the 1991 RI Data.

TABLE 2-3

GROUNDWATER DATA SUMMARY
AIR SPARGING TEST
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical of Concern	Air Sparge Well	Groundwater Monitoring Points	
	AS-1	GMP-2	GMP-4
Volatiles (mg/l)			
Acetone	20	ND	ND
Benzene	NR	**3.6**	**1.2**
2-Butanone	6.2	NR	ND
Carbon disulfide	0.099	ND	NR
Ethylbenzene	NR	11	4.3
Methylene chloride	0.17	NR	NR
Toluene	0.82	**42**	11
Total Xylene	NR	**98**	20
Trichloroethene	NR	**4.3**	NR
Total VOC	27	159	37
Natural Attenuation Parameters (mg/l)			
Dissolved Oxygen	-	0	0
Carbon Dioxide	-	125	110

Notes: ND = Not Detected
NR = Not Reported

Bold and shaded exceed target cleanup levels.

3.0 ANALYTICAL RESULTS AND EVALUATION

The concentration and distribution of the COCs and natural attenuation monitoring parameters in the groundwater samples from the second quarter (November 1998) sampling activities are presented in this chapter. Groundwater samples were collected from four monitoring wells and analyzed at a fixed-based laboratory for natural attenuation and chemical parameters and analyzed in the field for selected biodegradation natural attenuation parameters as shown in the tables of the Work Plan Addendum (TtNUS, 1998b). A fifth sample was collected from existing well CEF-05-26D and analyzed for Target Compound List Volatile Organic Compounds only. This sample was collected to verify the presence of tetrachloroethene (PCE) that was detected during the RI for OU 2, Site 5.

The four wells were sampled in accordance with TtNUS Standard Operating Procedures and the EPA Region 4's Environmental Investigation Standard Operating Procedures and Quality Assurance Manual for low-flow purging and sampling of monitoring wells. A field duplicate sample was collected from well CEF-05-LTM-02. GPL Laboratories in Gaithersburg, Maryland was used for analysis of the groundwater samples.

The purpose of this section is to present, in tabular and pictorial form, the results of the second quarter groundwater monitoring event conducted in November/December 1998 and provide information that would support a decision for natural attenuation or air sparging as the groundwater remedial alternative. A comprehensive annual report will be prepared based on the data observed from this sampling event, the previous quarter sampling event, and the next four quarters. The annual report will be similar in nature to the Initial (First Quarter) Groundwater Monitoring Report for OU 2, Site 5 and will contain data interpretation and recommendations for future sampling.

The network of four monitoring wells located upgradient, within, and immediately downgradient of the VOC plume was used to measure the long-term plume migration and biodegradation natural attenuation parameters. The rationale for the location of the long-term monitoring wells is as follows:

Monitoring Well	Rationale
CEF-05-LTM-7S	Background/upgradient of plume
CEF-05-LTM-01, CEF-05-LTM-02	Within VOC plume.
CEF-05-LTM-03	Downgradient of VOC plume.

3.1 HYDROLOGIC CHARACTERISTICS

The average horizontal hydraulic gradient is 0.0047 foot per foot in an east to southeasterly direction, at OU2, Site 5. The average hydraulic conductivity for the shallow, intermediate, and deep wells in the surficial aquifer system were estimated from test data to be 1.2 feet per day, 11 feet per day, and 5.5 feet per day, respectively. The seepage velocity from the pit to the drainage ditch was estimated to be 0.023 feet per day (ABB-ES, 1995).

Water-level measurements were obtained from the five monitoring wells sampled. Measurements were obtained with an electric water-level indicator using the top of the well casing pipe as the reference point. The water level measurements and calculated ground water elevations for the August 1998 and November 1998 sampling are summarized on Table 3-1. Groundwater elevation contours are shown on Figure 3-1.

The groundwater elevations for the November/December 1998 sampling event range from 65.75 feet above mean sea level (msl) to 67.40 feet msl. The groundwater flow is in a southeasterly direction. The groundwater elevations were approximately 0.1 to 0.6 feet lower than the elevations measured in August.

3.2 CHEMICAL OF CONCERN DISTRIBUTION

The frequency of detection and range of positive values for all parameters is provided in Table 3-2. Table 3-3 provides detailed positive analytical results for the VOC, SVOC, pesticides, and inorganic COCs for each well sampled. Appendix B contains the laboratory data sheets with the results of the analysis. Figures 3-2, 3-3, 3-4, and 3-5 provides tag maps of the VOC, SVOC and pesticide, total recoverable petroleum hydrocarbon (TRPH), and inorganic analytical results, respectively,

Most of the chemicals of concern were not detected or below the target cleanup levels. The chemicals of concern that were detected above the target cleanup levels included trichloroethene (TCE), 4-methylphenol, naphthalene, TRPH, and vanadium. There is a marked decrease in groundwater contamination concentrations for all of the COCs except TCE when compared to the results of the RI. Comparing the analytical results to the first quarter groundwater sampling event show the TCE, manganese, and vanadium concentrations decreased, and the bis (2-ethyl hexyl) phthalate, naphthalene, and TRPH concentrations increased slightly.

3.2.1 VOCs

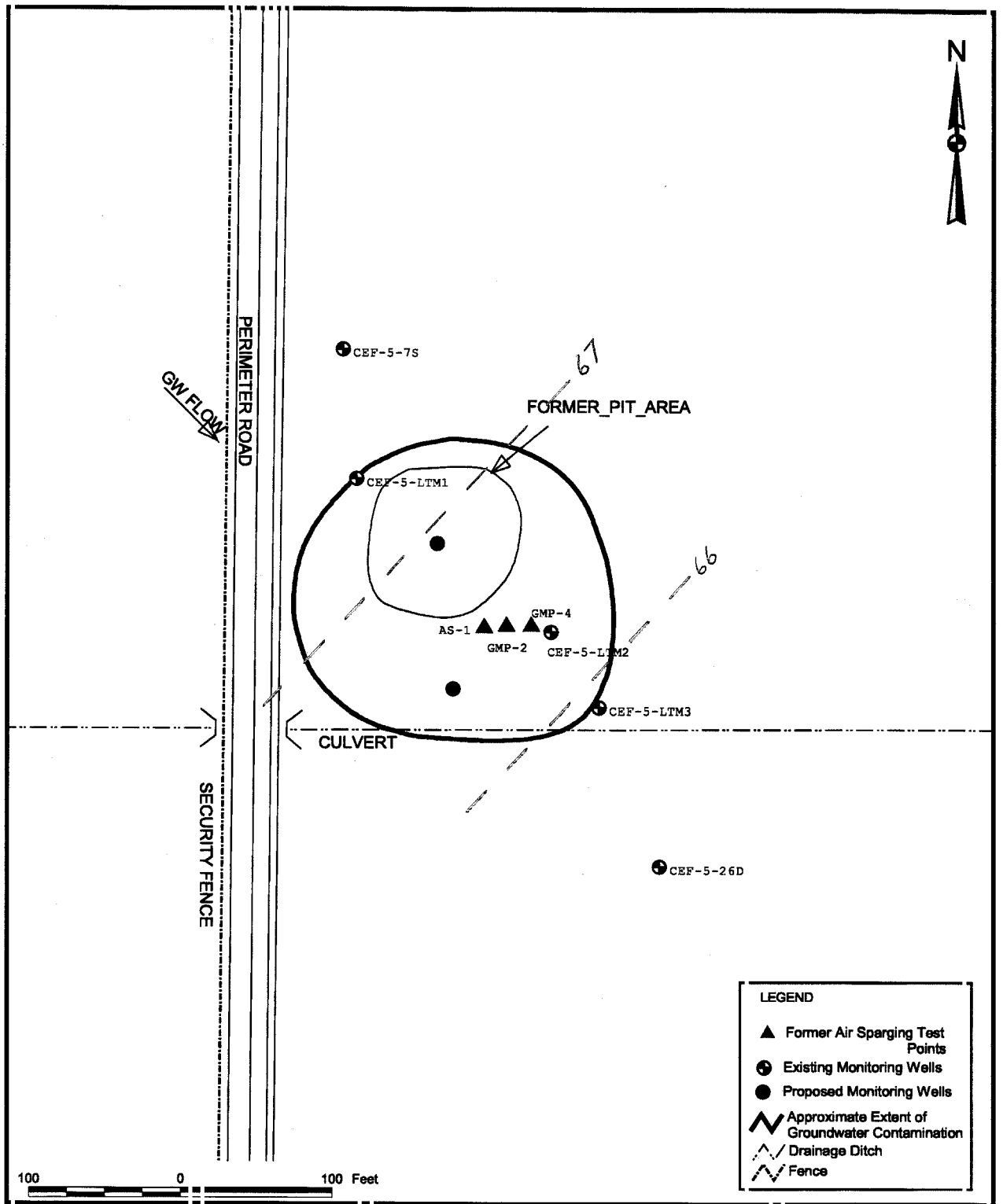
TCE was detected in one well (CEF-05-LTM-01) above the target cleanup level at a concentration of 5.6 µg/L. This well is located downgradient of the disposal pit. The TCE concentration has decreased in this

TABLE 3-1

GROUNDWATER LEVEL AND ELEVATION
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Monitoring Well	CEF-05-7S	CEF-05-LTM-01	CEF-05-LTM-02	CEF-05-LTM-03
Top of Casing	73.90	73.02	71.30	69.25
Ground Surface Elevation	70.7	69.8	68.4	66.3
Groundwater Elevation – August 1998	67.96	67.67	67.07	65.83
Depth to Groundwater – BTOC - August 1998	5.94	5.35	4.23	3.42
Groundwater Elevation – November 1998	67.40	67.21	66.61	65.75
Depth to Groundwater – BTOC - November 1998	6.50	5.81	4.69	3.50

BTOC – Below top of casing



DRAWN BY YLI	DATE 1/26/99	GROUNDWATER ELEVATION CONTOURS OPERABLE UNIT 2, SITE 5 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7898
CHECKED BY RD	DATE 1/30/99		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 3-1 REV 0

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TABLE 3-2

FREQUENCY OF DETECTIONS FOR POSITIVE DETECTIONS IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Parameter	First Quarter August 1998			Second Quarter November 1998		
	Range/Detection Frequency	Location of Maximum Positive Detect	Average of Detects	Range/Detection Frequency	Location of Maximum Positive Detect	Average of Detects
VOLATILES (µg/L)						
Acetone	12 (1/1)	CEF-05-GW-LTM02	12	ND	ND	ND
Benzene	0.2 - 0.6 (3/6)	CEF-05-GW-LTM02	0.3	0.6 (1/5)	CEF-05-LTM02	0.6
Ethylbenzene	1 - 2.8 (3/6)	CEF-05-GW-LTM02	1.6	1.8 - 2.7 (2/5)	CEF-05-LTM02-D	2.2
Toluene	1.5 - 1.8 (2/6)	CEF-05-GW-LTM01	1.6	3.5 - 5.2 (2/5)	CEF-05-LTM01	4.3
Trichloroethene	0.3 - 12 (4/6)	CEF-05-GW-DUP	6.2	1.1 - 5.6 (2/5)	CEF-05-LTM01	3.3
Xylenes, Total	9.2 - 14 (3/6)	CEF-05-GW-LTM02	10.9	13.7 - 15.2 (2/4)	CEF-05-LTM01	14.5
SEMIVOLATILES (ug/L)						
2,4-Dimethylphenol	1 - 10 (2/5)	CEF-05-GW-LTM02	5.5	6 - 8 (1/4)	CEF-05-LTM02-D	7
4-Methylphenol	10 (1/5)	CEF-05-GW-LTM02	10	12 - 17 (1/4)	CEF-05-LTM02-D	14
Naphthalene	ND	ND	ND	15 - 32 (2/4)	CEF-05-LTM02-D	21
PETROLEUM HYDROCARBONS (mg/L)						
TRPH	1.1 - 10.8 (4/5)	CEF-05-GW-LTM02	4.2	1.1 - 11.8 (2/4)	CEF-05-LTM02-02-D	6.2
INORGANICS (ug/L)						
Chromium	6.7 (1/5)	CEF-05-GW-LTM03	6.7	ND	ND	ND
Manganese	6.2 - 216 (5/5)	CEF-05-GW-LTM02	105.5	10.2 - 30.1 (4/4)	CEF-05-LTM02-D	18.1
Vanadium	22.3 - 140 (3/5)	CEF-05-GW-LTM02	68.2	5.9 - 94.3 (3/4)	CEF-05-LTM02-D	34.8

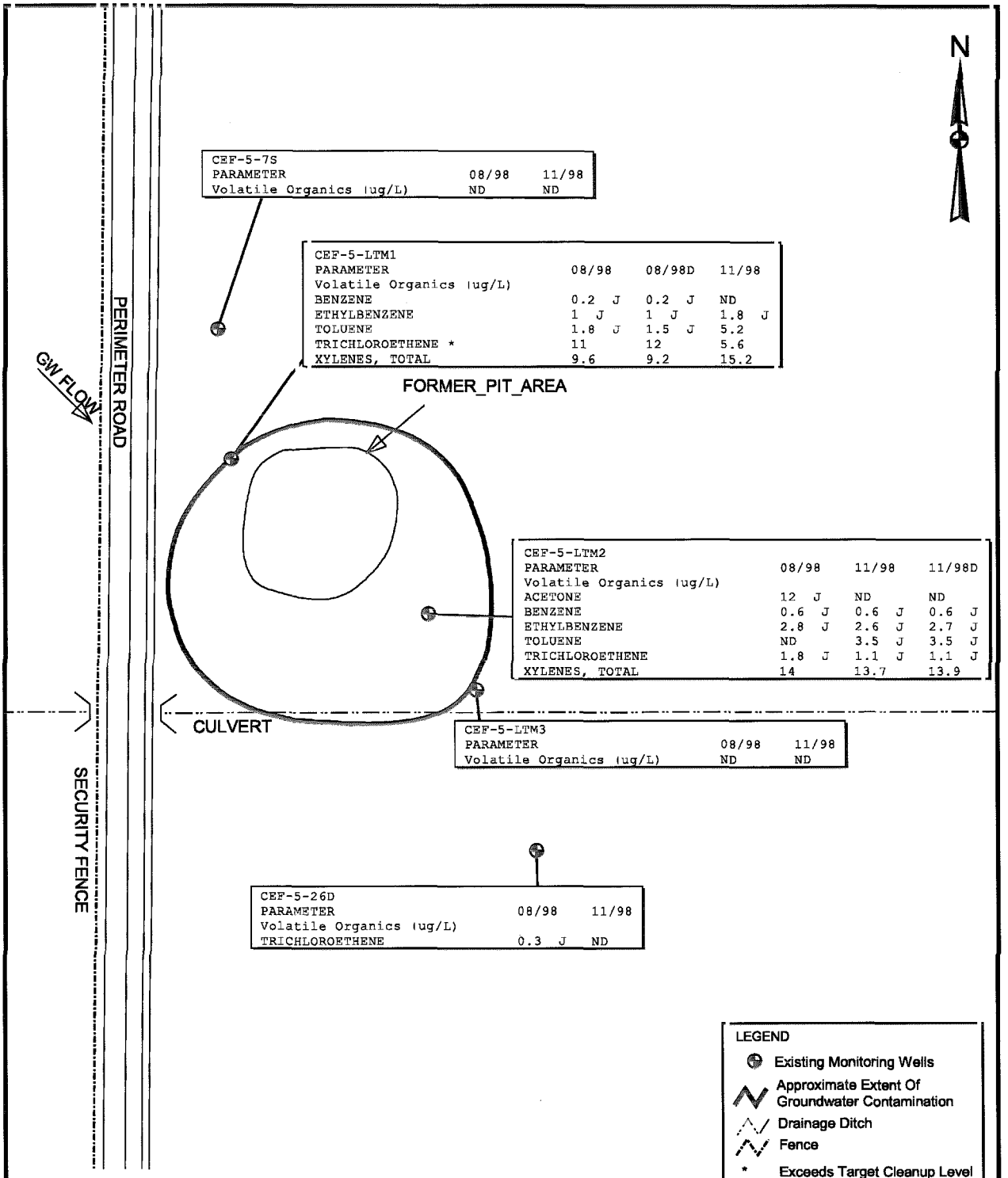
Notes:
NT - Not tested
ND - Not detected

TABLE 3-3

SUMMARY OF CHEMICALS OF CONCERN IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

PARAMETER	Target Cleanup Levels	CEF-5-7S		CEF-05-LTM01			CEF-05-LTM02			CEF-05-LTM03	
		Aug-98	Nov-98	Aug-98	Aug-98 Duplicate	Nov-98	Aug-98	Nov-98	Nov-98 Duplicate	Aug-98	Nov-98
VOLATILES (ug/L)											
ACETONE	700	10 UR	10 UR	10 UR	10 UR	10 UR	12 J	10 UR	10 UR	10 UR	10 UR
BENZENE	1	1 U	1 U	0.2 J	0.2 J	1 U	0.6 J	0.6 J	0.6 J	1 U	1 U
ETHYLBENZENE	30	5 U	5 U	1 J	1 J	1.8 J	2.8 J	2.6 J	2.7 J	5 U	5 U
TOLUENE	40	5 U	5 U	1.8 J	1.5 J	5.2	5 U	3.5 J	3.5 J	5 U	5 U
TRICHLOROETHENE	3	3 U	3 U	**11**	**12**	**5.6**	1.8 J	1.1 J	1.1 J	3 U	3 U
XYLENES, TOTAL	20	5 U	5 U	9.6	9.2	15.2	14	13.7	13.9	5 U	5 U
TOTAL VOCs		ND	ND	24	24	27.8	31	21.5	21.8	ND	ND
SEMIVOLATILES (ug/L)											
2,4-DIMETHYLPHENOL	140	11 U	11 U	10 U	10 U	10 U	10 J	6 J	8 J	1 J	10 U
4-METHYLPHENOL	4	4 U	4 U	4 U	4 U	4 U	**10**	**12**	**17**	4 U	4 U
BIS(2-ETHYLHEXYL)PHTHALATE	6	4 U	4 U	12 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
NAPHTHALENE	20	6 U	6 U	6 U	6 U	15	7 U	**23**	**32**	6 U	6 U
PESTICIDES/PCB (ug/L)											
ALPHA-CHLORDANE	2	0.05 U	0.053 U	0.052 U	0.052 U	0.052 U	0.052 U	0.052 U	0.051 U	0.052 U	0.052 U
BETA-BHC	0.02	0.02 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.021 U	0.020 U	0.021 U	0.021 U
PETROLEUM HYDROCARBONS (mg/L)											
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS	5	0.5 U	0.5 U	3.43	1.1	1.1	**10.8**	**10.8**	**11.8**	1.47	0.5 U
INORGANICS (ug/L)											
ANTIMONY	44.5	5 U	5.0 U	5 U	5 U	5.0 U	5 U	5.0 U	5.0 U	5 U	5.0 U
ARSENIC	50	10 U	5.0 U	10 U	10 U	5.0 U	10 U	5.0 U	5.0 U	10 U	5.0 U
BERYLLIUM	4	3 U	3.0 U	3 U	3 U	3.0 U	3 U	3.0 U	3.0 U	3 U	3.0 U
CADMIUM	6	3 U	3.0 U	3 U	3 U	3.0 U	3 U	3.0 U	3.0 U	3 U	3.0 U
CHROMIUM	100	5 U	5.0 U	5 U	5 U	5.0 U	5 U	5.0 U	5.0 U	6.7	5.0 U
MANANESE	96.15	6.2	14.1	**131**	**108**	10.2	**216**	28.7	30.1	66.3	18.8
VANADIUM	49	22.3	6.4	5 U	5 U	5.0 U	**140**	**89.9**	**94.3**	42.5	5.9

