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SITE ASSESSMENT REPORT ADDENDUM FOR BUILDING 351 NS MAYPORT FL
3/1/2003
TETRA TECH NUS

Rev. 1
03/27/03

Site Assessment Report Addendum

for

Building 351

Naval Station Mayport

Mayport, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0122

March 2003

Rev. 1
03/27/03

SITE ASSESSMENT REPORT ADDENDUM FOR BUILDING 351

NAVAL STATION MAYPORT
MAYPORT, 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 0122

MARCH 2003

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PROFESSIONAL CERTIFICATION

Site Assessment Report Addendum
Building 351
Naval Station, Mayport, Florida

This Site Assessment Report Addendum was prepared under the direct supervision of the undersigned geologist using geologic and hydrogeologic principles standard to the profession at the time the report was prepared in general conformance with the requirements of Florida Administrative Code 62-770. If conditions are determined to exist that differ from those described, the undersigned geologist should be notified to evaluate the effects of additional information on the assessment described in this report. This report was developed specifically for the referenced site and should not be construed to apply to any other site.

Mark Peterson, P.G.
Florida License No. PG-1852

3/27/03
Date

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ACRONYMS

AFVR	Aggressive Fluid Vapor Recovery
bls	Below Land Surface
CLEAN	Comprehensive Long-term Environmental Action Navy
CTO	Contract Task Order
EDB	Ethylene Dibromide
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FL-PRO	Florida Petroleum Range Organics
ft	Feet
GAG	Gasoline Analytical Group
GCTLs	Groundwater Cleanup Target Levels
HSAs	Hollow Stem Augers
IM	Interim Measure
KAG	Kerosene Analytical Group
µg/L	Micrograms per Liter
µmhos/cm	Microohms per Centimeter
mg/L	Milligrams per Liter
MONA	Monitoring Only Natural Attenuation
NAVY	United States Navy
NS	Naval Station
PAHs	Polynuclear Aromatic Hydrocarbons
PCW	Petroleum Contact Water
SAR	Site Assessment Report
SOPs	Standard Operating Procedures
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
STL	Severn Trent Laboratories
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has completed a Site Assessment Report (SAR) Addendum documenting the additional assessment and Interim Measure (IM) activities and results for Building 351 at Naval Station (NS) Mayport, Mayport, Florida. The IM was conducted to reduce petroleum impacts to the groundwater at Building 351 by the use of aggressive fluid vapor recovery (AFVR). Past assessments have determined that there are no impacts above regulatory thresholds to the soil. However, free product was reported to be present on the groundwater in one well. A January 2001 TtNUS SAR documents several elevated petroleum constituents above the Groundwater Cleanup Target Levels (GCTLs) and xylenes above Natural Attenuation Criteria in monitoring well MW-05. Product was once reported to be present in monitoring well MW-5. Because of the presence of free product, an IM was requested by the NS Mayport Partnering Team.

TtNUS performed the following tasks during the IM:

- Conducted a site survey to identify utilities.
- Installed one shallow 4-inch monitoring well to approximately 13 feet (ft) below land surface (bls) at the source area.
- Evaluated groundwater flow direction, gradient, and free product thickness before and after each AFVR event.
- Completed three AFVR events.
- Collected groundwater samples from five site monitoring wells for analyses of the gasoline analytical group (GAG) and kerosene analytical group (KAG) compounds listed in Tables A and B of Chapter 62-770, Florida Administrative Code (FAC), which include volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAH), ethylene dibromide (EDB), total lead, and total recoverable petroleum hydrocarbons (TRPH).
- Determined the effectiveness of the IM and made recommendations based on the investigation results.

After the implementation of the IM, free product was not encountered at the site. Groundwater samples were collected for analysis of the GAG/KAG group. Based on these groundwater analytical results,

contaminant concentrations were significantly decreased by use of AFVR. Benzo(a)anthracene, a PAH, was reported at a concentration of 0.62 micrograms per liter (µg/L), which exceeds its Florida Department of Environmental Protection (FDEP) GCTL of 0.2 µg/L. A TRPH result of 25 milligrams per liter (mg/L) was also reported exceeding the GCTL of 5 mg/L. No other KAG compound was identified at a concentration exceeding its GCTL. Based on results of this SAR Addendum, TtNUS recommends that a Monitored Natural Attenuation program be implemented at the site.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This SAR Addendum was prepared by TtNUS to document an IM conducted on behalf of the United States Navy (Navy) Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) under Contract Task Order (CTO) 0122 for the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888. The SAR addendum documents the additional assessment and IM actions that were conducted at Building 351 located at NS Mayport, Duval County, Florida. The FDEP Facility Identification Number is FL168626008. The work was performed to address FDEP's letter dated March 5, 2001, provided in Appendix A, and to meet the requirements of the NS Mayport Partnering Team.

The purpose of this IM was to remove free product and to reduce petroleum concentrations in groundwater. Sampling was done in accordance with the requirements of Chapter 62-770, FAC. To complete the SAR Addendum IM, TtNUS performed the following tasks:

- Installed one shallow monitoring well.
- Collected groundwater samples from five monitoring wells for analysis of KAG constituents.
- Estimated groundwater flow direction and free product thickness before and after each AFVR event.
- Prepared a SAR Addendum describing the effectiveness of IM at the site.

1.2 SITE DESCRIPTION AND SETTING

1.2.1 Location

NS Mayport is located within the corporate limits of the city of Jacksonville, Duval County, Florida, approximately 12 miles to the northeast of downtown Jacksonville, and adjacent to the town of Mayport. A Regional Area Map is provided as Figure 1-1. The Station complex is located on the northern end of a peninsula bound by the Atlantic Ocean to the east and the St. Johns River to the north and west. NS Mayport occupies the entire northern part of the peninsula except for the town of Mayport, which is located to the west between the Station and the St. Johns River.

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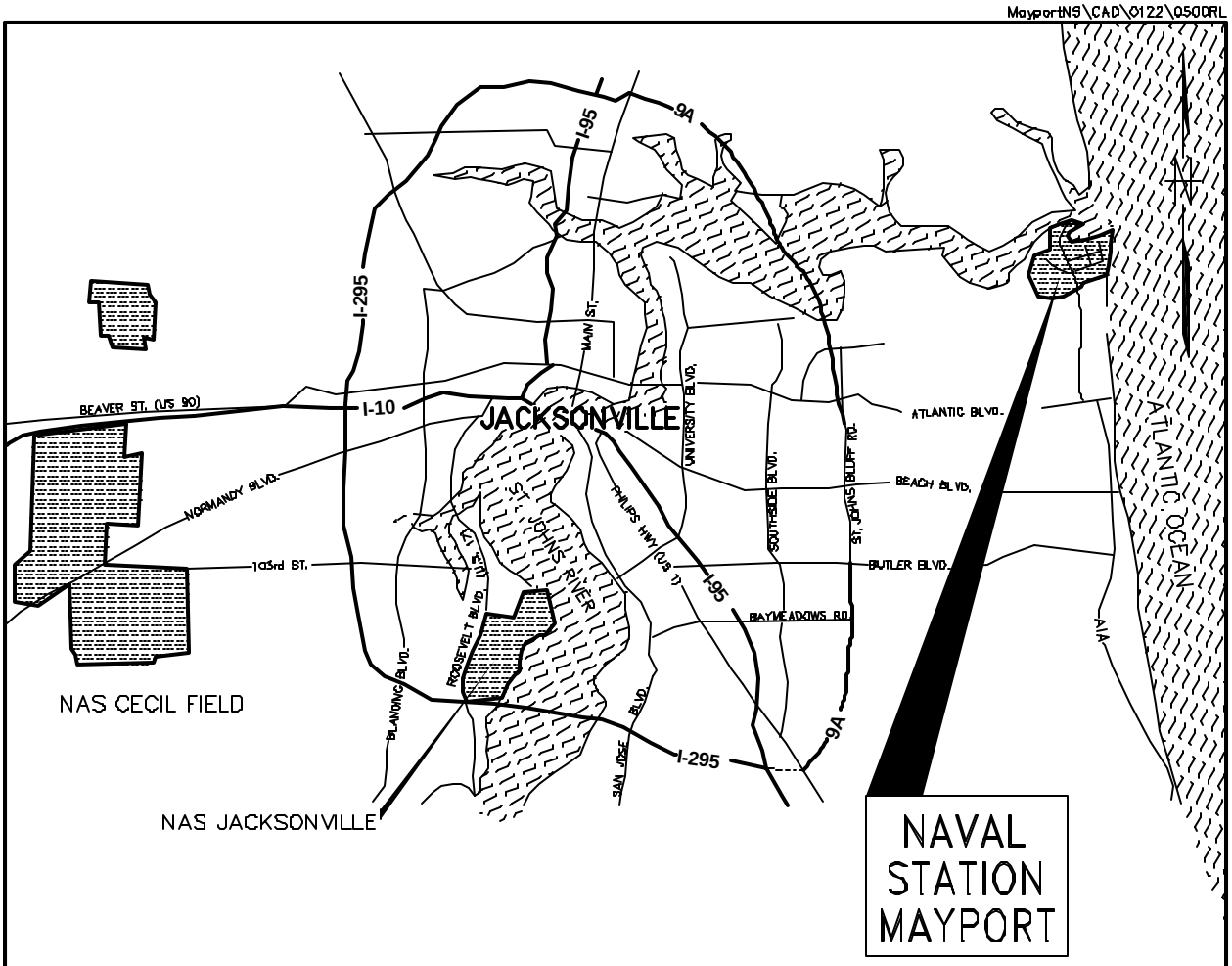

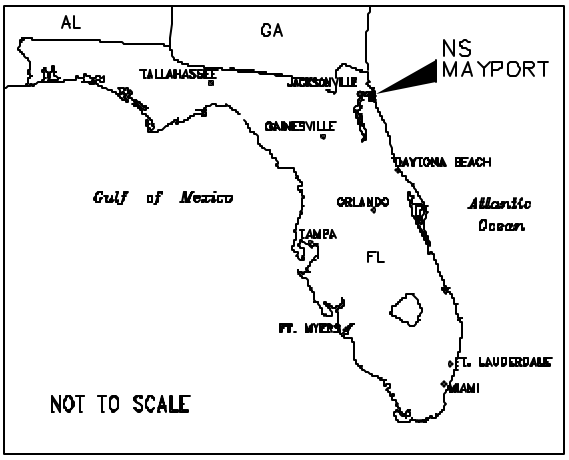

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CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1–1 / REV. 0

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1.2.2 Site Description

Building 351 is located in the northeastern section of NS Mayport as shown on Figure 1-2. It is one of the primary buildings comprising the Fleet Training Facility. The source area for the current investigation is located north of the northern main entrance to Building 351, between Buildings 351 and 1388. A site plan is presented as Figure 1-3.

1.3 SITE HISTORY

On July 2, 1999, a diesel fuel release was reported at Building 351. The source of the discharge was reported to be a leaking 1.5-inch diameter, underground (approximately 2.5 ft bls) distribution pipe containing diesel fuel. The total quantity of diesel fuel released was not known.

An area approximately 14 ft long by 8 ft wide was excavated to remove excessively contaminated soils from the fuel-impacted area. The horizontal extent of the excavation was limited due to the presence of permanent structures adjacent to the affected areas. Approximately seven tons of diesel-contaminated soil was eventually removed and transported offsite for treatment. After the excavation was completed, soil samples collected from the floor and walls were analyzed for appropriate diesel constituents. No concentrations exceeding FDEP Soil Cleanup Target Levels or leachability standards for groundwater protection were reported.

Four temporary monitoring wells were installed in the excavation area to evaluate groundwater quality. Using an oil-water interface probe, the presence of approximately 2 ft of liquid phase hydrocarbons in the shallow aquifer beneath the excavation area was recorded. Approximately 1,200 gallons of free product mixed with water were recovered between July and August 1999.

TtNUS was retained to conduct a site assessment. TtNUS initiated the site assessment in May 2000 in accordance with Chapter 62-770, FAC, requirements. The assessment included a soil vapor survey, soil and groundwater sampling using direct push technology, and installation of permanent monitoring wells for groundwater sampling and analysis. No excessively contaminated soil was identified. Petroleum constituents were identified in a groundwater sample at concentrations exceeding the FDEP cleanup target levels. The direction of groundwater flow was estimated to be northerly. A potentiometric map generated from groundwater elevation data obtained on June 14, 2000 during the SA is presented as Figure 1-4.