Notes:
ND - Not Detected
Bold and shaded exceed target cleanup levels



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COST/SCHEDULE-AREA

SCALE
AS NOTED

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NUMBER 7898

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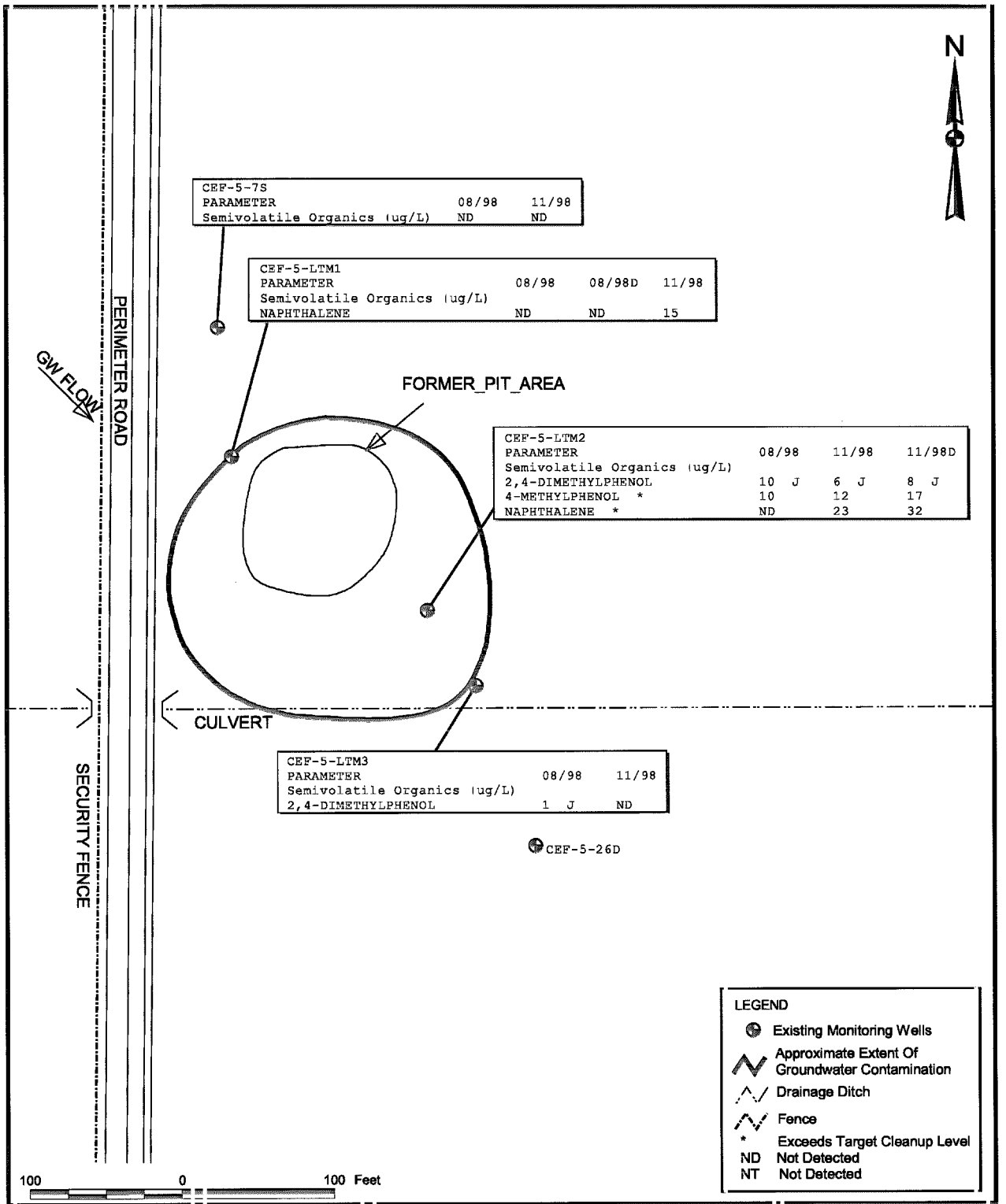
DRAWING NO. FIGURE 3-2 REV 0

P:\GIS\CECIL\SITE5_TAG.APR JAN-25-99 YLI LAYOUT TAG 1 VOA



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COST/SCHEDULE-AREA		APPROVED BY / DATE
		— —
SCALE		DRAWING NO. / REV
AS NOTED		FIGURE 3-3 / 0

SEMIVOLATILE ORGANIC COMPOUNDS
AND PESTICIDES IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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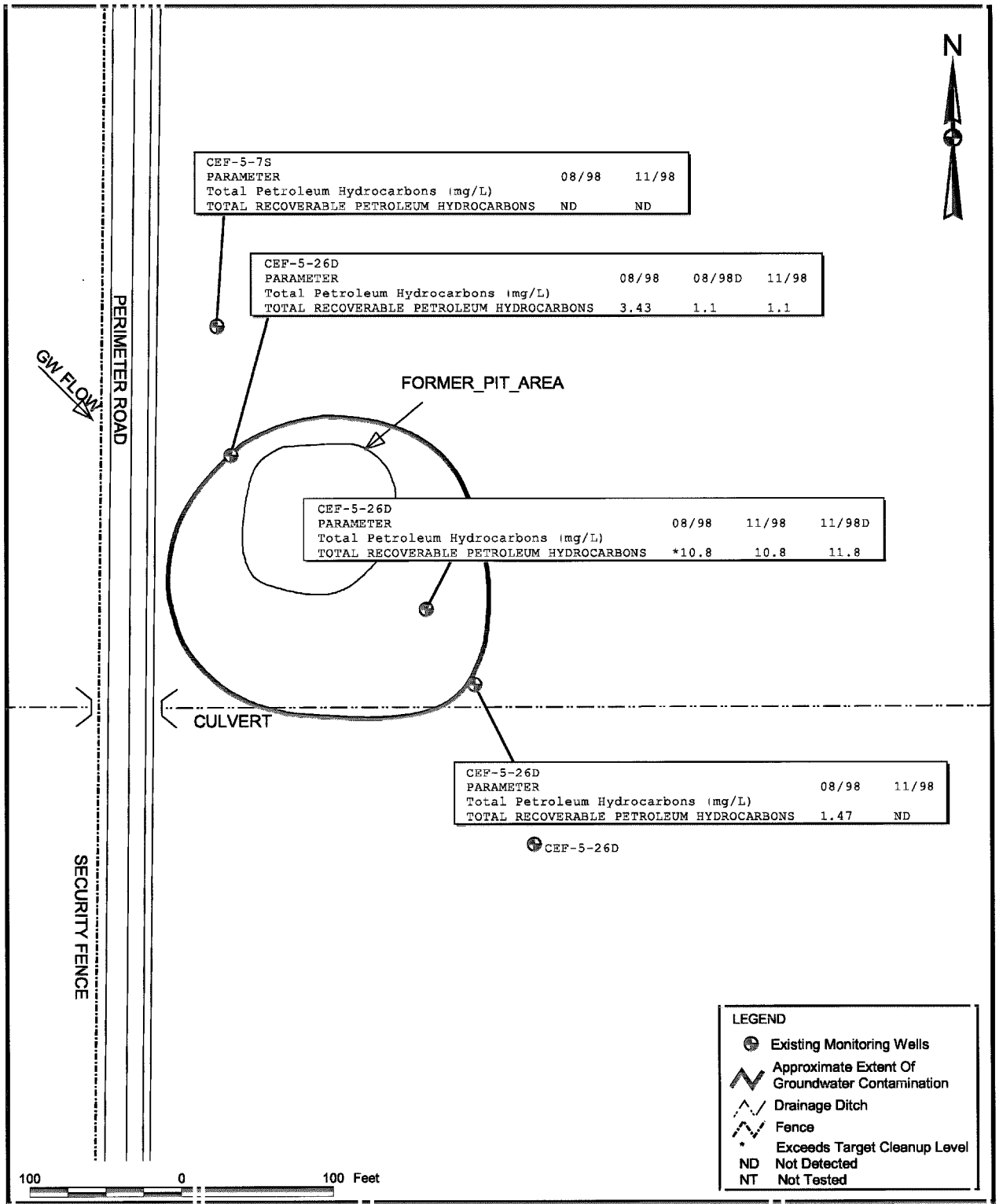

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COST/SCHEDULE-AREA

SCALE
AS NOTED

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NUMBER 7898

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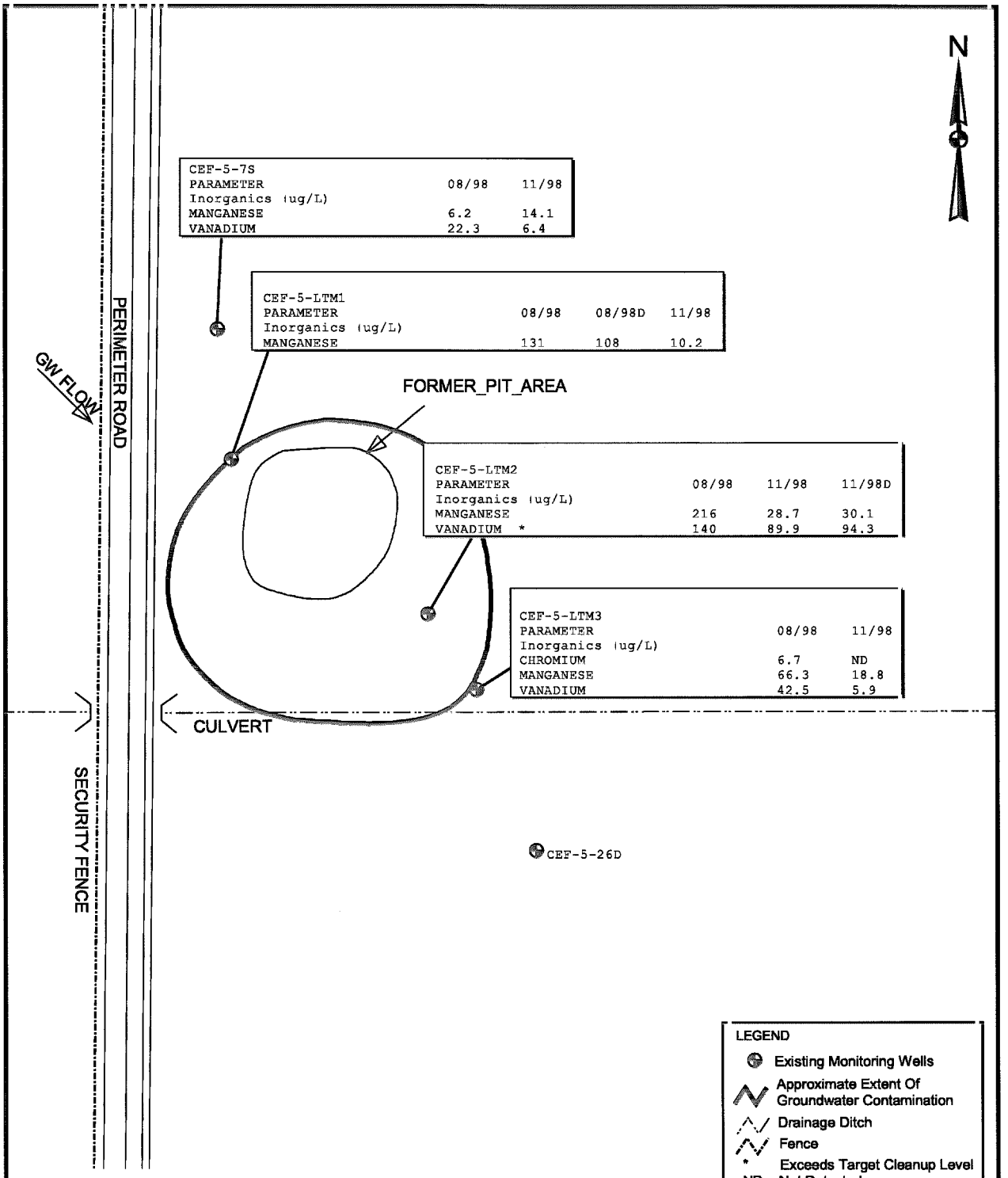
DRAWING NO. FIGURE 3-4 REV 0

P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 3 TRP



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COST/SCHEDULE-AREA

SCALE
AS NOTED

INORGANICS IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NUMBER 7898

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DRAWING NO. FIGURE 3-5 REV 0

P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 4 INORGANICS

monitoring well from 12 µg/L in the first quarter groundwater sampling event to 5.6 µg/L during the second quarter groundwater sampling event. The TCE concentrations in the other wells were below the detection limit and the target cleanup level.

The total VOC concentrations in the groundwater samples ranged from not detected to 27.8 µg/L during the second quarter groundwater sampling event. Comparing the total VOC analytical results to the first quarter groundwater sampling event indicate that total VOC concentrations decreased in monitoring well CEF-05-LTM-02 and increased slightly in monitoring well CEF-05-LTM-01. The total VOC concentrations were below the detection limits in monitoring wells CEF-05-7S and CEF-05-LTM-03. The slight increase in some of the parameters is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

Based on the sampling in the area believed to be of the highest contaminant concentration, the total VOCs in the groundwater appear to have degraded by a factor of ten when compared to the groundwater values reported in the Air Sparging Pilot Test (HLA, 1997). The total VOC concentration in groundwater was reported in the Air Sparging Pilot Test as 37 to 159 µg/L in the area of highest contamination. During the second quarter groundwater sampling event, the total VOCs in groundwater in the same area ranged from not detected to 27.8 µg/L.

A direct correlation between the Air Sparging Pilot Test and this sampling event may not be applicable due to the difference in the monitoring well screening interval. The results of the pilot study (with the wells screened from 12 to 15 feet below land surface) may not be indicative of the concentrations in the upper portion of the aquifer. However, the screened interval for this sampling event is the same as the RI. Comparing the total VOC concentration results from the RI with the total VOC concentration results of this sampling event, it appears that the total VOCs in groundwater has degraded by a factor of 50. The total VOC concentration in groundwater was 1320 µg/L in the area of highest contamination.

3.2.2 SVOCs

The concentration of 4-methylphenol was detected in the monitoring well CEF-05-LTM-02 in excess of its target cleanup level. The concentration of 4-methylphenol was 17 µg/L, compared to the target cleanup level of 4 µg/L. The maximum 4-methylphenol concentration has decreased significantly at the site from 820 µg/L in the RI to 17 µg/L during the second quarter groundwater sampling event, however the concentration has increased slightly since the first quarter groundwater sampling event.

The concentration of naphthalene was detected in the monitoring well CEF-05-LTM-02 in excess of its target cleanup level also. The concentration of naphthalene was 32 µg/L, compared to the target cleanup

level of 20 µg/L. The maximum naphthalene concentration has decreased significantly at the site from 270 µg/L in the RI to 32 µg/L during the second quarter groundwater sampling event, however the concentration has increased slightly since the first quarter groundwater sampling event.

The slight increase in 4-methlyphenol and naphthalene concentrations is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

3.2.3 Petroleum Hydrocarbons

The TRPH concentration in monitoring well CEF-05-LTM-02 exceeds the target clean up level of 5 mg/L. The concentration of TRPH was 11.8 mg/L. The maximum TPRH concentration has decreased significantly at the site from 160 mg/L in the RI to 11.8 mg/L during this sampling event, however the concentration has increased slightly since the first quarter groundwater sampling event. The slight increase in the TRPH concentration is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

3.2.4 Inorganics

Manganese has decreased below the target cleanup level in all of the monitoring wells during the second quarter groundwater monitoring event. The highest concentration of manganese detected in the second quarter groundwater monitoring event was 30.1 µg/L which has decreased since the RI with a maximum concentration of 263 µg/L.

Vanadium was detected in monitoring well CEF-05-LTM-02 at a concentration of 94.3 µg/L which is above the target cleanup level. The maximum vanadium concentration has decreased at the site since the first quarter groundwater monitoring event, from 140 µg/L to 94.3 µg/L.

3.2 NATURAL ATTENUATION PARAMETERS

Fixed-base laboratory analyses and field analytical tests were performed on samples of groundwater from the monitoring wells for biodegradation natural attenuation parameters. The fixed-base laboratory parameters included alkalinity, biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, total iron and dissolved iron, total manganese and dissolved manganese, methane, ethane, ethene, nitrate, nitrite, orthophosphate, sulfate, sulfide, and total organic carbon. Field analytical tests included pH, specific conductivity, temperature, turbidity, oxidation reduction potential, dissolved oxygen (DO), hydrogen sulfide as H_2S, sulfide as S_2, dissolved carbon dioxide (CO_2), ferrous iron (Fe^{2+}),

manganese, and alkalinity. This section presents the analytical results from the second quarter groundwater monitoring conducted in November/December 1998.