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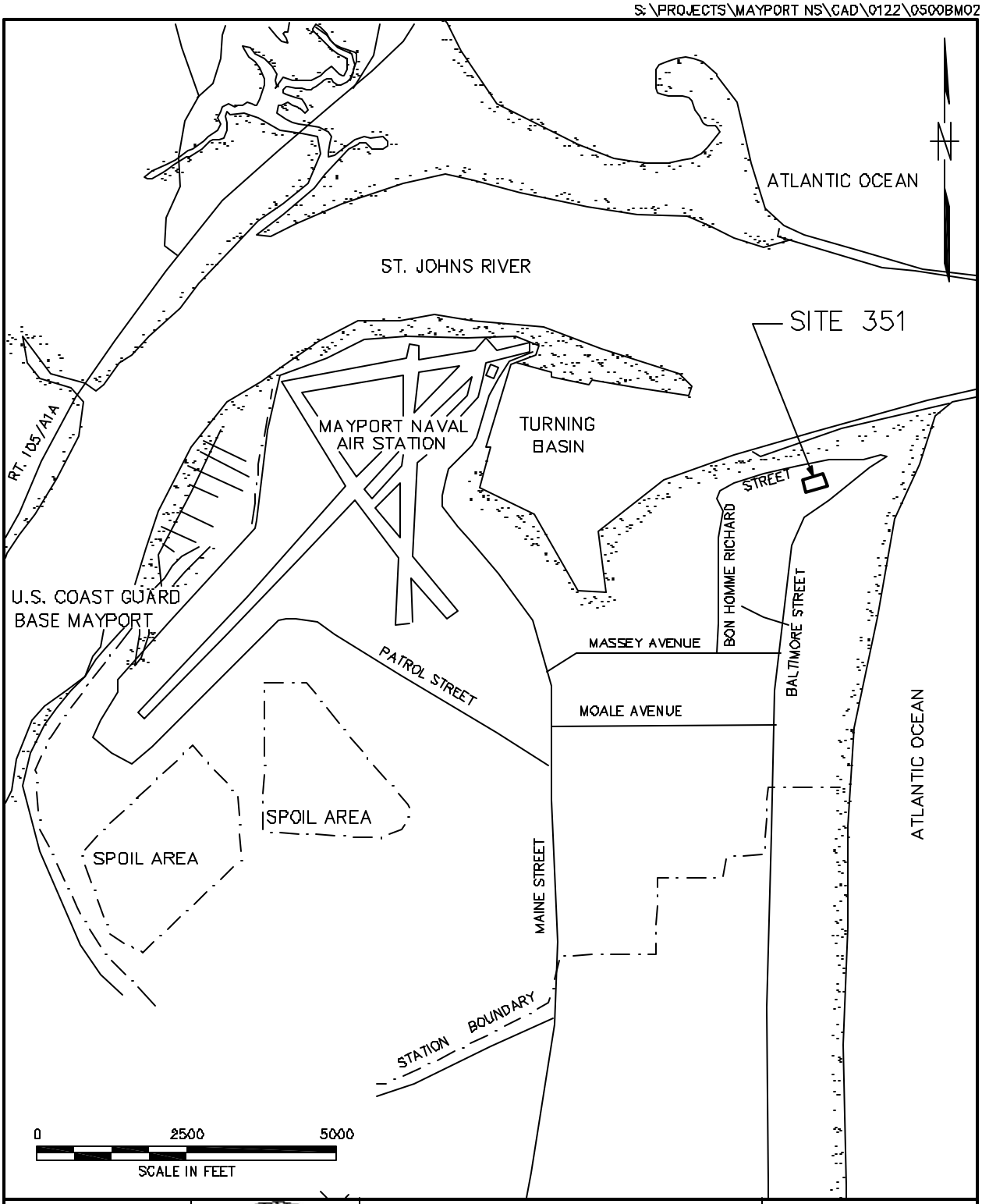

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COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1–2 / REV. 0

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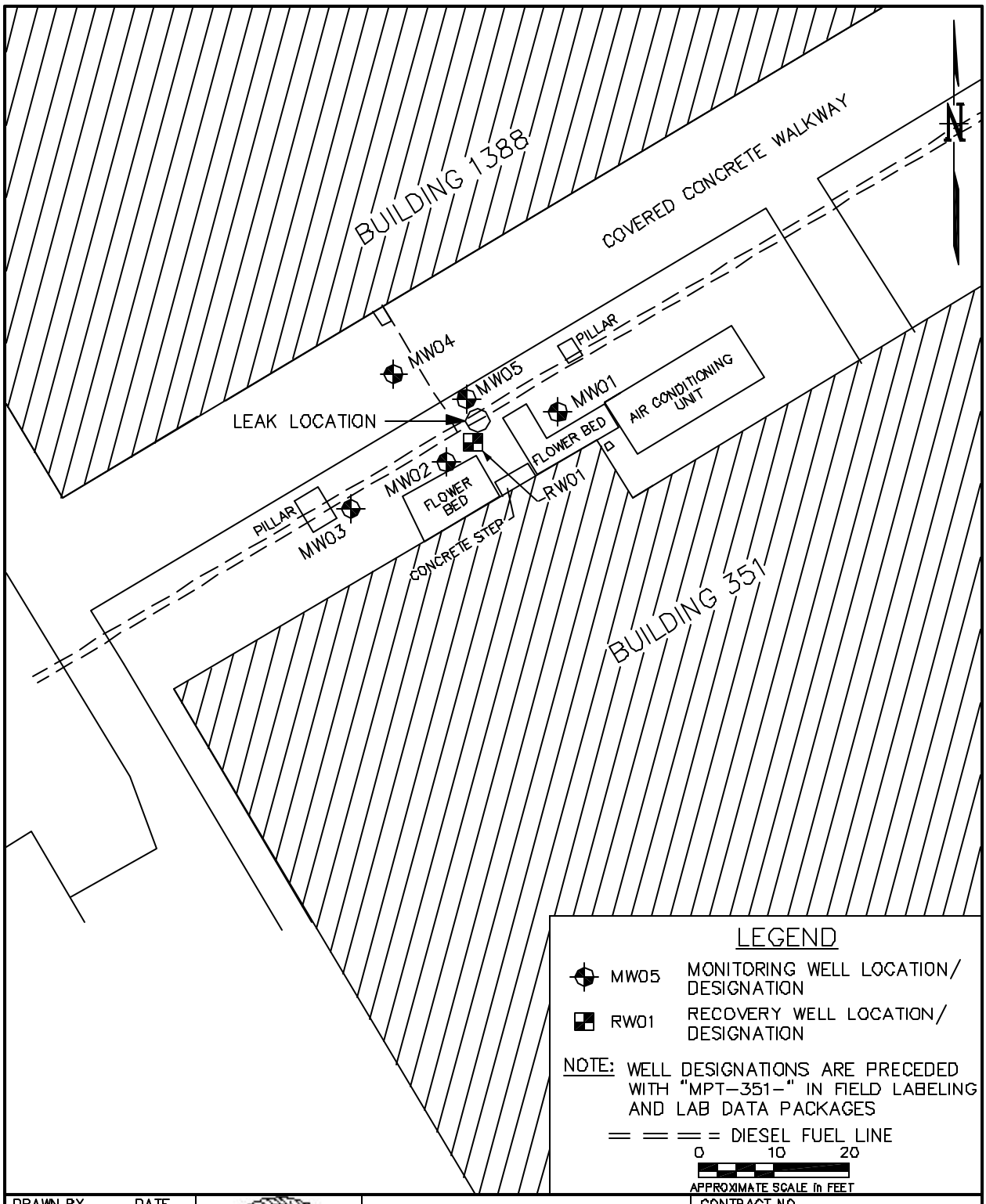

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COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-3 REV. 0