The biodegradation natural attenuation data are provided in Table 3-4. Figures 3-6, 3-7, 3-8, 3-9, 3-10, 3-11, 3-12, and 3-13 present tag maps of the natural attenuation analytical results.

3.3.1 Dissolved Oxygen

Depleted dissolved oxygen concentrations (concentration of 0 mg/L) were observed in the three monitoring wells that are within the plume and downgradient of the plume and disposal pit as shown on Figure 3-6. The dissolved oxygen concentration in the background monitoring well CEF-5-7S located on the upgradient side of the disposal pit was approximately 2.1 mg/L. These dissolved oxygen concentrations have decreased since the first quarter groundwater monitoring event. The dissolved oxygen concentrations indicate anaerobic conditions exist within the plume which is beneficial for reductive dechlorincation of the TCE.

3.3.2 Nitrate and Nitrite

Nitrate and nitrite concentrations were not detected in the groundwater samples in the three monitoring wells that are within the plume and downgradient of the plume and disposal site as shown on Figure 3-7. Nitrate was estimated in monitoring well CEF-05-7S at a concentration of 0.325 mg/L. Due to the lack of nitrate and nitrite in the groundwater system, it is unlikely that nitrate reduction is a significant portion of the total biodegradation capacity of the aquifer.

3.3.3 Ferrous Iron/Dissolved Iron

During this sampling event, ferrous iron ranged from 0.01 mg/L at well CEF-05-7S to 4.7 mg/L at well CEF-05-LTM-02, as shown on Figure 3-7. The downgradient wells at the site (within the plume area) show elevated ferrous iron concentrations compared to well CEF-05-7S suggesting that ferric iron reduction is a likely anaerobic pathway for biodegradation of the contamination. In general, the ferrous iron concentrations increased compared to the first quarter groundwater monitoring event.

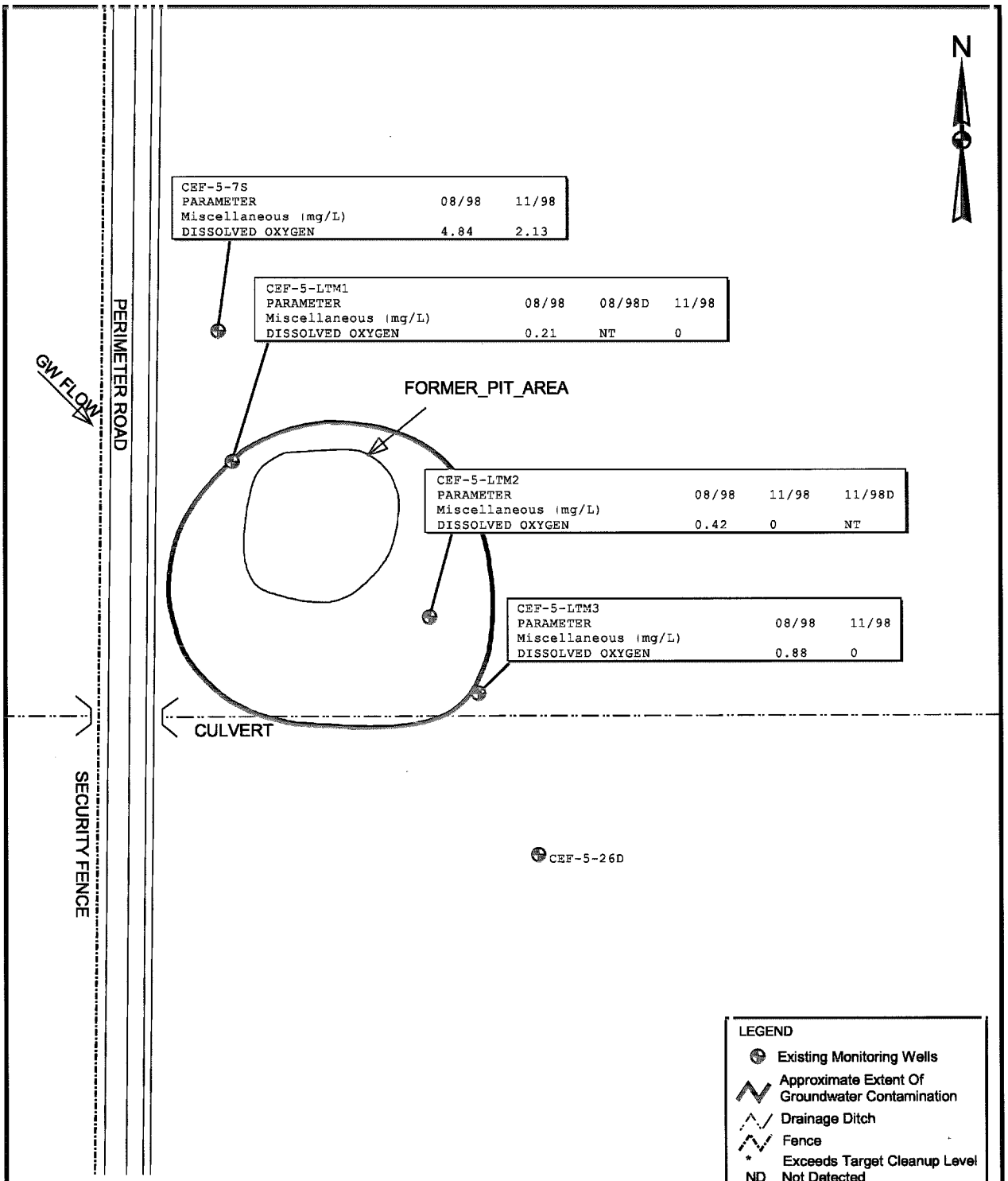
Dissolved iron concentrations range from not detect in the upgradient wells CEF-05-7S, to 5,540 µg/L in CEF-05-LTM-02. The iron increases significantly in the downgradient direction. The dissolved iron concentrations suggest a sufficient supply of iron is available as potential electron receptor at the monitoring wells with the elevated ferrous iron concentrations.

TABLE 3-4

SUMMARY OF NATURAL ATTENUATION PARAMETERS IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

PARAMETER	UNITS	CEF-5-7S		CEF-05-LTM01			CEF-05-LTM02			CEF-05-LTM03	
		Aug-98	Nov-98	Aug-98	Aug-98	Nov-98	Aug-98	Nov-98	Nov-98	Aug-98	Nov-98
					Duplicate				Duplicate		
ETHANE	UG/L	NT	6 U	NT	NT	6 U	NT	6 U	6 U	NT	6 U
ETHENE	UG/L	NT	6 U	NT	NT	6 U	NT	6 U	6 U	NT	6 U
METHANE	UG/L	7.6	29	253	385.1	325	2293	1552	1654	139.4	117
INORGANICS, UNFILTERED											
IRON	UG/L	100 U	NT	2980	3010	NT	3480	NT	NT	1180	NT
MANGANESE	UG/L	6.2	14.1	131	108	10.2	216	28.7	30.1	66.3	18.8
INORGANICS, FILTERED											
IRON, FILTERED	UG/L	100 U	100 U	3020	2950	3510	3580	5110	5540	1010	616
MANGANESE, FILTERED	UG/L	6	14.6	130	111	9.9	211	25.7	28.5	62.6	18.0
NATURAL ATTENUATION PARAMETERS											
ALKALINITY	MG/L	148	157	7.69	NT	1.0 UJ	11.5	7.77	5.18	3.84	7.77
ALKALINITY, FIELD	MG/L	119.5	298	4.7	NT	0	4.9	0	NT	10	0
BIOLOGICAL OXYGEN DEMAND	MG/L	3.6 J	2.0 U	2320 J	NT	2.0 U	3350 J	2.0 U	2.0 U	198 J	2.0 U
CARBON DIOXIDE	MG/L	63.2	166	103.6	NT	229	137	208	NT	58	93
CHEMICAL OXYGEN DEMAND	MG/L	55.6	28.6	16.7	22.2	23.4	66.7	80.5	80.5	11.1	18.2
CHLORIDE	MG/L	13.1	35.3 J	22.3	21.7	19.8 J	6.87	12.4 J	13.2 J	7.02	12.8 J
DISSOLVED FERROUS IRON	MG/L	0	0.01	3	NT	3.37	4	4.70	NT	1.6	0.56
DISSOLVED OXYGEN	MG/L	4.84	2.13	0.21	NT	0	0.42	0	NT	0.88	0
HARDNESS as CaCO3	MG/L	155	NT	16.3	16.3	NT	16.3	NT	NT	16.3	NT
SULFATE	MG/L	30.7	16.5 J	5.52	4.78	13.4 J	7.97	3.66 J	4.47 J	0.709	1.27 J
HYDROGEN SULFIDE (H2S)	MG/L	0	0.0	0.5	NT	0.5	0.5	0.6	NT	0.5	0.2
HYDROGEN SULFIDE (S-2)	MG/L	0	0.019	0	NT	0.719	0	0.719	NT	0	0.389
DISSOLVED SULFIDE	MG/L	NT	2.0 U	NT	NT	2.0 U	NT	2.0	2.0 U	NT	2.0 U
NITRATE	MG/L	0.06	0.325 J	0.05 U	NT	0.1 UJ	2.61 J	0.1 UJ	0.1 UJ	0.05	0.1 UJ
NITRITE	MG/L	0.061	0.1 U	0.05 U	NT	0.1 U	0.05 U	0.1 U	0.1 U	0.05 U	0.1 U
ORTHOPHOSPHATE	MG/L	0.02 U	0.1 UJ	0.02 U	NT	0.1 UJ	0.06	0.1 UJ	0.1 UJ	0.02 U	0.1 UJ
pH	unitless	6.73	6.12	4.8	NT	4.38	4.8	5.22	NT	5.27	4.98
OXIDATION-REDUCTION POTENTIAL	MV	NT	0	0	NT	-148.0	0	0	NT	0	0
SPECIFIC CONDUCTIVITY	MS/CM	0.41	0.437	0.118	NT	0.057	0.072	0.04	NT	0.049	0.029
TEMPERATURE	C	29.9	22.5	27.1	NT	23.7	26.7	23.4	NT	25.4	21.8
TOTAL ORGANIC CARBON	MG/L	NT	8.51	NT	NT	3.69	NT	19.4	18.2	NT	4.26
TURBIDITY	NTU	0	1	0	NT	0	0	0	NT	468	11.0

NT - Not tested



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COST/SCHEDULE-AREA

SCALE
AS NOTED

DISSOLVED OXYGEN IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

CONTRACT NUMBER 7898

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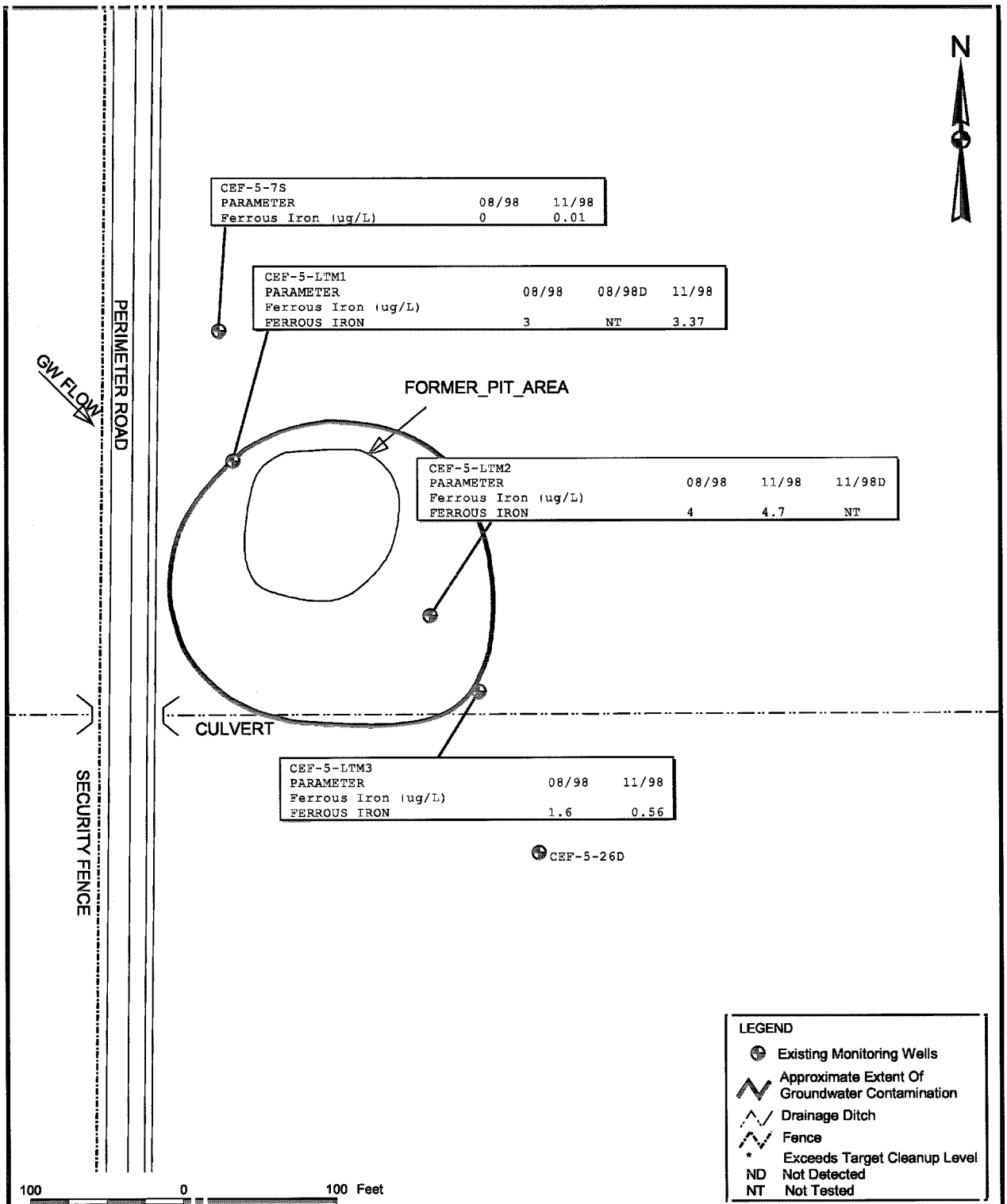
P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 5 DISSOLVED OXYGEN



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COST/SCHEDULE-AREA	
SCALE	
AS NOTED	

FERROUS IRON IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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FIGURE 3-7	0

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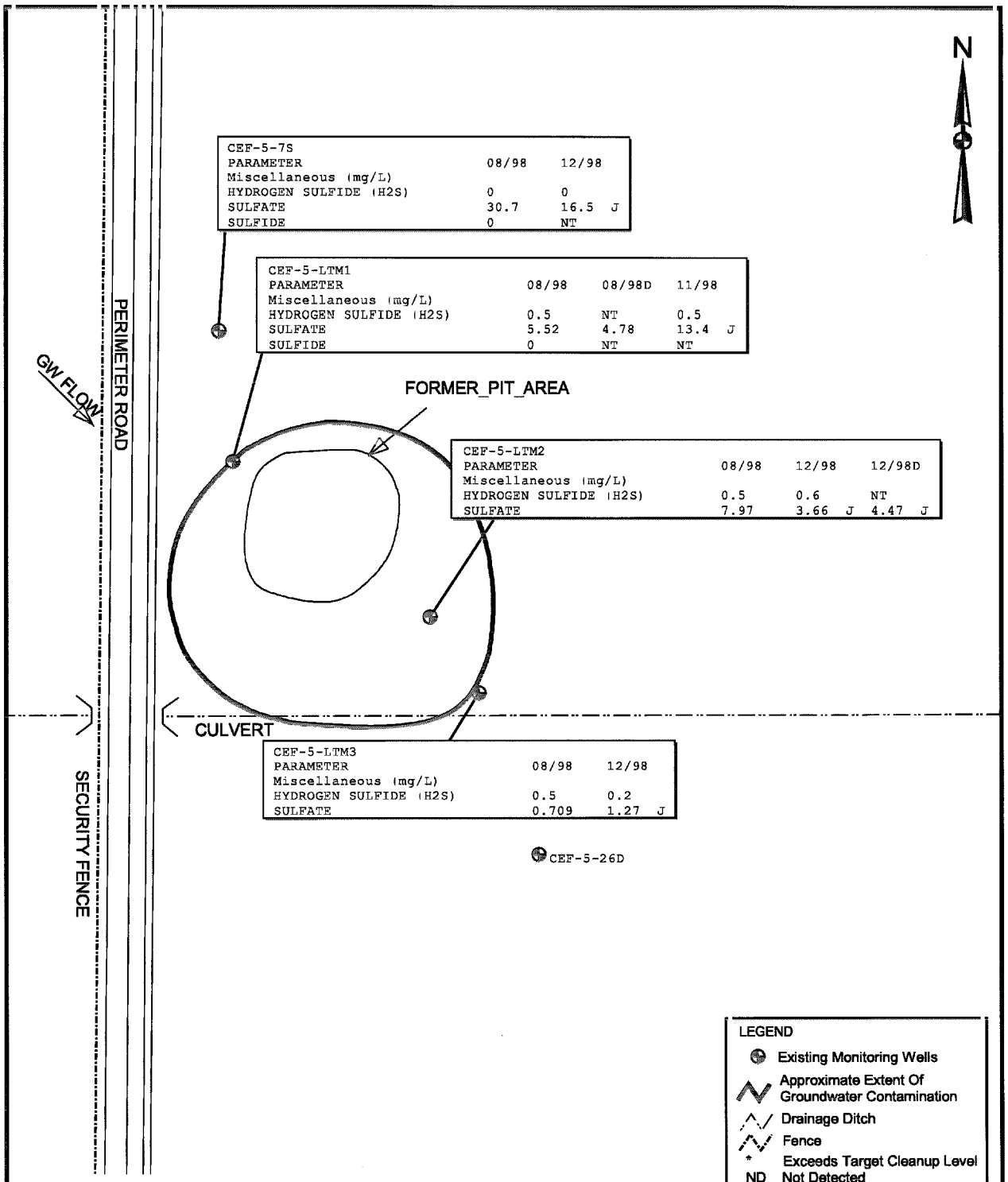