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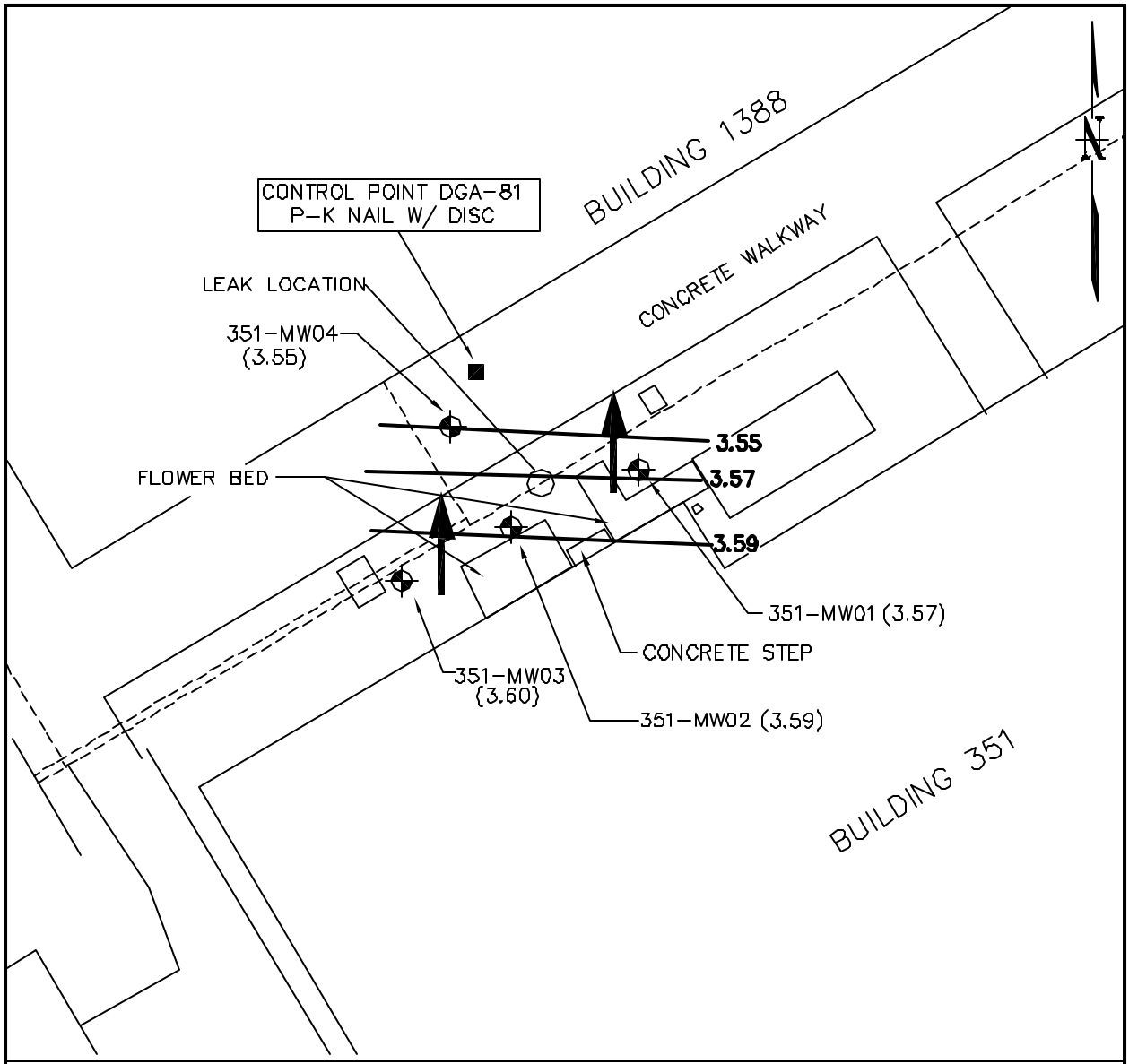

LEGEND

WATER TABLE ELEVATION (FT MSL) (3.57)

EQUIPOTENTIAL LINE (FT MSL) 3.55

INFERRED DIRECTION OF GROUNDWATER FLOW

MONITORING WELL

SURVEY CONTROL MNMT

DIESEL FUEL LINE

0 10 20
APPROXIMATE SCALE in FEET

DRAWN BY CW DATE 12/6/00		GROUNDWATER ELEVATION CONTOUR MAP, 6/14/00 BUILDING 351 SAR ADDENDUM U.S. NAVAL STATION MAYPORT MAYPORT, FLORIDA	CONTRACT NO. 0500
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-4 REV. 0

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A letter dated March 5, 2001, from Mr. Jim Cason of the FDEP to Ms. Beverly Washington of the Department of Navy, requested that a SAR Addendum be prepared. In response to FDEP and Navy comments during an NS Mayport Partnering Team meeting, TtNUS installed an additional monitoring well in the source area of a known release. The well was completed (micro well MW-05) on January 3, 2001, and sampled the next day for GAG/KAG constituents. Six petroleum constituents exceeded the GCTLs with xylenes exceeding natural attenuation parameters. On March 26, 2001, a TtNUS representative reported product in well MW-05 during routine depth-to-groundwater measurements. Product thickness measurements were not attainable, however, because the diameter of the interface probe was larger than that of the micro well. Product has not been observed in the other monitoring wells on site and has not been observed in well MW-05 since the March 26, 2001, site visit.

On June 6, 2002, it was proposed by the NS Mayport Partnering Team that an IM (instead of a Remedial Action Plan) be conducted using AFVR. This innovative technology was recommended because of heavy foot traffic and proximity of buildings in the area of concern.

2.0 SUBSURFACE INVESTIGATION METHODS

2.1 QUALITY ASSURANCE

The SAR Addendum was completed in general accordance with the Standard Operating Procedures (SOPs) prescribed by the FDEP Quality Assurance Section Document DER-001/92 and adopted by TtNUS.

2.2 GROUNDWATER MEASURMENTS

Prior to groundwater elevation measurements on October 28, 2002, TtNUS personnel measured the groundwater elevation levels in the site monitoring wells. Depth-to-water was measured from the top-of-casing of the monitor using an electronic water level indicator. The relative water table elevation at each location was calculated by subtracting the depth-to-water measurement from the surveyed top-of-casing elevation, and a groundwater flow direction (potentiometric) map was generated from the water table elevation data. The survey elevation data points were measured for monitoring wells MW-01, MW-02, MW-03, and MW-04 during the 2002 site assessment effort.

2.3 RECOVERY WELL INSTALLATION

On July 12, 2002, Transamerican Drilling, Inc. installed one recovery well (MPT-351-RW-01) under TtNUS supervision. The well was installed approximately 6 ft southwest of well MW-05 (a hand installed micro well) to generate maximum influence from AFVR operations. Rinse water generated during the decontamination of equipment and soil cuttings generated during borehole advancement were containerized in 55-gallon drums, sampled, and removed for later disposal.

The recovery well was installed with a track-mounted GeoProbe drill rig using 10-inch inside diameter hollow stem augers (HSAs). The well was constructed of a 4-inch, flush-threaded, Schedule 40 polyvinyl chloride riser attached to a 10-ft length of 0.010-inch slot well screen and bottom cap. Total depth of the well was approximately 13 ft bls. The annulus between the borehole and monitoring well was filled with US Standard Sieve size 20/30 silica sand to approximately 1 ft above the top of the screen. A 6-inch to 1-ft thick 30/65 fine sand seal was poured on top the filter pack. The remainder of the annulus was grouted to the surface. The well was secured with a locking, watertight cap within a steel, 8-inch diameter steel manhole. The manhole was set within a 24-inch square concrete apron finished slightly above grade. Recovery well construction details are summarized in Table 2-1 and illustrated as Figure 2-1. A recovery well completion record is provided in Appendix B.

Table 2-1
Well Construction Details

SAR Addendum for Building 351
Naval Station Mayport
Mayport, Florida

Well Number	Date Installed	Installation Method	Total Well Depth (ft)	Screened Interval (ft bls)	Well Diameter (inches)	Lithology of Screened Interval
MPT-351-RW-01	6/12/02	HSA	13.00	3 to 13	4.00	Medium to fine sand

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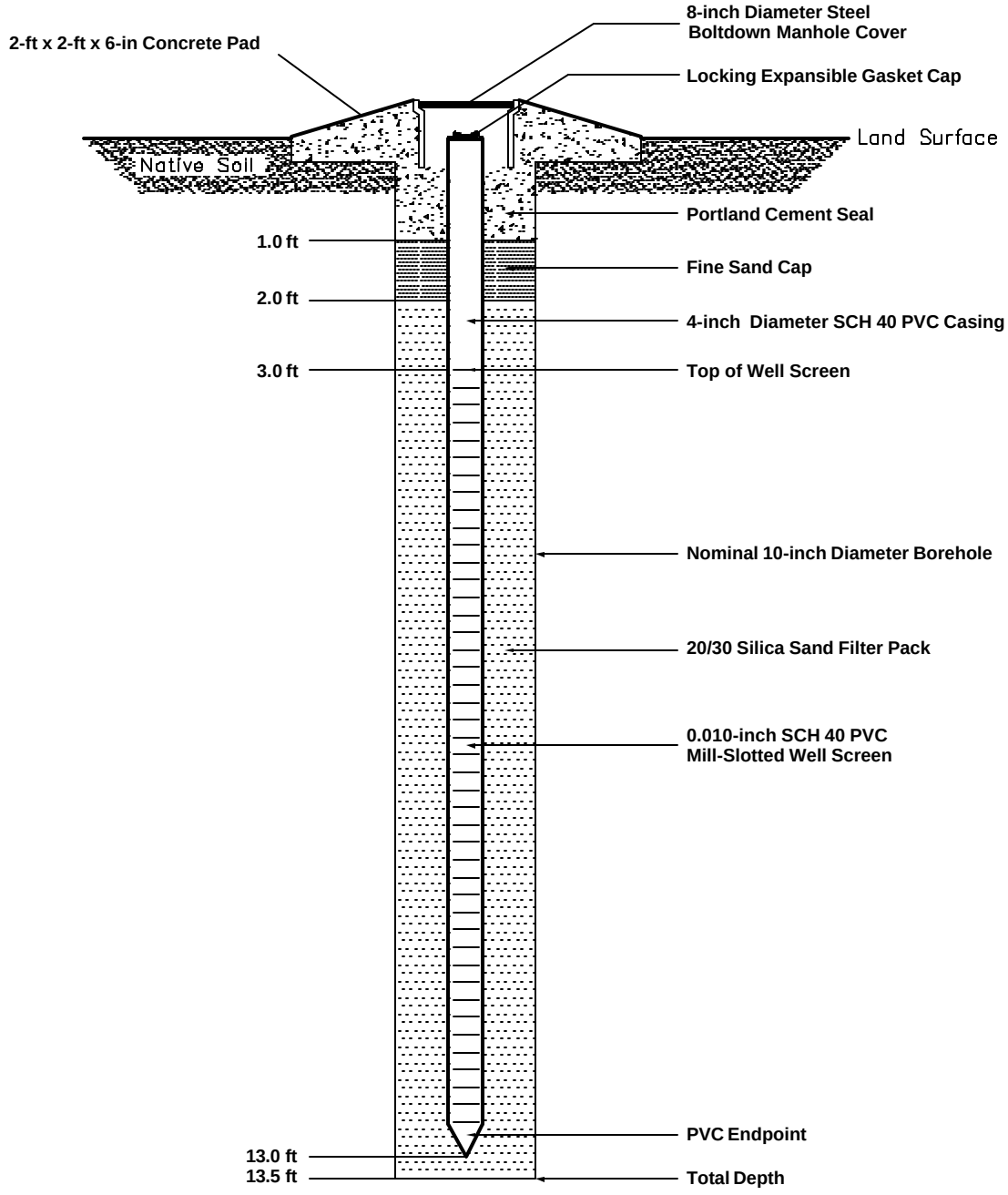
SITE	NS Mayport	DRILLER	David Hearne
LOCATION	Building 351	DRILLING METHOD	Hollow Stem Auger
PROJECT NUMBER	0500	INSTALLATION DATE(S)	July 12, 2002
TtNUS GEOLOGIST	Louis Knight	DEVELOPMENT METHOD	N/A



DRAWN BY LLK DATE 01/22/03		RECOVERY WELL CONSTRUCTION DETAIL SITE 351 SAR ADDENDUM NAVAL STATION MAYPORT MAYPORT, FLORIDA	CONTRACT NO. 0500
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COST/SCHED–AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 2–1 REV. 0

The recovery well was developed using a centrifugal pump. Field measurements of pH, temperature, and specific conductance were collected from the water generated during development. The recovery well was developed until such field measurements became stable and/or the discharge water clear. Stabilization of field measurements is based on the United States Environmental Protection Agency's (USEPA) SOPs (USEPA, 1997), which specify the following criteria: temperature +/-0.5 degrees Celsius, pH +/-0.1 unit, and specific conductance +/-10 microohms per centimeter (µmhos/cm). Development water was containerized as liquid investigation derived waste for later sampling and disposal. Field data sheets are provided as Appendix C.

2.3.1 Free Product Measurements

Prior to groundwater sampling, TtNUS personnel checked each monitoring well (MW-01, MW-02, MW-03, MW-04, MW-05, and RW-01) for free product using an oil/water interface probe. Product measurements were also taken two weeks after each AFVR event. No free product was encountered in any monitoring well during the AFVR events, although a strong petroleum odor was routinely present in groundwater from wells MW-05 and RW-01. Sheen was present after the first AFVR event, but was not present before or after the remaining events. Well MW-05 is a micro-well and was not measured for free product due to size constraints, but was observed for the presence of free product. The small diameter of the well prevented product measurement.