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COST/SCHEDULE-AREA

SCALE
AS NOTED

SULFATE, SULFIDE,
AND HYDROGEN SULFIDE IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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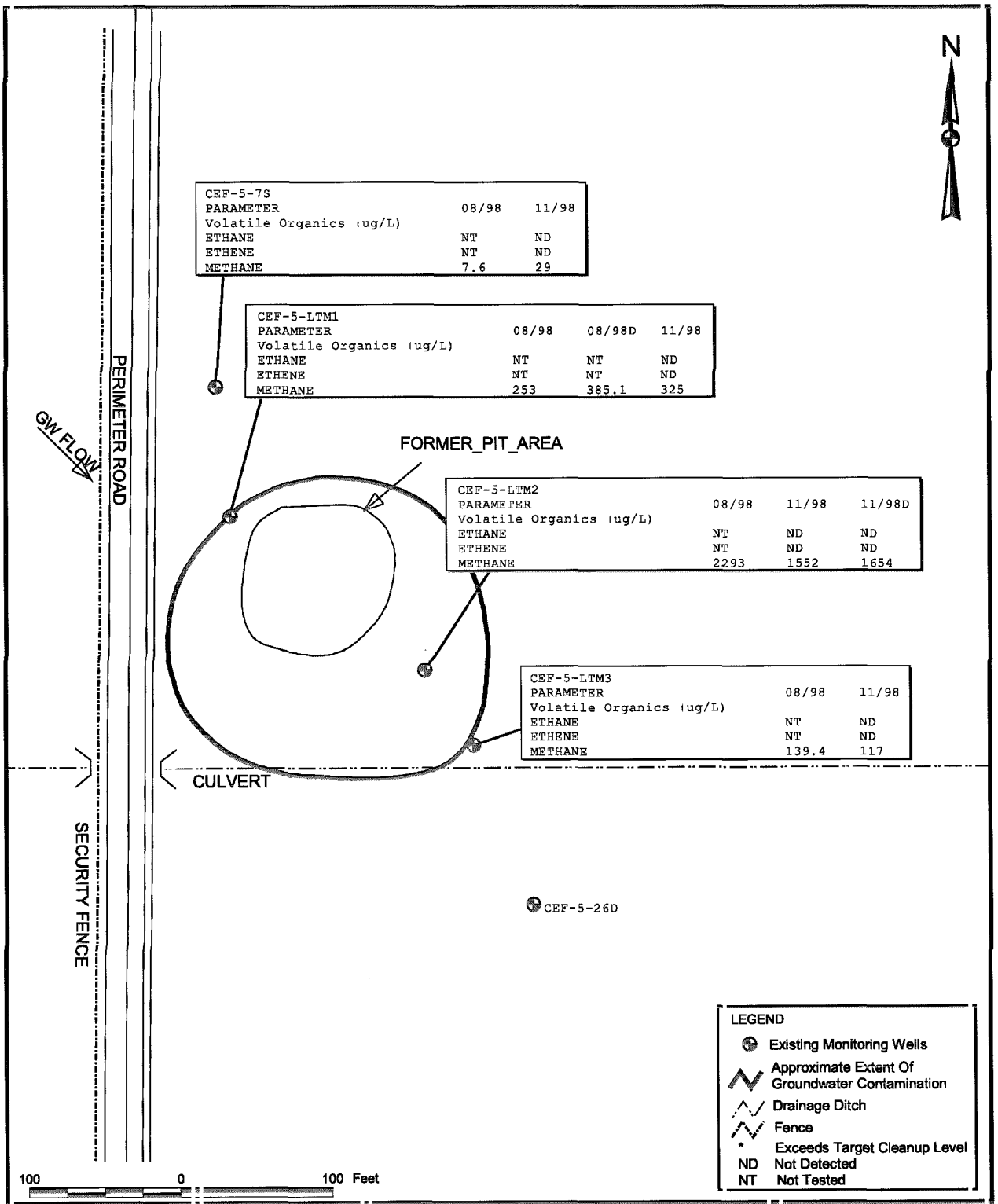
P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 7 SULFATE



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COST/SCHEDULE-AREA

SCALE
AS NOTED

METHANE, ETHANE, AND ETHENE IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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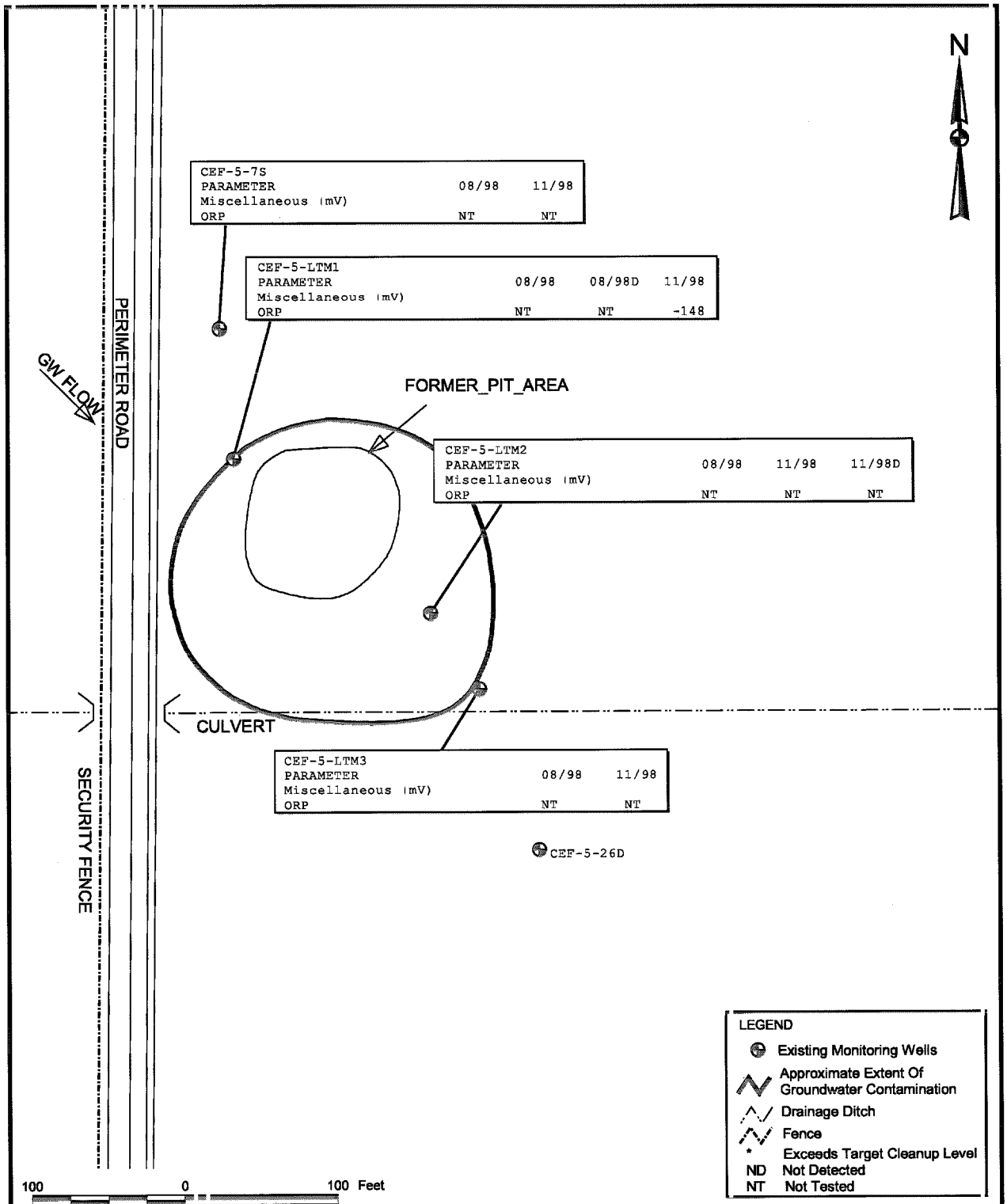
DRAWING NO. FIGURE 3-9 REV 0

P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 8 METHANE



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COST/SCHEDULE-AREA

SCALE
AS NOTED

GROUNDWATER OXIDATION-REDUCTION POTENTIAL
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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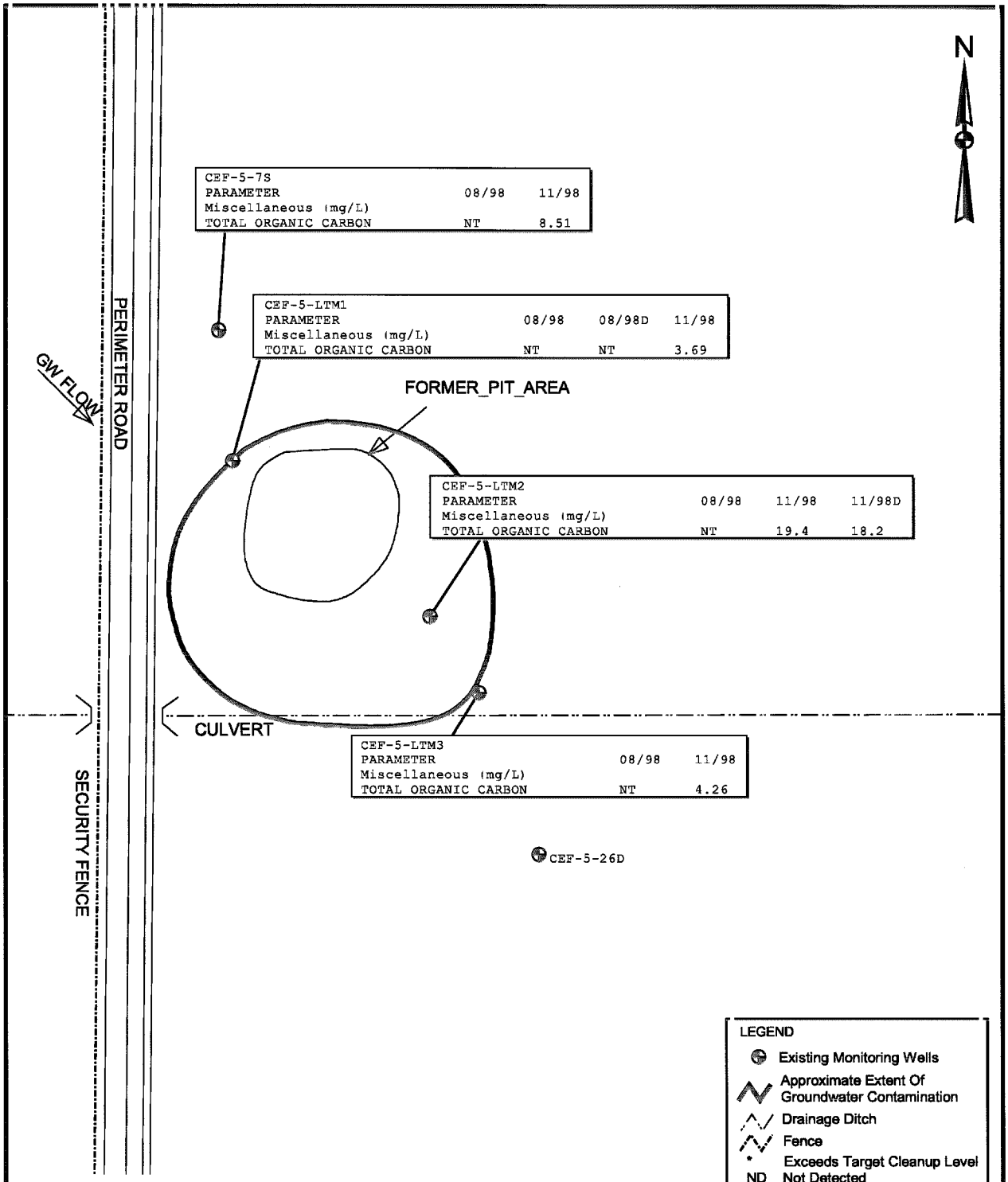

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COST/SCHEDULE-AREA

SCALE
AS NOTED

TOTAL ORGANIC CARBON IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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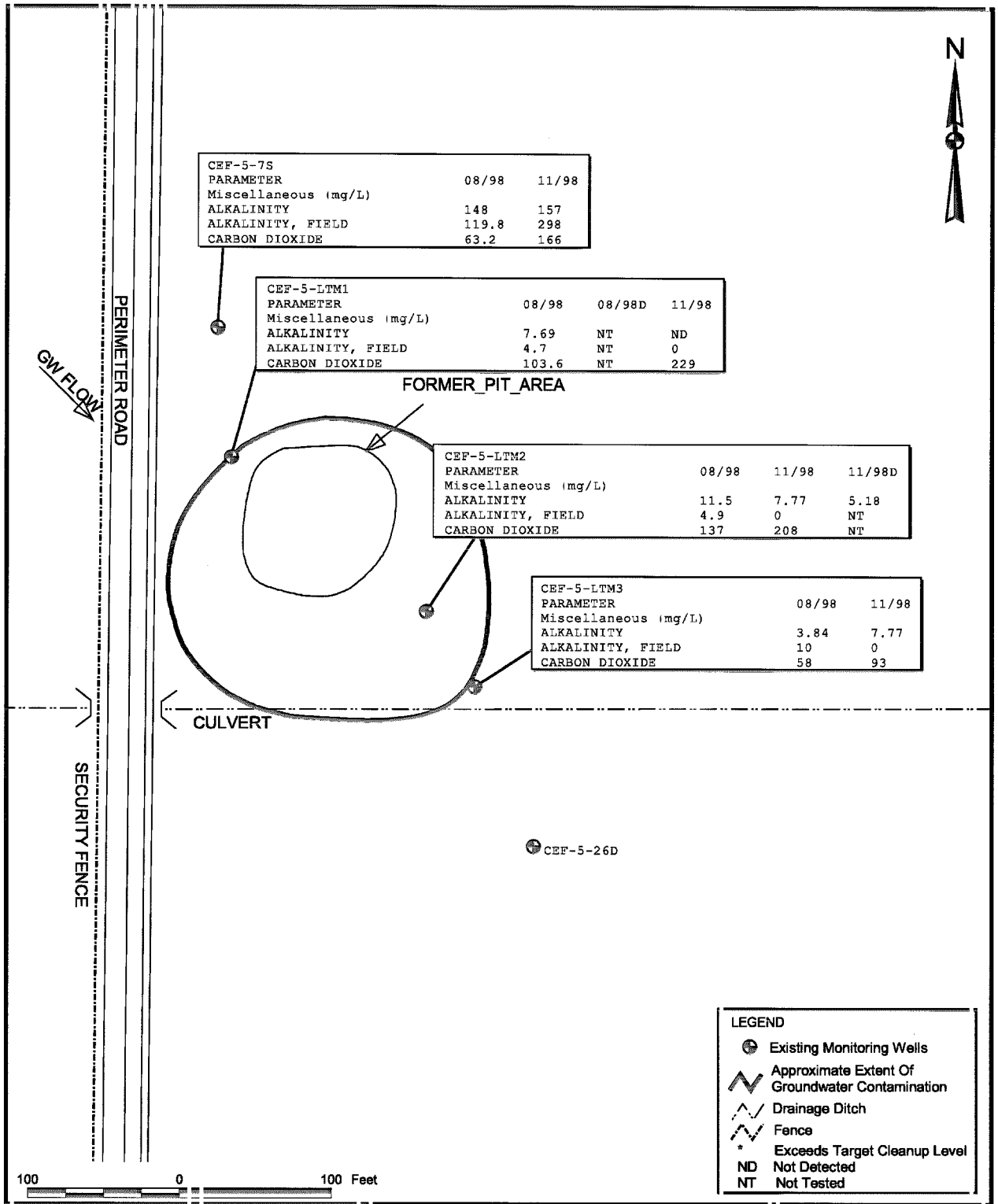
P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 10 ORGANIC CARBON



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COST/SCHEDULE-AREA

SCALE
AS NOTED

CARBON DIOXIDE AND ALKALINITY IN GROUNDWATER
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

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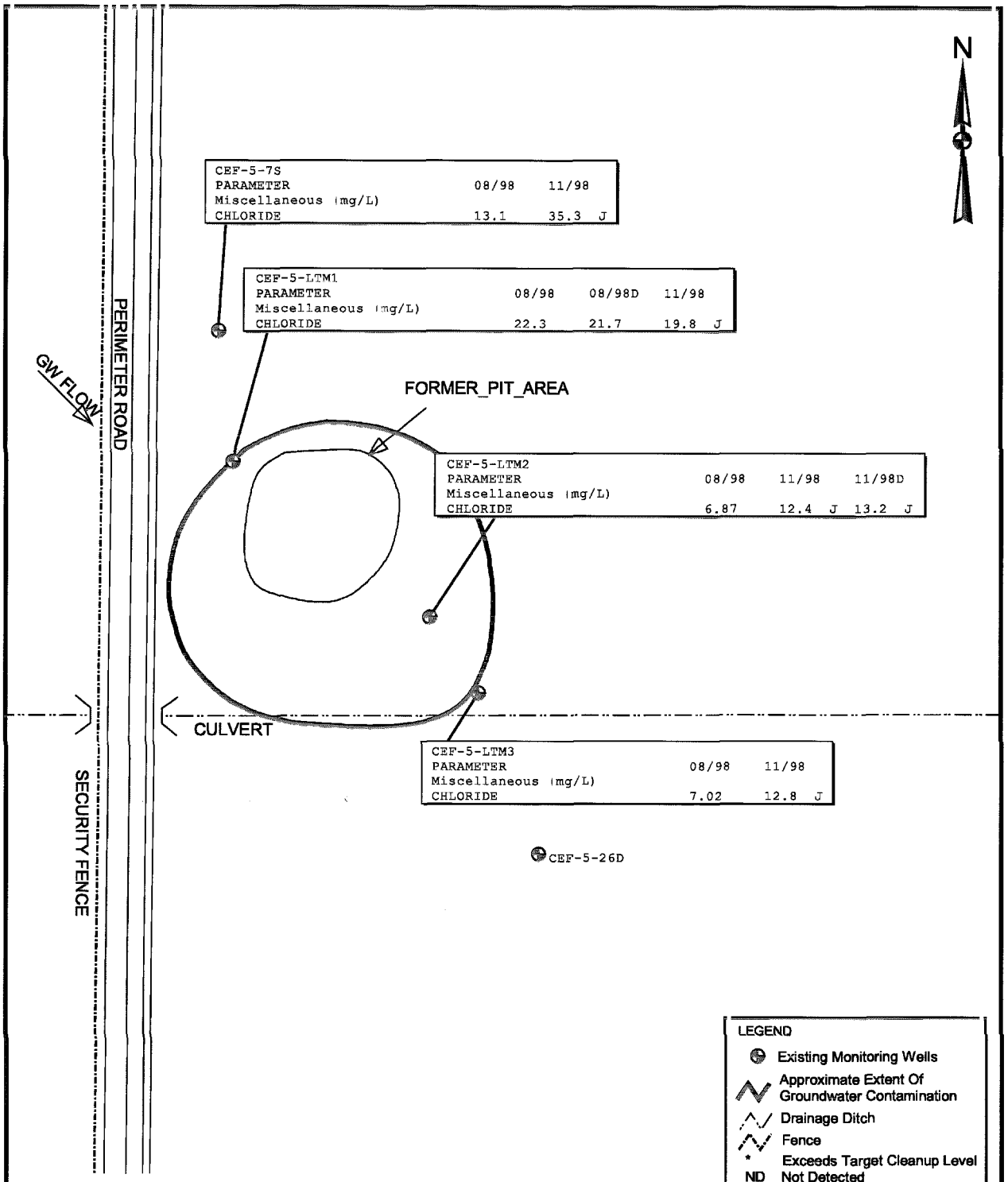
DRAWING NO. FIGURE 3-12 REV 0

P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 11 CARBON DIOXIDE



DRAWN BY YLI	DATE 10/26/98	CHLORIDE IN GROUNDWATER OPERABLE UNIT 2, SITE 5 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7898
CHECKED BY BD	DATE 10/30/98		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 3-13 REV 0

P:\GIS\CECIL\SITE5.APR 01/FEB/99 CPG LAYOUT TAG 12 CHLORIDE

3.3.4 Dissolved Manganese

Dissolved manganese concentration range from 9.9 µg/L to 28.5 µg/L in CEF-05-LTM-02. The dissolved manganese concentrations have decreased compared to the concentrations detected in the first quarter groundwater monitoring event. The dissolved manganese concentration increases in the downgradient direction in the second quarter groundwater monitoring event. The manganese concentrations suggest a sufficient supply of manganese is available as a potential electron receptor.

3.3.5 Sulfate, Sulfide, and Hydrogen Sulfide

The sulfate concentration decreased in the downgradient direction of the plume from 16.5 mg/L to 1.27 mg/L, as shown on Figure 3-8. In, general, these concentrations are less than the concentrations detected in the first quarter groundwater monitoring event.

The hydrogen sulfide concentrations in the downgradient wells (0.5 and 0.6 mg/L) were higher when compared to background monitoring well CEF-05-7S (0.0 mg/L). The concentration of hydrogen sulfide in the second quarter groundwater monitoring event was the same as the first quarter groundwater monitoring event. Sulfide (S_2) followed the same pattern as the hydrogen sulfide concentrations. The sulfide concentrations ranged from 0.019 mg/L in the background monitoring well CEF-05-7S to 0.719 mg/L in the monitoring wells within the plume. Dissolved sulfide was detected in one well (CEF-05-LTM02) in the laboratory analysis at the detection limit (2 mg/L). The results of the hydrogen sulfide and dissolved sulfide analyses are shown on Figure 3-8.

The decreasing trend of sulfate and the increasing trend in hydrogen sulfide and sulfide in groundwater is noted with the groundwater flow direction. This is a strong indicator of a sulfate-reducing environment.

3.3.6 Phosphate

Phosphate was not detected in the monitoring wells at the site. Due to the general lack of phosphate as an electron acceptor in the groundwater system, it is unlikely that phosphate reduction is a significant portion of the total biodegradation capacity of the aquifer.

3.2.7 Methane, Ethane, and Ethene

Methane was detected in three monitoring wells, ranging in concentration from 117 µg/L to 1,654 µg/L, as shown on Figure 3-9. Monitoring well CEF-05-LTM-02 had the highest concentration of methane. These methane concentrations were elevated by one to two orders of magnitude compared to the background

monitoring well CEF-05-7S, which had a methane concentration of 29 µg/L. The methane concentration increases significantly in the dowgradient direction, suggesting methanogenic degradation of the hydrocarbon plume is occurring. The methane concentrations have decreased since the first quarter groundwater monitoring event.

Ethane and ethene, byproducts of reductive dechlorination of TCE and 1,1-DCE were not detected in the laboratory analysis.

3.3.8 Total Organic Carbon

The results of the total organic carbon (TOC) analysis are shown on Figure 3-10. TOC was detected at 8.51 mg/L in the background well CEF-05-7S. TOC concentrations range from 3.6 mg/L to 18.2 mg/L at the site. The background well suggest that sufficient organic carbon is present in the aquifer to act as the primary substrate for reductive dechlorination.

3.3.9 Carbon Dioxide

Elevated carbon dioxide concentrations were measured in two wells (CEF-05-LTM-01 and CEF-05-LTM-02) at concentrations of 229mg/L and 208 mg/L, as shown on Figure 3-11. The carbon dioxide concentration in monitoring well CEF-05-LTM-03 was 93 mg/L and in monitoring well CEF-5-7S was 166 mg/L. The elevated carbon dioxide concentration were approximately 1.25 times the concentrations in the background monitoring well CEF-05-7S, and an indicator that biodegradation is occurring. The carbon dioxide increase (in excess of background) suggests active biodegradation is occurring. The carbon dioxide concentrations have increased compared to the first quarter groundwater sampling event.

3.3.10 Total Alkalinity

Total alkalinity concentration from the laboratory ranged from not detected to 157 mg/L, as shown on Figure 3-11. The alkalinity concentration from the field testing range from 0 mg/L to 298 mg/L, as shown on Figure 3-11. The alkalinity is decreasing in the downgradient direction which may indicate an overall increase in carbon dioxide.

3.3.11 Chloride

Chloride concentrations in groundwater are normally elevated following the biodegradation of chlorinated solvents. The chloride concentration ranged from 12.4 mg/L in monitoring well CEF-05-LTM-02 to 35.3 mg/L in the background monitoring well CEF-05-7S, as shown on Figure 3-12. There was no correlation of the concentration of chloride. In general, the chloride concentrations increased compared to the first quarter groundwater monitoring event.

3.3.12 Biochemical Oxygen Demand

BOD concentrations were not detected in the monitoring wells at the site. These non-detections were less than the concentrations measured in the first quarter groundwater monitoring event. There was no correlation between the concentrations of BOD and COCs. Since the biodegradation of the hydrocarbons is occurring under anaerobic conditions, the results of this parameter provide little information.

3.3.13 Chemical Oxygen Demand

COD concentrations were detect in all of the monitoring wells and ranged from 18.2 mg/L in well CEF-05-LTM-03 to 80.5 mg/L in well CEF-05-LTM-02. There was no correlation between the concentrations of COD and COCs. Since the biodegradation of the hydrocarbons is occurring under anaerobic conditions, the results of this parameter provide little information.

3.3.14 pH

pH values ranged from 4.4 to 6.1 and generally decreased in the downgradient direction. The pH was approximately the same as the first quarter groundwater monitoring event. The pH is within the tolerable range for biodegradation.

3.3.15 Specific Conductivity

Specific conductivity values ranged from 0.437 mS/cm in the upgradient well. The specific conductivity generally decreased in the downgradient direction to a minimum value of 0.029 in CEF-05-LTM-03. This minor variation indicates that all groundwater samples were from a consistent source.

3.3.16 Temperature

Temperature values ranged from approximately 22 ^{0}C to 23 ^{0}C across the site during the November 1998 sampling event. These temperatures are within the range of values acceptable for bioremediation to take place. These temperatures were three to seven degrees cooler than the groundwater samples collected during the first quarter groundwater monitoring event.

3.4 SUMMARY OF ANALYSIS

The reduction in the total VOCs concentration since the RI and the air sparging pilot-scale test is the strongest line of evidence that biodegradation natural attenuation is occurring at OU 2, Site 5. Comparing the total VOC analytical results to the first quarter groundwater sampling event show the total VOC

concentrations decreased in monitoring well CEF-05-LTM-02 and increased slightly in monitoring well CEF-05-LTM-01. The total VOC concentrations were below the detection limits in monitoring wells CEF-05-7S and CEF-05-LTM-03. The slight increase in some of the parameters is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

4-methylphenol was detected in only one monitoring well in excess of its target cleanup level and the concentration has decreased significantly compared to the concentrations detected in the RI. The concentration of 4-methylphenol has increased slightly since the first quarter groundwater sampling event. Naphthalene was also detected in only one monitoring well in excess of its target cleanup level and the concentration has decreased significantly compared to the RI. The concentration of naphthalene has increased slightly since the first quarter groundwater sampling event. The slight increase in both of these COCs is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

TRPH concentrations exceed the target clean up level of 5 mg/L in one monitoring well and the concentration has decreased significantly compared to the concentrations detected in the RI. The concentration of TRPH has increased slightly since the first quarter groundwater sampling event. The slight increase is likely within the range of uncertainty in the analysis, the potential variability in sampling technique, or a result of seasonal variations.

Manganese has decreased below the target cleanup level in all of the monitoring wells during the second quarter groundwater monitoring event. Vanadium was detected in one monitoring well above the target cleanup level at a concentration of 94 µg/L. The maximum vanadium concentration has decreased at the site since the first quarter groundwater monitoring event.

The geochemical data support natural attenuation. The concentrations of geochemical indicators of biodegradation suggest that active biodegradation is occurring in the area of the plume. The specific anaerobic biodegration processes include iron reduction, sulfate reduction, and methanogenesis.

3.5 MONITORING WELL CEF-05-26D RESULTS

The results of the groundwater sampling and analysis of the sample from well CEF-05-26D are summarized in Table 3-5. None of the TCL VOC (including tetrachloroethene [PCE]) compounds were detected in the second quarter groundwater sampling event. TCE was not detected in this monitoring well during this sampling event.

TABLE 3-5

SUMMARY OF CHEMICALS OF CONCERN IN GROUNDWATER
MONITORING WELL CEF-05-26D
OPERABLE UNIT 2, SITE 5
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

PARAMETER	CEF-05-26D	
	Aug-98	Nov-98
VOLATILES (ug/L)		
1,1,1-TRICHLOROETHANE	1 U	1 U
1,1,2,2-TETRACHLOROETHANE	0.2 UJ	1 U
1,1,2-TRICHLOROETHANE	1 U	1 U
1,1-DICHLOROETHANE	1 U	1 U
1,1-DICHLOROETHENE	1 U	1 U
1,2-DICHLOROETHANE	1 U	1 U
1,2-DICHLOROETHENE (TOTAL)	1 U	NT
1,2-DICHLOROPROPANE	1 U	1 U
2-BUTANONE	1 UR	5 U
2-HEXANONE	1 U	5 U
4-METHYL-2-PENTANONE	1 U	5 UR
ACETONE	1 UR	5 U
BENZENE	1 U	1 U
BROMODICHLOROMETHANE	0.6 U	1 U
BROMOFORM	1 U	1 U
BROMOMETHANE	1 U	1 U
CARBON DISULFIDE	1 UJ	1 U
CARBON TETRACHLORIDE	1 U	1 U
CHLOROBENZENE	1 U	1 U
CHLOROETHANE	1 U	1 U
CHLOROFORM	1 U	1 U
CHLOROMETHANE	1 U	1 U
CIS-1,2-DICHLOROETHENE	NT	1 U
CIS-1,3-DICHLOROPROPENE	1 U	1 U
DIBROMOCHLOROMETHANE	1 U	1 U
ETHYLBENZENE	1 U	1 U
M+P-XYLENES	NT	1 U
METHYL TERT-BUTYL ETHER	1 U	NT
METHYLENE CHLORIDE	0.5 U	1 U
O-XYLENE	NT	1 U
STYRENE	1 U	1 U
TETRACHLOROETHENE	1 U	1 U
TOLUENE	1 U	1 U
TRANS-1,2-DICHLOROETHENE	NT	1 U
TRANS-1,3-DICHLOROPROPENE	1 U	1 U
TRICHLOROETHENE	0.3 J	1 U
VINYL CHLORIDE	1 U	1 U
XYLENES, TOTAL	1 U	NT

4.0 CONCLUSIONS AND RECOMMENDATIONS

Quarterly groundwater monitoring events were conducted in August and November 1998 to obtain data on the site conditions at Cecil Field Operable Unit 2, Site 5 to evaluate the effectiveness of the biodegradation processes of natural attenuation as a potential remedial alternative. The investigation and evaluation was conducted in accordance with the Initial Natural Attenuation Sampling Work Plan (TtNUS, 1998a) and Work Plan Addendum for Long-term Groundwater Monitoring at Sites 3, 5, 8, and 16 (TtNUS, 1998b). The conclusions and recommendations for both quarterly groundwater monitoring events are presented in this section to provide the NAS Cecil Field Partnering Team with information to make a decision on whether to further evaluate natural attenuation and/or to implement an air sparging remedial system in the contaminant source area.

4.1 CONCLUSIONS

The following conclusions are made based on the analytical results and evaluation of both quarterly groundwater monitoring events:

- The evaluation of the concentration for the COC from these quarterly monitoring events compared to the past activities (RI and air sparging pilot-scale test) has shown a significant decrease in contamination. It appears that removal of the source during the IRA has also been effective based on the decrease of the contaminants in groundwater.

- The total concentration of VOCs appears to have degraded by a factor of 10 compared to the air sparging pilot-scale test results conducted in October 1997 and by a factor of 50 compared to the RI conducted in 1993/1994. Reduction in contaminant concentrations is the strongest line of evidence that natural attenuation is working at OU2, Site 5. The concentration of BTEX compounds in groundwater are below the target cleanup levels.

- The concentration of most of the COCs were not detected or below the target cleanup levels. TCE, 4-methylphenol, naphthalene, TRPH, and vanadium were detected above the target cleanup level. However, there was a marked decrease in the concentration of 4-methylphenol, naphthalene, TRPH, and vanadium when compared to the results from the RI. 4-methylphenol, naphthalene, TRPH, and vanadium were all detected in one monitoring well (CEF-05-LTM-02) above the target cleanup level.

- The maximum concentration of TCE increased from 4.3 μg/L from the RI to 12 μg/L in the first quarter groundwater monitoring event and has decreased to 5.6 μg/L in the second quarter groundwater monitoring event in monitoring well CEF-05-LTM-01. The increase may be due to the sampling procedure and/or difference in the monitoring well screening interval.

- Monitoring well CEF-05-26D was sampled for VOCs because of a previous detection of PCE. Groundwater analytical results from well CEF-05-26D indicated that PCE was not detected at this location.

- In monitoring wells CEF-05-GW-LTM-03 and CEF-05-26D, the COCs were either not detected or were below target cleanup levels.

- The natural attenuation parameters collected during this sampling event indicate that natural attenuation is occurring at the site. The dissolved oxygen, ferrous iron, sulfate, methane, and carbon dioxide parameters provided significant evidence that natural attenuation is occurring. The dissolved oxygen concentration in the downgradient wells was depleted and the carbon dioxide concentrations were elevated. The oxygen and carbon dioxide concentrations in the wells indicate active biodegradaton processes are occurring. The elevated levels of ferrous iron in the downgradient well indicate iron reduction is occurring. The decreasing trend of sulfate concentration and increase in sulfide and hydrogen sulfide in the groundwater flow direction indicates a sulfate reducing environment. In addition, the presence of methane in the groundwater is an indicator of biodegradation of hydrocarbons through methanogenesis.

4.2 RECOMMENDATIONS

The following actions are recommended based on both quarterly groundwater monitoring events:

- Based on a comparison of data from the quarterly long-term monitoring sampling events and data from the RI and Air Sparging Pilot-Scale Study test, it appears that source removal and natural attenuation is effectively reducing concentrations of COCs at Site 5. The concentration of most of the COCs were not detected or below the target cleanup levels. Based on first and second quarter data, it is recommended that monitoring for the biodegradation processes of natural attenuation continue as the selected remedial alternative for groundwater at OU 2, Site 5. Data from future groundwater sampling events will be used to confirm that natural attenuation should be the selected remedial alternative.

- TtNUS recommends the installation of two additional monitoring wells as shown on Figure 1-2. The proposed monitoring well between CEF-05-LTM-01 and CEF-05-LTM-02 is recommended to provide an additional monitoring well within the location of the former disposal pit area. The natural attenuation guidance documents (U.S. EPA, 1997, U.S. EPA, 1998, Wiedemeier, 1998) recommend that one monitoring well needs to be installed in the area of the source. The proposed monitoring well west of CEF-05-LTM-03 may be recommended to obtain an additional groundwater sample that is in the plume, downgradient of the pit. This well will replace monitoring well CEF-05-4S (which was destroyed/removed during the IRA) from the RI that had the highest total VOC concentration.

- TtNUS recommends continuing the long-term monitoring of the well network. The monitoring should be performed in accordance with the Work Plan (TtNUS, 1998a) and the Work Plan Addendum (TtNUS, 1998b) for the next four quarters. This sampling regime should be followed to determine whether significant temporal changes are observed as a result of seasonal variation. Based on the analytical data obtained during the next four sampling events, a comprehensive, annual monitoring report will be prepared. This report will contain data interpretation regarding whether natural attenuation is occurring at the site and recommendations for future action.

- It is recommended that sampling an analysis of monitoring well CEF-05-26D be discontinued since PCE has not been detected during the last two sampling events.