2.3.2 Aggressive Fluid Vapor Recovery

On July 18, 2002; August 20, 2002; and September 24, 2002, AFVR was performed at recovery well MPT-351-RW-01. AFVR, an innovative technology developed by the principals of Ecovac Services, allows the simultaneous removal of multiple phases (i.e., dissolved, vapor, absorbed, and liquid) of VOCs. These phases are removed from the subsurface utilizing high flow rates and vacuum pressures created by the pumps of a vacuum truck. The atmospheric vapor pressure in nearby monitoring wells is monitored to assess the radius of influence. The vacuum pressures provide a large enough radius of influence affecting the area beneath structures, such as buildings or concrete sidewalks. The three AFVR events lasted eight hours and were spaced approximately 30 days apart. At the completion of each event, petroleum contact water (PCW) was retained in a vacuum truck and transported to a State licensed disposal facility. Manifests documenting the disposal location, date, and volume of the PCW are presented in Appendix C.

During the removal of VOCs, some volatilization occurs. As a result, air emissions from the stack were monitored every 15 to 30 minutes. To estimate the emissions rate, a TtNUS representative conducted air monitoring using an organic vapor analyzer equipped with a flame ionization detector. The sampling port for air monitoring was located 3.5 ft off the ground in the 12-ft tall, 3-inch diameter emissions stack. The

FDEP daily limit for air emissions is 13.7 pounds for VOCs. To calculate the pounds per day rate, a formula approved by the FDEP was prepared and is presented as Appendix D. The daily rate of 13.7 pounds per day was not exceeded in any of the three events. If the daily rate had been exceeded, air emissions would have been treated prior to discharge by burning the emissions through specially fitted engines.

3.0 RESULTS OF INVESTIGATION

3.1 LITHOLOGY

A lithologic boring log for MTP-351-RW-1 was compiled during well installation. The complete profile (0 to 13 ft bls) predominantly consists of a fine-grained sand. The upper 5 ft is gray. From 6 ft bls to total depth (13 ft bls), the sand becomes light brown with some shell fragments.

3.2 GROUNDWATER FLOW DATA

Using the method discussed in Section 2.2, the direction of groundwater flow in the uppermost surficial aquifer underlying the site was calculated. Groundwater elevation data obtained on October 28, 2002, are presented in Table 3-1, and a groundwater flow map generated from the data is provided as Figure 3-1.

Table 3-1
Well Measurements

SAR Addendum for Building 351
Naval Station Mayport
Mayport, Florida

Well ID	Date	Top-of-Casing Elevation (ft)	Depth to Water (ft)	Water Elevation (ft)
MPT-351-MW01	10/28/02	8.94	4.35	4.59
MPT-351-MW02	10/28/02	8.90	4.35	4.55
MPT-351-MW03	10/28/02	8.76	4.20	4.56
MPT-351-MW04	10/28/02	9.52	4.99	4.53

Notes:
The top of casings of MW-05 and RW-01 were not surveyed.

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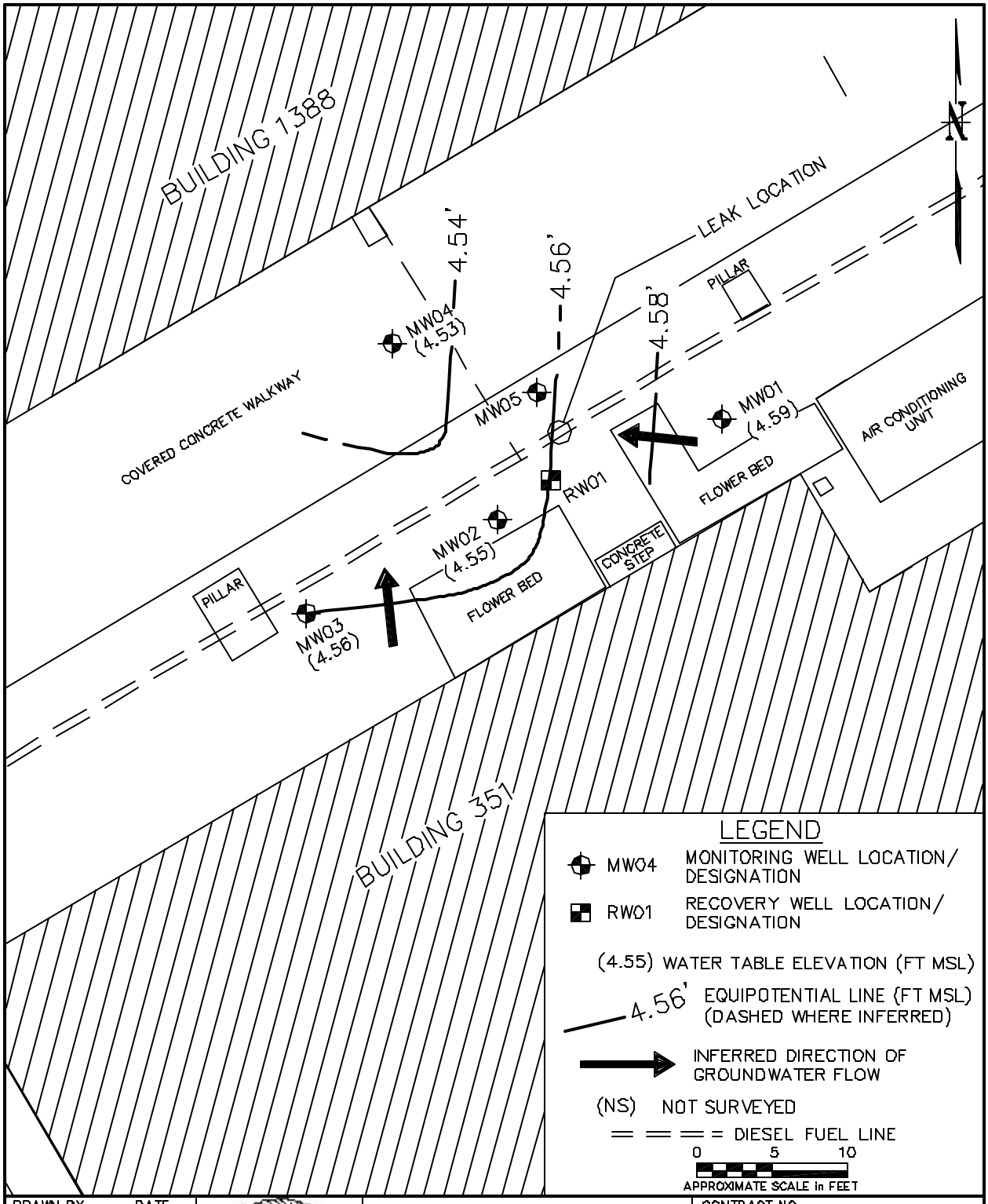

DRAWN BY LLK DATE 11/26/02		CONTRACT NO. 0500	
CHECKED BY DATE	GROUNDWATER ELEVATION CONTOUR MAP, 10/28/02 SITE 351 SAR ADDENDUM MAYPORT NAVAL STATION MAYPORT, FLORIDA	APPROVED BY DATE	
COST/SCHED–AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 3–1	REV. 0

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3.3 AGGRESSIVE FLUID VAPOR RECOVERY

Photographs documenting activities during the three AFVR events are provided as Appendix E. Monitoring well RW-01 was selected for AFVR for each treatment. The results of each event detailing the hydrocarbon removal rate, zone of influence, amount of product in each well, and the volume of PCW removed from RW-01 are provided as Appendix C. A summary of this data is provided in Table 3-2.

Table 3-2
AFVR Summary

SAR Addendum for Building 351
Naval Station Mayport
Mayport, Florida

Date	Average VOC Emissions Rate (pounds per hour)	Radius of Pressure Influence (ft)	Volume of PWC Collected (gallons)	Free Product (RW-01)	Groundwater Level (ft) (RW-01)
7/18/2002	0.031	15	2078	None, sheen	4.72
8/20/2002	0.005	20	2275	None	4.81
9/24/2002	0.005	15	1922	None	4.25

Notes:
The FDEP emissions rate should not exceed 13.7 pounds per an 8-hour day or 1.71 pounds per hour.
Prior to beginning each event, RW-01 and other wells were measured for free product.

During the initial AFVR event, the daily VOC removal rate was 0.031 pounds. This value declined to 0.005 pounds by the third event. The FDEP emissions rate should not exceed 13.7 pounds per 8-hour day or 1.71 pounds per hour. This decline in hydrocarbon concentration was present from beginning to end of the individual events, as well as between events. For each event, the initial hydrocarbon concentration (measured in parts per million) was more than three times greater than the value at the end of the AFVR event, implying a decline in groundwater petroleum concentrations.

The zone of influence was estimated by measuring atmospheric pressure. The change in pressure was recorded within a 15- to 20-ft radius of RW-01. This is an approximate number obtained by measuring the decrease of pressure in nearby monitoring wells. This radius of pressure influence was greater than the area of impacted groundwater, suggesting complete coverage of the affected area by the operating system. Pressures readings for the surrounding wells are provided in Appendix C.

Groundwater measurements were taken two weeks after each AFVR event. No product was observed in any well, although sheen was noted on RW-01 groundwater after the first event. The removal of the petroleum sheen in later AFVR events coincides with the decreased emissions rates in these events.

An average of 2076 gallons of water was removed for disposal to Industrial Water Services during each AFVR event. Prior to disposal, the fluids in the tank were measured for free product and none was observed.

3.4 GROUNDWATER CHARACTERISTICS

3.4.1 Monitoring Well Sampling

On October 28, 2002, TtNUS representatives collected groundwater samples from five monitoring wells (MW-01, MW-02, MW-03, MW-04, and MW-05) and shipped the samples to Severn Trent Laboratories (STL) for analysis of GAG/KAG constituents. Groundwater analytical results are summarized in Table 3-3, and a map showing well locations is provided as Figure 3-2. A complete report submitted by STL is provided as Appendix F.

Petroleum constituents were recorded in monitoring wells MW03, MW-04, and MW-05. No petroleum constituent was recorded above the GCTLs for samples collected from MW-03 and MW-04. Several constituents were recorded in samples collected from well MW-05 (the well formerly containing product). Benzo(a)anthracene (0.62 µg/L) and TRPH (25 mg/L) were the only recorded constituents at concentrations that exceed the respective GCTLs of 0.2 µg/L and 5 mg/L.

Historically, seven constituents exceed the GCTLs for groundwater samples collected from well MW-05. The ground water concentration of these constituents are benzene at 4.0 µg/L, ethylbenzene at 32 µg/L, total xylenes at 180 µg/L, naphthalene at 41 µg/L, 1-methylnaphthalene at 93 µg/L, 2-methylnaphthalene at 110 µg/L, and TRPH at 5.5 µg/L. These groundwater analytical results were obtained from the January 2001 SAR (TtNUS, 2001) and have been added to Table 3-3, which also presents the most recent groundwater analytical data. Current groundwater analytical results are also depicted on Figure 3-2.

Table 3-3
Groundwater Analytical Results

SAR Addendum for Building 351
Naval Station Mayport
Mayport, Florida

Compound	FDEP Target Level[1] (µg/L)	MW-01		MW-02		MW-03		MW-04		MW-05	
Sample Date		06/14/00	10/28/02	06/14/00	10/28/02	06/14/00	10/28/02	06/14/00	10/28/02	11/30/00	10/28/02
VOCs (USEPA Method 8260B) (µg/L)											
Benzene	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**4J**	<1.0
Ethylbenzene	30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	**32**	0.39 J
Methyl tert-butyl ether	50	<5.0	<1.0	<5.0	<1.0	<5.0	<1.0	<5.0	<1.0	29	<1.0
Trichloroethene	3	<1.0	<1.0	<1.0	<1.0	1.9	2.4	<1.0	<1.0	NA	<1.0
Xylenes, total	20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**180**	3.3
USEPA 504.1 (µg/L)											
EDB	0.02	<1.0	<0.02	<1.0	<0.02	<1.0	<0.02	<1.0	<0.02	<0.02	<0.02
PAHs (USEPA Method 8310) (µg/L)											
Acenaphthylene	210	<10	<1.0	<10	<1.0	3	<1.0	1.4	1.5	<10	<1.0
Acenaphthene	20	<1.0	<1.0	<1.0	<1.0	<1.0	0.98 J	<1.0	<1.0	<1.0	<1.0
Benzo(a)anthracene	0.2	<.1	<0.2	<.1	<0.2	<.1	<0.2	<.1	<0.2	<.1	**0.62 J**
Fluorene	280	<10	<0.2	<10	<0.2	0.71	1.9	<10	<0.2	6.7	1.1 J
1-Methylnaphthalene	20	<10	<1.0	<10	<1.0	4.6	9.2	<10	<1.0	**93**	4.2
2-Methylnephthalene	20	<10	<1.0	<10	<1.0	2.4	1.6 J	<10	<1.0	**110**	<1.0
Naphthalene	20	<10	<1.0	<10	<1.0	<10	<1.0	5.2	<1.0	**41**	<1.0
Phenanthrene	210	<1.0	<0.2	<1.0	<0.2	<1.0	0.26 J	<1.0	<0.2	<4	0.24 J
Pyrene	210	<.1	<0.2	<.1	<0.2	<.1	<0.2	<.1	.034 J	<.4	1.0 J
FL-PRO (USEPA Method 8270) (mg/L)											
TRPH	5	<1.0	0.3	<1.0	0.3	.160	0.69	.630	0.3	**5.5**	**25**
Metals Analysis (µg/L)											
Total Lead	15	<1.7	<1.6	<1.7	<1.5	<1.7	<1.9	<1.7	<3.0	<1.7	<3.4

Notes:
[1]Chapter 62-770, FAC (April 30, 1999)
* Well was installed on 06/12/02.
FL-PRO = Florida Petroleum Range Organics