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APPENDIX A

ANALYTICAL LABORATORY RESULTS

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-01-9-036

TO: ~~MR. M. SPERANZA~~ **DATE: JANUARY 11, 1999**

FROM: **JUSTIN ORBICH** **CC: DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – VOA/SVOA/PEST/GAS**
CTO 066 – NAS CECIL FIELD, FLORIDA
SDG 9812006

SAMPLES: 8/Aqueous

CEF-05-26D-02+	CEF-05-7S-02
CEF-05-DUP1-02	CEF-05-LTM01-02
CEF-05-LTM02-02	CEF-05-LTM03-02
TRIP BLANK*	TRIP BLANK*

OVERVIEW

The sample set for CTO 066, SDG 9812006, Naval Air Station (NAS) Cecil Field, Florida consists of eight (8) aqueous environmental samples, which includes two (2) trip blanks (designated TRIP BLANK). The samples were analyzed for selected Target Compound List (TCL) volatile, semivolatile, pesticide, and dissolved gas organic compounds. The sample designated (+) was analyzed for TCL volatile organic compounds only. Samples designated (*) were analyzed for select TCL volatile organic compounds only. One (1) field duplicate pair (CEF-05-DUP1-02/CEF-05-LTM02-02) was included in this SDG.

The samples were collected by Tetra Tech, NUS on November 30th and December 1st, 1998, and analyzed by GPL Laboratories. All analyses were performed in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria and analyzed according to SW 846 Methods 8260B, 8270C, and 8081A and GC (FID). The data in this SDG was validated with regard to the following parameters:

* • Data Completeness
* • Holding Times
• Initial/continuing calibrations
• Laboratory method/field quality control blank results
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified analytical results are presented in Appendix A.

VOLATILE FRACTION

The initial and continuing calibration Relative Response Factors (RRFs) were below the 0.05 quality control limit for acetone. The nondetected results were qualified as rejected, (UR).

Several samples contained positive results for a compound below the contract required quantitation limits (CRQL). These results were qualified as estimated (J).

In sample CEF-05-LTM02-02, the surrogate Percent Recovery (%R) exceeded the quality control limit for 1,2-dichloroethane-d4. The sample was reanalyzed with similar results. The original analysis was used for validation purposes. No action was warranted since the review was limited.

SEMIVOLATILE FRACTION

The following table summarizes the maximum concentrations of semivolatile organic compounds found in the method blanks.

Compound	Concentration	Aqueous Action Level
Bis(2-ethylhexyl)phthalate	2.0µg/L	20.0µg/L

Blank Actions

- Value < Contract Required Quantitation Limit (CRQL); report CRQL followed by a U.
- Value > CRQL and < Action level; report value followed by a U.
- Value > CRQL and > Action level; report value unqualified.

Dilution factors and sample aliquot were taken into consideration during the application of all action levels. The positive results reported for this compound in the affected samples were qualified in the manner indicated by the blank action table. No action was taken due to the nondetected results.

Several samples contained positive results for a compound below the contract required quantitation limits (CRQL). These results were qualified as estimated (J).

PESTICIDE FRACTION

All quality control parameters were met for this fraction.

DISSOLVED GAS

The following table summarizes the maximum concentrations of dissolved gas organic compounds found in the method blank.

Compound	Concentration	Aqueous Action Level
Methane	1.4µg/L	7.0µg/L

Blank Actions

- Value < Contract Required Quantitation Limit (CRQL); report CRQL followed by a U.
- Value > CRQL and < Action level; report value followed by a U.
- Value > CRQL and > Action level; report value unqualified.

Dilution factors and sample aliquot were taken into consideration during the application of all action levels. The positive results reported for this compound in the affected samples were qualified in the manner indicated by the blank action table. The positive results for methane were qualified as nondetected, (U), as a result of blank contamination.

Samples CEF-05-LTM02-02 and CEF-DUP1-02 were diluted 100X due to the presence of methane above the instrument's linear calibration range. Results from the dilution were transposed over the undiluted sample results and used for validation purposes.

Samples CEF-05-LTM01-02 was diluted 10X due to the presence of methane above the instrument's linear calibration range. The result from the dilution was transposed over the undiluted sample result and used for validation purposes.

Samples CEF-05-LTM03-02 was diluted 5X due to the presence of methane above the instrument's linear calibration range. The result from the dilution was transposed over the undiluted sample result and used for validation purposes.

ADDITIONAL COMMENTS

The laboratory failed to analyze for the full Target Compound List (TCL) volatile organic compounds in sample CEF-05-26D-02. The laboratory was notified, and in return, amended the Form I and all the support documentation associated with the aforementioned sample.

EXECUTIVE SUMMARY

Laboratory performance: Initial and continuing calibration RRFs were below the 0.05 quality control limit for acetone. The nondetected results were qualified as rejected, (UR). Bis(2-ethylhexyl)phthalate and methane were detected in the method blanks. Several samples exceeded the instrument's linear calibration range for methane.

Other Factors Affecting Data Quality: None.

MEMO TO: MR. M. SPERANZA
DATE: JANUARY 11, 1999 – PAGE 4

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (February, 1994), and the NFESC guidelines "Navy Installation Restoration Program Laboratory Quality Assurance Guide" (February, 1996). The text of this report has been formulated to address only those problems affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Justin Orbich
Chemist/Data Validator
Tetra Tech, NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer
Tetra Tech, NUS

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

MEMO TO: **MR. M. SPERANZA**
DATE: **JANUARY 11, 1999 – PAGE 5**

NAS CECIL FIELD
SDG 9812006
TABLE 1 - RECOMMENDATION SUMMARY

Sample No.	VOA	SVOA	PEST	GAS
CEF-05-26D-02	R^1			
CEF-05-7S-02	R^1			
CEF-05-DUP1-02	J^1 R^1	J^1		
CEF-05-LTM01-02	J^1 R^1			
CEF-05-LTM02-02	J^1 R^1	J^1		
CEF-05-LTM03-02	R^1			
TRIP BLANK	R^1			
TRIP BLANK	R^1			

If the field is blank, the qualifier is A, accept all data.

R^1 - Reject, (UR), nondetected results for acetone as a result of both initial and continuing calibration RRFs less than 0.05.

J^1 - Accept data, but qualify positive results below the contract required quantitation limit (CRQL) as estimated (J).

FIELD DUPLICATE SUMMARY
SDG 9812006

Compound	Sample CEF-05-LTM02-03 ug/L	Duplicate CEF-05-DUP1-03 ug/L	Relative Percent Difference (RPD) %
Acetone	10	10	0
Benzene	0.6	0.6	0
Ethylbenzene	2.6	2.7	4
Toluene	3.5	3.5	0
Trichloroethene	1.1	1.1	0
Xylene, total	13.7	13.9	1

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-26D-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-01A

Sample wt/vol: 25.0 (g/ml) ML Lab File ID: F13466.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: not dec. Date Analyzed: 12/14/98

GC Column: RTXVOA ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.0	U
156-60-5	Trans-1,2-dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
156-59-2	Cis-1,2-dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
78-3-93	2-Butanone	5.0	U
71-43-2	Benzene	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
79-01-6	Trichloroethene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	Cis-1,3-dichloropropene	1.0	U
108-88-3	Toluene	1.0	U
10061-02-6	Trans-1,3-dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-10-1	4-Methyl-2-pentanone	5.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
108-38-3	m,p-xylene	1.0	U
95-47-6	o-xylene	1.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-7S-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-01A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13475.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. _____ Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethene	3.0	U
108-88-3	Toluene	5.0	U
100-41-4	Ethylbenzene	5.0	U
108-38-3	m,p-xylene	5.0	U
95-47-6	o-xylene	5.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-DUP1-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-07A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13478.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	0.6	J
79-01-6	Trichloroethene	1.1	J
108-88-3	Toluene	3.5	J
100-41-4	Ethylbenzene	2.7	J
108-38-3	m,p-xylene	9.9	
95-47-6	o-xylene	4.0	J

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM01-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-02A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13467.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: not dec. Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethene	5.6	
108-88-3	Toluene	5.2	
100-41-4	Ethylbenzene	1.8	J
108-38-3	m,p-xylene	8.6	
95-47-6	o-xylene	6.6	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM02-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13476.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. _____ Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	0.6	J
79-01-6	Trichloroethene	1.1	J
108-88-3	Toluene	3.5	J
100-41-4	Ethylbenzene	2.6	J
108-38-3	m,p-xylene	9.8	
95-47-6	o-xylene	3.9	J

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM02-02RE

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03BRE

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13502.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. _____ Date Analyzed: 12/15/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
67-64-1	Acetone	17.7	
71-43-2	Benzene	0.6	J
79-01-6	Trichloroethene	1.1	J
108-88-3	Toluene	3.6	J
100-41-4	Ethylbenzene	2.7	J
108-38-3	m,p-xylene	10.2	
95-47-6	o-xylene	4.0	J

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM03-02

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-05A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13477.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. _____ Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethene	3.0	U
108-88-3	Toluene	5.0	U
100-41-4	Ethylbenzene	5.0	U
108-38-3	m,p-xylene	5.0	U
95-47-6	o-xylene	5.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

TRIP BLANK

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-04A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13468.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: not dec. _____ Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND (ug/L or ug/Kg) UG/L		Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethene	3.0	U
108-88-3	Toluene	5.0	U
100-41-4	Ethylbenzene	5.0	U
108-38-3	m,p-xylene	5.0	U
95-47-6	o-xylene	5.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

TRIP BLANK

Lab Name: GPLL LABORATORIES Contract: NUS_SOUTHD

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-09A

Sample wt/vol: 25.000 (g/ml) ML Lab File ID: F13479.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: not dec. _____ Date Analyzed: 12/14/98

GC Column: RTX_VO ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
67-64-1	Acetone	10.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethene	3.0	U
108-88-3	Toluene	5.0	U
100-41-4	Ethylbenzene	5.0	U
108-38-3	m,p-xylene	5.0	U
95-47-6	o-xylene	5.0	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF057S02

Lab Name: GPL_LABORATORIES Contract: NUS_SOUT

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-01C

Sample wt/vol: 940 (g/ml) ML Lab File ID: D13812.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: _____ decanted:(Y/N) N Date Extracted: 12/02/98

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/15/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
106-44-5	4-Methylphenol	4	U
105-67-9	2,4-Dimethylphenol	11	U
91-20-3	Naphthalene	6	U
117-81-7	bis(2-Ethylhexyl)phthalate	4	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF05DUP102

Lab Name: GPL_LABORATORIES Contract: NUS_SOUT

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-07C

Sample wt/vol: 970 (g/ml) ML Lab File ID: D13815.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: _____ decanted:(Y/N) N Date Extracted: 12/02/98

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/16/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
106-44-5	4-Methylphenol	17	
105-67-9	2,4-Dimethylphenol	8	J
91-20-3	Naphthalene	32	
117-81-7	bis(2-Ethylhexyl)phthalate	4	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF05LTM0102

Lab Name: GPL_LABORATORIES Contract: NUS_SOUT

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-02C

Sample wt/vol: 970 (g/ml) ML Lab File ID: D13875.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: _____ decanted:(Y/N) N Date Extracted: 12/02/98

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/18/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
106-44-5	4-Methylphenol	4	U
105-67-9	2,4-Dimethylphenol	10	U
91-20-3	Naphthalene	15	
117-81-7	bis(2-Ethylhexyl)phthalate	4	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF05LTM0202

Lab Name: GPL_LABORATORIES Contract: NUS_SOUT

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03C

Sample wt/vol: 980 (g/ml) ML Lab File ID: D13813.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: _____ decanted:(Y/N) N Date Extracted: 12/02/98

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/15/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
106-44-5	4-Methylphenol	12	
105-67-9	2,4-Dimethylphenol	6	J
91-20-3	Naphthalene	23	
117-81-7	bis(2-Ethylhexyl)phthalate	4	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF05LTM0302

Lab Name: GPL_LABORATORIES Contract: NUS_SOUT

Lab Code: GPLL Case No.: N/A SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-05C

Sample wt/vol: 970 (g/ml) ML Lab File ID: D13814.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: _____ decanted:(Y/N) N Date Extracted: 12/02/98

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/16/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
106-44-5	4-Methylphenol	4	U
105-67-9	2,4-Dimethylphenol	10	U
91-20-3	Naphthalene	6	U
117-81-7	bis(2-Ethylhexyl)phthalate	4	U

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-7S-02

Lab Name: GP ENVIRONMENTAL SERVICES Contract: NUS_SOUTHD

Lab Code: GPES Case No.: 9812018 SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-01E

Sample wt/vol: 950 (g/ml) ML Lab File ID: AB5420P.D

% Moisture: _____ decanted:(Y/N) N Date Received: 12/02/98

Extraction: (SepF/Cont/Sonc) CONT Date Extracted: 12/07/98

Concentrated Extract Volume: 10000 (uL) Date Analyzed: 12/10/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____ Sulfur Cleanup: (Y/N) N

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
319-85-7	beta-BHC	0.021	U
5103-71-9	alpha-Chlordane	0.053	U

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-DUP1-02

Lab Name: GP ENVIRONMENTAL SERVICES Contract: NUS_SOUTHD

Lab Code: GPES Case No.: 9812018 SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-07E

Sample wt/vol: 980 (g/ml) ML Lab File ID: AB5423P.D

% Moisture: _____ decanted:(Y/N) N Date Received: 12/02/98

Extraction: (SepF/Cont/Sonc) CONT Date Extracted: 12/07/98

Concentrated Extract Volume: 10000 (uL) Date Analyzed: 12/10/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____ Sulfur Cleanup: (Y/N) N

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
319-85-7	beta-BHC	0.020	U
5103-71-9	alpha-Chlordane	0.051	U

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM01-02

Lab Name: GP ENVIRONMENTAL SERVICES Contract: NUS_SOUT

Lab Code: GPES Case No.: N/A SAS No.: N/A SDG No.: CF66-1

ALE 12-09-98

Matrix: (soil/water) WATER Lab Sample ID: 9812006-02E

Sample wt/vol: 970 (g/ml) ML Lab File ID: AB5394P.D

% Moisture: _____ decanted:(Y/N) N Date Received: 12/01/98

Extraction: (SepF/Cont/Sonc) CONT Date Extracted: 12/02/98

Concentrated Extract Volume: 10000 (uL) Date Analyzed: 12/07/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____ Sulfur Cleanup: (Y/N) N

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
319-85-7	beta-BHC	0.021	U
5103-71-9	alpha-Chlordane	0.052	U

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM02-02

Lab Name: GP ENVIRONMENTAL SERVICES Contract: NUS_SOUTHD

Lab Code: GPES Case No.: 9812018 SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03E

Sample wt/vol: 960 (g/ml) ML Lab File ID: AB5421P.D

% Moisture: _____ decanted:(Y/N) N Date Received: 12/02/98

Extraction: (SepF/Cont/Sonc) CONT Date Extracted: 12/07/98

Concentrated Extract Volume: 10000 (uL) Date Analyzed: 12/10/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____ Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
319-85-7	beta-BHC	0.021	U
5103-71-9	alpha-Chlordane	0.052	U

1D

PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CEF-05-LTM03-02

Lab Name: GP ENVIRONMENTAL SERVICES Contract: NUS_SOUTHD

Lab Code: GPES Case No.: 9812018 SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-05E

Sample wt/vol: 960 (g/ml) ML Lab File ID: AB5422P.D

% Moisture: _____ decanted:(Y/N) N Date Received: 12/02/98

Extraction: (SepF/Cont/Sonc) CONT Date Extracted: 12/07/98

Concentrated Extract Volume: 10000 (uL) Date Analyzed: 12/10/98

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: _____ Sulfur Cleanup: (Y/N) N

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
319-85-7	beta-BHC	0.021	U
5103-71-9	alpha-Chlordane	0.052	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-7S-02

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-01J

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12576.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	28.5	B
74-84-0	Ethane	5.8	U
74-85-1	Ethylene	6.2	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-DUP1-02

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-07J

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12582.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	1748.8	EB
74-84-0	Ethane	5.8	U
74-85-1	Ethylene	6.2	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-DUP1-02 DL

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-07J 100X

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12583.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	1654.0	BD
74-84-0	Ethane	580.0	U
74-85-1	Ethylene	624.0	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM01-02

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-02J

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12574.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	252.7	EB
74-84-0	Ethane	5.8	U
74-85-1	Ethylene	6.2	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM01-02 DL

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812006-02J 10X

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12575.D

Level: (low/med) LOW Date Received: 12/01/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	324.9	BD
74-84-0	Ethane	58.0	U
74-85-1	Ethylene	62.4	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM02-02

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03J

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12577.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND		Q
74-82-8	Methane	1589.4	EB
74-84-0	Ethane	5.8	U
74-85-1	Ethylene	6.2	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM02-02 DL

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-03J 100X

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12578.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	1552.0	BD
74-84-0	Ethane	580.0	U
74-85-1	Ethylene	624.0	U

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM03-02

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-05J

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12579.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	104.6	EB
74-84-0	Ethane	5.8	U
74-85-1	Ethylene	6.2	U

Level

Level

FORM I SV-1 8015M

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT ID

-05-LTM03-02 DL

Lab Name: GPL LABORATORIES Contract: NUS_SOUT

Lab Code: GPL Case No.: SAS No.: N/A SDG No.: CF66-1

Matrix: (soil/water) WATER Lab Sample ID: 9812018-05J 5X

Sample wt/vol: 10 (g/ml) ML Lab File ID: N12580.D

Level: (low/med) LOW Date Received: 12/02/98

% Moisture: decanted:(Y/N) N Date Extracted:

Concentrated Extract Volume: 1 (uL) Date Analyzed: 12/11/98

Injection Volume: 500. (uL) Dilution Factor: 5.0

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-82-8	Methane	117.0	BD
74-84-0	Ethane	29.0	U
74-85-1	Ethylene	31.2	U

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-01-9-038

TO: **M. SPERANZA** **DATE:** **JANUARY 15, 1999**

FROM: **GRETCHEN PHIPPS** **COPIES:** **DV FILE**

SUBJECT: **DATA VALIDATION – SELECT METALS, DISSOLVED IRON AND MANGANESE AND MISCELLANEOUS PARAMETERS**
CTO 066 - NAS CECIL FIELD
SDG - 9812006

SAMPLES: 10/Aqueous/

CEF-05-7S-02	CEF-05-7S-02-F
CEF-05-DUP1-02	CEF-05-DUP1-02-F
CEF-05-LTM01-02	CEF-05-LTM01-02-F
CEF-05-LTM02-02	CEF-05-LTM02-02-F
CEF-05-LTM03-02	CEF-05-LTM03-02-F

Overview

The sample set for CTO 066, NAS Cecil Field, SDG 9812006, consists of ten (10) aqueous environmental samples. Two (2) field duplicate pairs (CEF-05-DUP1-02/ CEF-05-LTM02-02 and CEF-05-DUP1-02-F/ CEF-05-LTM02-02-F) were included within this SDG.

All samples, with exception to those designated –F, were analyzed for antimony, arsenic, beryllium, cadmium, chromium, manganese, vanadium, alkalinity, biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, dissolved sulfide, nitrate, nitrite, orthophosphate, sulfate and total organic carbon (TOC). The samples designated with a –F were analyzed for dissolved iron and manganese. The samples were collected by Tetra Tech NUS on November 30 and December 1, 1998 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control criteria. Metals analyses were conducted using SW-846 method 6010B. BOD analyses were conducted using EPA method 405.1. COD analyses were conducted using EPA method 410.1. Chloride, Nitrate, Nitrite, 0-Phosphate and Sulfate analyses were conducted using EPA method 300. Dissolved sulfide analyses were conducted using EPA method 376.1. Alkalinity analyses were conducted using EPA method 310.1. TOC analyses were conducted using SW 846 method 9060.

The data was evaluated based on the following parameters:

- Data Completeness
- Holding Times
- Calibration Verifications
- * Laboratory Blank Analyses

* - All quality control criteria were met for this parameter.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Holding Times

The holding time for alkalinity was exceeded by one (1) day for sample CEF-05-LTM01-02. The nondetected result reported for alkalinity in the affected sample was qualified as estimated, "UJ".

Calibration Verification

The Initial Calibration Verification (ICV) percent recovery (%R) for chloride was <90% quality control limit. The positive results reported for chloride were qualified as estimated, "J".

The ICV %R for nitrate was <90% quality control limit. The positive and nondetected results reported for nitrate were qualified as estimated, "J" and "UJ", respectively.

The ICV and Continuing Calibration Verification (CCVs) %Rs for o-phosphate were <90% quality control limit. The nondetected results reported for o-phosphate were qualified as estimated, ""J""

The ICV %R for sulfate was <90% quality control limit. The positive results reported for sulfate were qualified as estimated, "J".

Notes

The CCV %R for nitrite was >110% quality control limit. However, no validation action was required, as all results reported for nitrite were nondetected.

The data for dissolved sulfide analyses was not included in the data package. The information was requested and submitted by the laboratory.

Executive Summary

Laboratory Performance: The holding time for alkalinity affecting one (1) samples was exceeded. The ICVs and/or CCVs for chloride, nitrate, o-phosphate and sulfate were <90% quality control limit.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitles "Navy Installation Restoration Laboratory Quality Assurance Guide." (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS
Gretchen A. Phipps

Tetra Tech NUS
Joseph A. Samchuck
Quality Control Officer

Attachments:

1. Appendix A - Qualified Analytical Data
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Cecil Field
SDG 9810026

Table 1 - RECOMMENDATION SUMMARY

Antimony	
Arsenic	
Beryllium	
Cadmium	
Chromium	
Manganese	
Vanadium	
Dissolved Iron	
Dissolved Manganese	
Alkalinity	J^1
BOD	
COD	
Chloride	J^2
Dissolved Sulfide	
Nitrate	J^2
Nitrite	
Orthophosphate	J^2
Sulfate	J^2
TOC	

If the field is left blank, the qualifier is A - Accept data.

J^1 - Accept data, but qualify positive results as estimated, "J, as a result of holding time exceedance.

J^2 - Accept data, but qualify positive and nondetected results as estimated, "J" and "UJ", respectively, as a result of calibration noncompliance.

ENVIROFORMS/INORGANIC CLP

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INORGANIC ANALYSIS DATA SHEET

SAMPLE NO. CEF-05-7S-02

-7S-02

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-01

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony	5.0	U		P
7440-38-2	Arsenic	5.0	U		P
7440-39-3	Barium				
7440-41-7	Beryllium	3.0	U		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium				
7440-47-3	Chromium	5.0	U		P
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	14.1	B		P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium	6.4	B		P
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-7S-02-F

7S-02F

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-02

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron	100	U		P
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	14.6	B		P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-DUP1-02

UP1-02

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-07

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony	5.0	U		P
7440-38-2	Arsenic	5.0	U		P
7440-39-3	Barium				
7440-41-7	Beryllium	3.0	U		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium				
7440-47-3	Chromium	5.0	U		P
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	30.1			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium	94.3			P
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-DULP1-02-F

P1-02F

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-08

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron	5540			P
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	28.5			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-LTM-01-02

M01-02

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812006-02

Level (low/med): LOW Date Received: 12/01/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony	5.0	U		P
7440-38-2	Arsenic	5.0	U		P
7440-39-3	Barium				
7440-41-7	Beryllium	3.0	U		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium				
7440-47-3	Chromium	5.0	U		P
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	10.2	B		P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium	5.0	U		P
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-LTM 01-02-F

M0102F

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812006-03

Level (low/med): LOW Date Received: 12/01/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron	3510			P
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	9.9	B		P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-LTM02-02

M02-02

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-03

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony	5.0	U		P
7440-38-2	Arsenic	5.0	U		P
7440-39-3	Barium				
7440-41-7	Beryllium	3.0	U		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium				
7440-47-3	Chromium	5.0	U		P
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	28.7			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium	89.9			P
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-05-LTM-02-02-F

M0202F

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-04

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron	5110			P
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	25.7			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-US-LTMU3-02

M03-02

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-05

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony	5.0	U		P
7440-38-2	Arsenic	5.0	U		P
7440-39-3	Barium				
7440-41-7	Beryllium	3.0	U		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium				
7440-47-3	Chromium	5.0	U		P
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron				
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	18.8			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium	5.9	B		P
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

CEF-OS-LJTM03-02-F

M0302F

Lab Name: GPL LABORATORIES Contract:

Lab Code: GPL Case No.: SAS No.: SDG No.: NUS006

Matrix (soil/water): WATER Lab Sample ID: 9812018-06

Level (low/med): LOW Date Received: 12/02/98

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				
7440-36-0	Antimony				
7440-38-2	Arsenic				
7440-39-3	Barium				
7440-41-7	Beryllium				
7440-43-9	Cadmium				
7440-70-2	Calcium				
7440-47-3	Chromium				
7440-48-4	Cobalt				
7440-50-8	Copper				
7439-89-6	Iron	616			P
7439-92-1	Lead				
7439-95-4	Magnesium				
7439-96-5	Manganese	18.0			P
7439-97-6	Mercury				
7440-02-2	Nickel				
7440-09-7	Potassium				
7782-49-2	Selenium				
7440-22-4	Silver				
7440-23-5	Sodium				
7440-28-0	Thallium				
7440-62-2	Vanadium				
7440-66-6	Zinc				
	Cyanide				
7740-42-8	Boron				
7740-42-0	Tin				
7439-98-7	Molybdenum				

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FORM I - IN

RUN SUMMARY SHEET
Alkalinity

DATA FILE: ALKD1498
INSTRUMENT FILE: INSTRUMENT: WET_LAB ANALYZED: 12/14/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	MDL	Units	%Recovery	%RPD	%RSD
1	BLANK	ICB	0		0.000	0.000	1.00	mg/L			
2	3483	ICV	143.3		143	143	1.00	mg/L	91.3		
3	9812006-02	CEF-05-LTM01-02	0		0.000	0.000	1.00	mg/L			
4	9812018-01	CEF-05-7S-02	157.1		157	157	1.00	mg/L			
5	9812018-03	CEF-05-LTM02-02	7.77		7.77	7.77	1.00	mg/L			
6	9812018-05	CEF-05-LTM03-02	7.77		7.77	7.77	1.00	mg/L			
7	9812018-07	CEF-05-DUP1-02	5.18		5.18	5.18	1.00	mg/L			
8	9812026-01	CEF-3-13S-01	5.18		5.18	5.18	1.00	mg/L			
9	9812026-02	CEF-3-14I-01	3.45		3.45	3.45	1.00	mg/L			
10	9812037-01	CEF-3-36S-01	10.36		10.4	10.4	1.00	mg/L			
11	9812037-02	CEF-3-37I-01	18.99		19.0	19.0	1.00	mg/L			
12	9812037-03	CEF-3-38S-01	6.90		6.90	6.90	1.00	mg/L			
13	9812037-04	CEF-3-39I-01	10.36		10.4	10.4	1.00	mg/L			
14	9812044-01	CEF-3-7S-01	27.62		27.6	27.6	1.00	mg/L			
15	9812053-01	CEF-3-8S-01	10.36		10.4	10.4	1.00	mg/L			
16	9812053-02	CEF-3-9I-01	3.45		3.45	3.45	1.00	mg/L			
17	9812087-01	CEF-3-28S-01	0		0.000	0.000	1.00	mg/L			
18	9812087-02	CEF-3-DUP2-01	1.73		1.73	1.73	1.00	mg/L			
19	9812087-03	CEF-3-31S-01	135.5		136	136	1.00	mg/L			
20	9812087-04	CEF-3-WP-01	140.7		141	141	1.00	mg/L			
21	9812087-04D	CEF-3-WP-01D	141.5		142	142	1.00	mg/L		0.567	
22	3483	CCV	143.3		143	143	1.00	mg/L	91.3		
23	BLANK	CCB	0		0.000	0.000	1.00	mg/L			
24	9812065-01	CEF-3-25S-01	0		0.000	0.000	1.00	mg/L			
25	9812065-02	CEF-3-DUP1-01	1.73		1.73	1.73	1.00	mg/L			
26	9812067-01	MW33033	393.5		394	394	1.00	mg/L			
27	9812067-02	MW33012	234.7		235	235	1.00	mg/L			
28	9812067-03	MW33008	253.7		254	254	1.00	mg/L			
29	9812067-04	FB33001	18.99		19.0	19.0	1.00	mg/L			
30	9812078-01	MW33-020-981209	363.7		364	364	1.00	mg/L			
31	9812078-02	MW33-019-981209	509.2		509	509	1.00	mg/L			
32	9812078-03	MW33-018-981209	277.0		277	277	1.00	mg/L			
33	9812078-04	MW33-017-981209	295.1		295	295	1.00	mg/L			
34	9812078-05	MW33-007-981209	333.1		333	333	1.00	mg/L			
35	9812078-06	MW33-035-981209	198.5		198	198	1.00	mg/L			
36	9812078-08	MW33-002-981209	375.4		375	375	1.00	mg/L			
37	9812056-04	MW33-001-981207	225.2		225	225	1.00	mg/L			
38	3483	CV	145.0		145	145	1.00	mg/L	92.4		
39	BLANK	CB	0		0.000	0.000	1.00	mg/L			

Jane Chatterton SC 1-4-99
Analyst / Date

Chris Berg 1-4-99
Lab Supervisor / Date

6063

RUN SUMMARY SHEET
Biological Oxygen Demand

DATA FILE: BODD0798
INSTRUMENT FILE: INSTRUMENT: WET_LAB ANALYZED: 12/07/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	MDL	Units	%Recovery	%RPD	%RSD
1	UNSEEDED BLAN	UBLK	0	0	0.000	0.000	2.00	mg/L			
2	SEEDED BLANK	SBLK	0.50	0.35	0.425	0.425	2.00	mg/L			25.0
3	WC0132	G/GA	166.6	120.1	143	143	2.00	mg/L	71.7		22.9
4	WC0149	LCSW	80.4	68.4	74.4	74.4	2.00	mg/L	89.7 OK		11.4
5	9812006-02	CEF-05-LTM01-02	0		0.000	0.000	2.00	mg/L			
6	9812018-01	CEF-05-7S-02	0		0.000	0.000	2.00	mg/L			
7	9812018-03	CEF-05-LTM02-02	0		0.000	0.000	2.00	mg/L			
8	9812018-05	CEF-05-LTM03-02	0		0.000	0.000	2.00	mg/L			
9	9812018-05D	CEF-05-LTM03-02	0		0.000	0.000	2.00	mg/L		DIV BY	
10	9812018-07	CEF-05-DUP1-02	0		0.000	0.000	2.00	mg/L			

Steve Chatterton SC 1-5-99
Analyst / Date

Chris Bean 1-5-99
Lab Supervisor / Date

RUN SUMMARY SHEET
Chemical Oxygen Demand

DATA FILE: CODD2298
INSTRUMENT FILE:
INSTRUMENT: WET_LAB
ANALYZED: 12/22/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	Prep Blank	PB	0		0.000	0.000	5.00	mg/L			
2	ERA 8067	ICV	70.0		70.0	140	10.0	mg/L	101		
3	9812006-02	CEF-05-LTM01-02	23.4		23.4	23.4	5.00	mg/L			
4	9812018-01	CEF-05-7S-02	28.6		28.6	28.6	5.00	mg/L			
5	9812018-03	CEF-05-LTM02-02	80.5		80.5	80.5	5.00	mg/L			
6	9812018-05	CEF-05-LTM03-02	18.2		18.2	18.2	5.00	mg/L			
7	9812018-07	CEF-05-DUP1-02	80.5		80.5	80.5	5.00	mg/L			
8	9812018-07D	CEF-05-DUP1-02D	80.50		80.5	80.5	5.00	mg/L		0.000	
9	9812018-07S	CEF-05-DUP1-02S	135.0		135	135	5.00	mg/L	109		
10	9812087-01	CEF-3-28S-01	23.4		23.4	23.4	5.00	mg/L			
11	9812087-02	CEF-3-DUP2-01	23.4		23.4	23.4	5.00	mg/L			
12	9812087-03	CEF-3-31S-01	18.2		18.2	18.2	5.00	mg/L			
13	9812087-04	CEF-3-WP-01	28.6		28.6	28.6	5.00	mg/L			
14	9812101-01	004305	153.2		153	15300	500	mg/L			
15	9812123-01	984912-1	54.5		54.5	54.5	5.00	mg/L			
16	9812164-01	PW09	18.2		18.2	18.2	5.00	mg/L			

SN
Analyst / Date

Tracy Wardell 12-28-98
Lab Supervisor / Date

RUN SUMMARY SHEET
CHLORIDE BY IC METHOD 300

DATA FILE: IC-D0298
INSTRUMENT FILE: INSTRUMENT: DIONEX ANALYZED: 12/02/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	BLANK	S0	7866		-0.025	-0.025	0.100	mg/L			
2	0.1 PPM	S1	43236		0.097	0.097	0.100	mg/L			
3	0.5 PPM	S2	168492		0.527	0.527	0.100	mg/L			
4	1.0 PPM	S3	306595		1.00	1.00	0.100	mg/L			
5	3.0 PPM	S4	889857		3.01	3.01	0.100	mg/L			
6	5.0 PPM	S5	1467690		4.99	4.99	0.100	mg/L			
7	ICV	ICV	1034973		3.51	1750	50.0	mg/L	87.6		
8	BLANK	ICB	0		-0.052	-0.052	0.100	mg/L			
9	over calibration										
10	over calibration										
11	over calibration										
12	9812006-02	CEF-05-LTM01-02	591365		1.98	19.8	1.00	mg/L			
13	9812006-02D	CEF-05-LTM01-02	594857		1.99	19.9	1.00	mg/L		0.604	
14	9812006-02S	CEF-05-LTM01-02	1061571		3.60	71.9	2.00	mg/L	104		
15	9812018-03	CEF-05-LTM02-02	612094		2.05	2.05	0.100	mg/L			
16	9812018-07	CEF-05-DUP1-02	688319		2.31	2.31	0.100	mg/L			
17	over calibration										
18	over calibration										
19	CCV1	CCV1	1097274		3.72	1860	50.0	mg/L	93.0		
20	CCB1	CCB1	0		-0.052	-0.052	0.100	mg/L			
21	9812018-07	CEF-05-DUP1-02	206543		0.658	13.2	2.00	mg/L			
22	9812018-03	CEF-05-LTM02-02	195179		0.619	12.4	2.00	mg/L			
23	9812018-01	CEF-05-7S-02	528166		1.76	35.3	2.00	mg/L			
24	9812018-05	CEF-05-LTM03-02	201331		0.640	12.8	2.00	mg/L			
25	CCV2	CCV2	1139930		3.87	1930	50.0	mg/L	96.7		
26	CCB2	CCB2	0		-0.052	-0.052	0.100	mg/L			

VF
Analyst / Date

Tracy Wardell 1-6-98
Lab Supervisor / Date

6003

GP-W-054

Method Title: Sulfide, Titrimetric, Iodine, Sodium Thiosulfate
Method Reference: MCAWW 376.1
Method Detection Limit: 2 mg/L

Analyst: TW
Date: 12-7-98
Reviewed by/Date: Chris Beard 12-7-98

ANALYSIS RAW DATA

Client ID[1]	GP ID	Sample Vol./Wt.	% Solid	Iodine (ml)	Sodium (ml) Thiosulfate	A-B	H_2O Final Results[1] (mg/L)	Soil Final Results[2] ( )
ICB	BLANK	20 ml	N/A	5.00	5.00	0	<2	N/A
ERA	3234	20 ml		* ~~4.50~~ 5.00	4.50	0.5 ml	10 mg	
~~CEF-05~~ LTM01-02	9812006-02	20 ml		5.00	5.00	0	<2	
-75-02	9812012-010	20 ml		5.00	5.00	0	<2	
-LTM02-02	030	20 ml		5.00	4.90	0.1	2	
-LTM03-02	050	20 ml		5.00	5.00	0	<2	
DUP1-02	070	20 ml		5.00	5.00	0	<2	
~~CEF~~-3-135 01	9812026-01L	20 ml		5.00	5.00	0	<2	
-147-01	02L	20 ml		5.00	5.00	0	<2	
-365-01	9812037-01L	20 ml		5.00	5.00	0	<2	
-37I-01	02L	20 ml		5.00	5.00	0	<2	
-325-01	03L	20 ml		5.00	5.00	0	<2	
-39I-01	04L	20 ml		5.00	5.00	0	<2	
AD-7485	9812040-01A	20 ml		5.00	4.50	0.50	10 mg	
CEF-375-01	9812044-01L	20 ml	N/A	5.00	5.00	0	<2	N/A
ICB	BLANK				did	not	run yet	
ERA	3234	20 ml	N/A	5.00	will	continue on next page		

CALCULATION:

1. mg/L Sulfide = $\frac{400\ (A-B)}{\text{Sample Volume}}$
2. A = Volume 0.0250N I_2 added
   B = Volume 0.0250N $Na_2S_2O_3$ added

[1] H_2O Final Results = Dilution Factor X Concentration (if not detected report < ____)

[2] Soil Final Results = $\frac{\text{Dilution Factor X Concentration}}{\text{wt. of sample}}$ % Solids

RUN SUMMARY SHEET
NITRATE BY IC

DATA FILE: IC-D0298
INSTRUMENT FILE: INSTRUMENT: DIONEX ANALYZED: 12/02/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	BLANK	S0	0		0.013	0.013	0.100	mg/L			
2	0.1 PPM	S1	5153		0.125	0.125	0.100	mg/L			
3	0.5 PPM	S2	23813		0.529	0.529	0.100	mg/L			
4	1.0 PPM	S3	44649		0.981	0.981	0.100	mg/L			
5	3.0 PPM	S4	132683		2.89	2.89	0.100	mg/L			
6	5.0 PPM	S5	233082		5.06	5.06	0.100	mg/L			
7	ICV	ICV	77887		1.70	850	50.0	mg/L	85.0		
8	BLANK	ICB	0		0.013	0.013	0.100	mg/L			
9	9812006-02	CEF-05-LTM01-02	563		0.025	0.025	0.100	mg/L			
10	9812006-02D	CEF-05-LTM01-02	432		0.023	0.023	0.100	mg/L		~~142~~ NA	
11	9812006-02S	CEF-05-LTM01-02	108908		2.37	4.75	0.200	mg/L	94.9		
12	9812006-02	CEF-05-LTM01-02	0		0.013	0.132	1.00	mg/L			
13	9812006-02D	CEF-05-LTM01-02	0		0.013	0.132	1.00	mg/L		~~135~~ NA	
14	9812006-02S	CEF-05-LTM01-02	102860		2.24	44.8	2.00	mg/L	89.7		
15	9812018-03	CEF-05-LTM02-02	585		0.026	0.026	0.100	mg/L			
16	9812018-07	CEF-05-DUP1-02	603		0.026	0.026	0.100	mg/L			
17	9812018-01	CEF-05-7S-02	14407		0.325	0.325	0.100	mg/L			
18	9812018-05	CEF-05-LTM03-02	0		0.013	0.013	0.100	mg/L			
19	CCV1	CCV1	89692		1.96	978	50.0	mg/L	97.8		
20	CCB1	CCB1	0		0.013	0.013	0.100	mg/L			
21	9812018-07	CEF-05-DUP1-02	0		0.013	0.264	2.00	mg/L			
22	9812018-03	CEF-05-LTM02-02	0		0.013	0.264	2.00	mg/L			
23	9812018-01	CEF-05-7S-02	1136		0.038	0.756	2.00	mg/L			
24	9812018-05	CEF-05-LTM03-02	0		0.013	0.264	2.00	mg/L			
25	CCV2	CCV2	92282		2.01	1010	50.0	mg/L	101		
26	CCB2	CCB2	0		0.013	0.013	0.100	mg/L			

VF
Analyst / Date

Tracy Warden 1-6-98
Lab Supervisor / Date

RUN SUMMARY SHEET
NITRITE BY IC

DATA FILE: IC-D0298
INSTRUMENT FILE: INSTRUMENT: DIONEX ANALYZED: 12/02/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	BLANK	S0	0		-0.005	-0.005	0.100	mg/L			
2	0.1 PPM	S1	6366		0.093	0.093	0.100	mg/L			
3	0.5 PPM	S2	31756		0.483	0.483	0.100	mg/L			
4	1.0 PPM	S3	66234		1.01	1.01	0.100	mg/L			
5	3.0 PPM	S4	198395		3.04	3.04	0.100	mg/L			
6	5.0 PPM	S5	323977		4.97	4.97	0.100	mg/L			
7	ICV	ICV	13509		0.203	101	50.0	mg/L	101		
8	BLANK	ICB	0		-0.005	-0.005	0.100	mg/L			
9	9812006-02	CEF-05-LTM01-02	0		-0.005	-0.005	0.100	mg/L			
10	9812006-02D	CEF-05-LTM01-02	0		-0.005	-0.005	0.100	mg/L			~~164~~ NA
11	9812006-02S	CEF-05-LTM01-02	200326		3.07	6.15	0.200	mg/L	123		
12	9812006-02	CEF-05-LTM01-02	0		-0.005	-0.048	1.00	mg/L			
13	9812006-02D	CEF-05-LTM01-02	0		-0.005	-0.048	1.00	mg/L			~~164~~ NA
14	9812006-02S	CEF-05-LTM01-02	165116		2.53	50.6	2.00	mg/L	101		
15	9812018-03	CEF-05-LTM02-02	0		-0.005	-0.005	0.100	mg/L			
16	9812018-07	CEF-05-DUP1-02	0		-0.005	-0.005	0.100	mg/L			
17	9812018-01	CEF-05-7S-02	0		-0.005	-0.005	0.100	mg/L			
18	9812018-05	CEF-05-LTM03-02	0		-0.005	-0.005	0.100	mg/L			
19	CCV1	CCV1	14751		0.222	111	50.0	mg/L	111		
20	CCB1	CCB1	0		-0.005	-0.005	0.100	mg/L			
21	9812018-07	CEF-05-DUP1-02	0		-0.005	-0.096	2.00	mg/L			
22	9812018-03	CEF-05-LTM02-02	0		-0.005	-0.096	2.00	mg/L			
23	9812018-01	CEF-05-7S-02	0		-0.005	-0.096	2.00	mg/L			
24	9812018-05	CEF-05-LTM03-02	0		-0.005	-0.096	2.00	mg/L			
25	CCV2	CCV2	15194		0.229	114	50.0	mg/L	114		
26	CCB2	CCB2	0		-0.005	-0.005	0.100	mg/L			

VF
Analyst / Date

Tracy Wadell 1-6-98
Lab Supervisor / Date

RUN SUMMARY SHEET
O-Phosphate (as phosphorus)

DATA FILE: IC-D0298
INSTRUMENT FILE: INSTRUMENT: DIONEX ANALYZED: 12/02/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	BLANK	S0	0		0.019	0.019	0.100	mg/L			
2	0.1 PPM	S1	294		0.083	0.083	0.100	mg/L			
3	0.5 PPM	S2	2000		0.456	0.456	0.100	mg/L			
4	1.0 PPM	S3	4432		0.988	0.988	0.100	mg/L			
5	3.0 PPM	S4	14226		3.13	3.13	0.100	mg/L			
6	5.0 PPM	S5	22446		4.93	4.93	0.100	mg/L			
7	ICV	ICV	868		0.209	104	50.0	mg/L	52.2		
8	BLANK	ICB	0		0.019	0.019	0.100	mg/L			
9	9812006-02	CEF-05-LTM01-02	0		0.019	0.019	0.100	mg/L			
10	9812006-02D	CEF-05-LTM01-02	0		0.019	0.019	0.100	mg/L			164 NA
11	9812006-02S	CEF-05-LTM01-02	6736		1.49	2.98	0.200	mg/L	59.7		
12	9812006-02	CEF-05-LTM01-02	0		0.019	0.191	1.00	mg/L			
13	9812006-02D	CEF-05-LTM01-02	0		0.019	0.191	1.00	mg/L			164 NA
14	9812006-02S	CEF-05-LTM01-02	8302		1.83	36.7	2.00	mg/L	73.3		
15	9812018-03	CEF-05-LTM02-02	0		0.019	0.019	0.100	mg/L			
16	9812018-07	CEF-05-DUP1-02	0		0.019	0.019	0.100	mg/L			
17	9812018-01	CEF-05-7S-02	0		0.019	0.019	0.100	mg/L			
18	9812018-05	CEF-05-LTM03-02	0		0.019	0.019	0.100	mg/L			
19	CCV1	CCV1	747		0.182	91.2	50.0	mg/L	45.6		
20	CCB1	CCB1	0		0.019	0.019	0.100	mg/L			
21	9812018-07	CEF-05-DUP1-02	0		0.019	0.382	2.00	mg/L			
22	9812018-03	CEF-05-LTM02-02	0		0.019	0.382	2.00	mg/L			
23	9812018-01	CEF-05-7S-02	0		0.019	0.382	2.00	mg/L			
24	9812018-05	CEF-05-LTM03-02	0		0.019	0.382	2.00	mg/L			
25	CCV2	CCV2	682		0.168	84.1	50.0	mg/L	42.0		
26	CCB2	CCB2	0		0.019	0.019	0.100	mg/L			

VF
Analyst / Date

Tracy Wadell 1-6-99
Lab Supervisor / Date

6007

RUN SUMMARY SHEET
SULFATE BY IC METHOD 300

DATA FILE: IC-D0298
INSTRUMENT FILE: INSTRUMENT: DIONEX ANALYZED: 12/02/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	CRDL	Units	%Recovery	%RPD	%RSD
1	BLANK	S0	0		-0.106	-0.106	0.100	mg/L			
2	0.1 PPM	S1	85743		0.344	0.344	0.100	mg/L			
3	0.5 PPM	S2	106454		0.453	0.453	0.100	mg/L			
4	1.0 PPM	S3	192151		0.902	0.902	0.100	mg/L			
5	3.0 PPM	S4	594095		3.01	3.01	0.100	mg/L			
6	5.0 PPM	S5	972655		5.00	5.00	0.100	mg/L			
7	ICV	ICV	683889		3.48	1740	50.0	mg/L	87.0		
8	BLANK	ICB	0		-0.106	-0.106	0.100	mg/L			
9	reporting diluted run										
10	reporting diluted run										
11	reporting diluted run										
12	9812006-02	CEF-05-LTM01-02	276248		1.34	13.4	1.00	mg/L			
13	9812006-02D	CEF-05-LTM01-02	268306		1.30	13.0	1.00	mg/L		3.15	
14	9812006-02S	CEF-05-LTM01-02	705058		3.59	71.9	2.00	mg/L	117		
15	9812018-03	CEF-05-LTM02-02	625230		3.17	3.17	0.100	mg/L			
16	9812018-07	CEF-05-DUP1-02	542088		2.74	2.74	0.100	mg/L			
17	9812018-01	CEF-05-7S-02	1869735		9.70	9.70	0.100	mg/L			
18	9812018-05	CEF-05-LTM03-02	262364		1.27	1.27	0.100	mg/L			
19	CCV1	CCV1	741445		3.78	1890	50.0	mg/L	94.6		
20	CCB1	CCB1	0		-0.106	-0.106	0.100	mg/L			
21	9812018-07	CEF-05-DUP1-02	62773		0.223	4.47	2.00	mg/L			
22	9812018-03	CEF-05-LTM02-02	55082		0.183	3.66	2.00	mg/L			
23	9812018-01	CEF-05-7S-02	177244		0.824	16.5	2.00	mg/L			
24	9812018-05	CEF-05-LTM03-02	0		-0.106	-2.12	2.00	mg/L			
25	CCV2	CCV2	737684		3.76	1880	50.0	mg/L	94.1		
26	CCB2	CCB2	0		-0.106	-0.106	0.100	mg/L			

VF
Analyst / Date

Tracy Wardell 1-6-98
Lab Supervisor / Date

6008

RUN SUMMARY SHEET
Total Organic Carbon

DATA FILE: TOCD2198
INSTRUMENT FILE: INSTRUMENT: DOHRMAN ANALYZED: 12/21/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	MDL	Units	%Recovery	%RPD	%RSD
1	WC0149	ICV	55.59		55.6	55.6	1.00	mg/L	103		
2	BLANK	ICB	0.000		0.000	0.000	1.00	mg/L			
3	9812123-01	984912-1	9.147		9.15	9.15	1.00	mg/L			
4	9812037-01	CEF-3-36S-01	3.355		3.36	3.36	1.00	mg/L			
5	9812037-02	CEF-3-37I-01	0.841		0.841	0.841	1.00	mg/L			
6	9812037-03	CEF-3-38S-01	6.343		6.34	6.34	1.00	mg/L			
7	9812037-04	CEF-3-39I-01	2.540		2.54	2.54	1.00	mg/L			
8	9812018-01	CEF-05-7S-02	8.509		8.51	8.51	1.00	mg/L			
9	9812018-03	CEF-05-LTM02-02	19.38		19.4	19.4	1.00	mg/L			
10	9812018-05	CEF-05-LTM03-02	4.265		4.26	4.26	1.00	mg/L			
11	9812018-07	CEF-05-DUP1-02	18.22		18.2	18.2	1.00	mg/L			
12	WCO 149	WCO 149	54.11		54.1	54.1	1.00	mg/L	100		
13	BLANK	BLANK	0.000		0.000	0.000	1.00	mg/L			
14	9812026-01	CEF-3-13S-01	22.96		23.0	23.0	1.00	mg/L			
15	9812026-02	CEF-3-14I-01	0.368		0.368	0.368	1.00	mg/L			
16	9812053-01	CEF-3-8S-01	0.971		0.971	0.971	1.00	mg/L			
17	9812053-02	CEF-3-9I-01	0.330		0.330	0.330	1.00	mg/L			
18	9812053-02D	CEF-3-9I-01D	0.328		0.328	0.328	1.00	mg/L		0.608	
19	9812053-02S	CEF-3-9I-01S	9.223		9.22	9.22	1.00	mg/L	92.2		
20	9812065-01	CEF-3-25S-01	0.265		0.265	0.265	1.00	mg/L			
21	9812065-02	CEF-3-DUP1-01	0.237		0.237	0.237	1.00	mg/L			
22	WCO 149	WCO 149	54.19		54.2	54.2	1.00	mg/L	101		
23	BLANK	BLANK	0.000		0.000	0.000	1.00	mg/L			

Sue Chatterton SC 12-29-98
Analyst / Date

Tracy Vardell 12-28-98
Lab Supervisor / Date

RUN SUMMARY SHEET
Total Organic Carbon

DATA FILE: TOCD1598
INSTRUMENT FILE: INSTRUMENT: DOHRMAN ANALYZED: 12/15/1998

Seq	Lab ID	Client ID	Rep1	Rep2	Raw Conc.	Result	MDL	Units	%Recovery	%RPD	%RSD
1	WC0149	ICV	55.006		55.0	55.0	1.00	mg/L	102		
2	BLANK	ICB	-0.189		-0.189	-0.189	1.00	mg/L			
3	9812055-02	YR-4	36.029		36.0	36.0	1.00	mg/L			
4	9811176-01	CEF-8-MW-13S-02	42.750		42.8	42.8	1.00	mg/L			
5	9811176-03	CEF-8-MW-10S-02	29.902		29.9	29.9	1.00	mg/L			
6	9811176-05	CEF-8-MW-6S-02	5.297		5.30	5.30	1.00	mg/L			
7	9811176-07	CEF-8-MW-DUP1-0	43.040		43.0	43.0	1.00	mg/L			
8	9811176-09	CEF-8-MW-DUP2-0	29.422		29.4	29.4	1.00	mg/L			
9	9811198-01	CEF-8-MW-4S-02	17.457		17.5	17.5	1.00	mg/L			
10	9811198-03	CEF-8-MW-12S-02	4.662		4.66	4.66	1.00	mg/L			
11	9811201-01	10EGW05	15.830		15.8	15.8	1.00	mg/L			
12	9811201-01D	10EGW05D	14.985		15.0	15.0	1.00	mg/L		5.48	
13	WC0149	CCV	55.472		55.5	55.5	1.00	mg/L	103		
14	BLANK	CCB	-0.030		-0.030	-0.030	1.00	mg/L			
15	9811201-01S	10EGW05S	24.467		24.5	24.5	1.00	mg/L	86.4		
16	9811201-02	10EGW06	0.601		0.601	0.601	1.00	mg/L			
17	9811201-03	10EGW07	0.791		0.791	0.791	1.00	mg/L			
18	9811201-04	10GW17	1.940		1.94	1.94	1.00	mg/L			
19	9811201-05	10GW18	0.354		0.354	0.354	1.00	mg/L			
20	9811201-06	10GW25	0.167		0.167	0.167	1.00	mg/L			
21	9811201-07	10GW34	8.980		8.98	8.98	1.00	mg/L			
22	9811201-08	10GW35	3.623		3.62	3.62	1.00	mg/L			
23	9811201-09	10GW42	1.218		1.22	1.22	1.00	mg/L			
24	9811201-10	10GW48	1.919		1.92	1.92	1.00	mg/L			
25	WC0149	CCV	55.018		55.0	55.0	1.00	mg/L	102		
26	BLANK	CCB	-0.095		-0.095	-0.095	1.00	mg/L			
27	9811201-11	10B	-0.072		-0.072	-0.072	1.00	mg/L			
28	9811213-01	CEF-8-MW-24I-02	3.140		3.14	3.14	1.00	mg/L			
29	9811213-03	CEF-8-MW-23S-02	1.071		1.07	1.07	1.00	mg/L			
30	9811213-05	CEF-8-MW-9S-02	1.441		1.44	1.44	1.00	mg/L			
31	9811228-02	OU9-W2	0.870		0.870	0.870	1.00	mg/L			
32	9811228-02D	OU9-W2D	0.839		0.839	0.839	1.00	mg/L		NA ~~3.63~~ 4B 12-15-98	
33	9811228-02S	OU9-W2S	9.677		9.68	9.68	1.00	mg/L	96.8		
34	9812006-02	CEF-05-LTM01-02	3.687		3.69	3.69	1.00	mg/L			
35	9812044-01	CEF-3-7S-01	36.004		36.0	36.0	1.00	mg/L			
36	WC0149	CV	53.278		53.3	53.3	1.00	mg/L	98.8		
37	BLANK	CB	-0.065		-0.065	-0.065	1.00	mg/L			

Chris Beard DCB 12-15-98
Analyst / Date

Tracy Wardell 12-16-98
Lab Supervisor / Date

6048