Bold indicates exceedance of FDEP target level.
J = estimated value
NA = not analyzed

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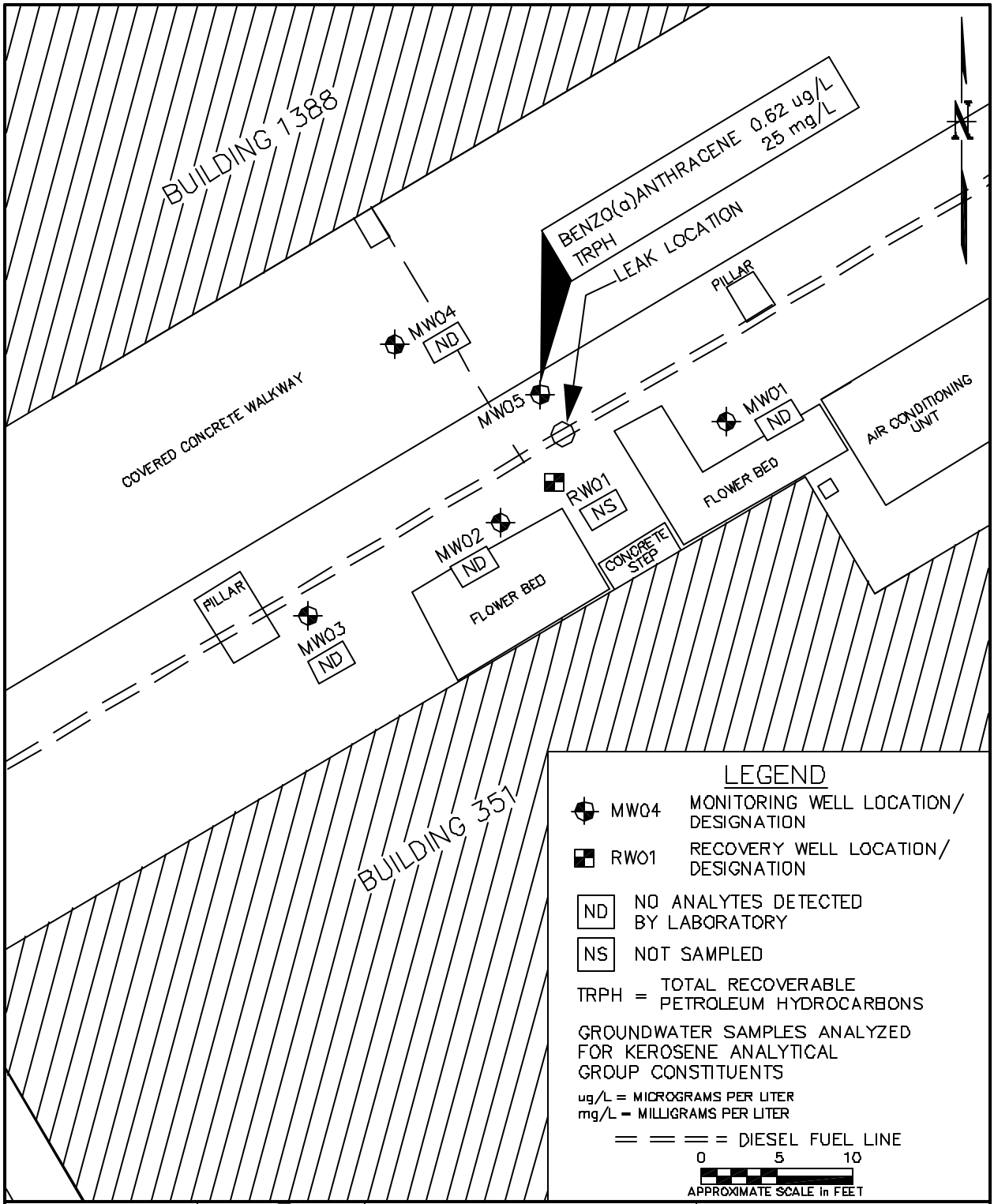

DRAWN BY LLK DATE 11/26/02		GROUNDWATER ANALYTICAL RESULTS SITE 351 SAR ADDENDUM MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 0500
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3–2 REV. 0

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

4.0 SUMMARY

An IM involving the removal of petroleum from groundwater using AFVR technology was conducted as part of a SAR Addendum at Building 351. Three 8-hour events were conducted with approximate 30-day intervals between events. The AFVR technology was implemented on a 4-inch diameter, 13-ft deep monitoring (recovery) well (RW-01) installed at the focal point of a diesel release first reported in July 1999. Approximately one month after the final (third) AFVR event, groundwater samples were collected from five existing monitoring wells closely surrounding the subject AFVR well and analyzed for KAG constituents. Free product measurements were recorded in each well, including RW-01, two weeks after each AFVR event.

No measurable free product was observed during the course of the IM. Sheen was noted on the groundwater surface of the recovery well (RW-01) two weeks after the first AFVR event, but none was noted after the second or third events. Groundwater samples were collected from the five site monitoring wells (MW-01 through MW-05) on October 28, 2002, and analyzed for GAG/KAG constituents. Benzo(a)anthracene was reported at a concentration of 0.62 µg/L, and TRPH was reported at a concentration of 25 mg/L in a sample collected from well MW-05 (the original source area well). These concentrations exceed the respective GCTLs of 0.2 µg/L and 5 mg/L. No other GAG/KAG constituent was reported at concentrations exceeding GCTLs in samples collected from well MW-05. Historically groundwater analyzed from well MW-05 had seven constituents exceeding respective GCTLs.

The upper 14 ft at the site consists of fine sand containing some shell fragments. No confining layer is present. Groundwater flow is to the north.

Evidence presented in the SAR (TtNUS, 2001) and in this SAR Addendum document that petroleum contamination in the groundwater has not migrated beyond the existing monitoring well network, nor has it migrated vertically into the deeper zones of the surficial aquifer.

It is recommended that the site be monitored for natural attenuation since the concentrations are below the Natural Attenuation Default Concentrations presented in Table Five of Chapter 62-777, FAC. These default concentrations are 20 µg/L for benzo(a)anthracene and 50 mg/L for TRPH. In addition to being below the default concentration, the chemical characteristics of benzo(a)anthracene and TRPH are conducive to natural attenuation. Due to the small area of impact to groundwater and the chemical properties of the contaminants, the cost effective means to abate the impact is through natural attenuation. A Monitoring Only Natural Attenuation (MONA) plan is provided as Section 5.0.

5.0 MONITORING ONLY NATURAL ATTENUATION PLAN

5.1 MONA IMPLEMENTATION

The rational for implementing a MONA is discussed in the summary (Section 4.0). To accommodate the requirement per Rule 62-770.690, FAC, three monitoring wells [MW-05 (source area), RW-01 (recovery well), and MW-04 (immediately downgradient of source)] will be sampled quarterly as part of the MONA program. A figure depicting the well locations is presented as Figure 5-1. The time frame for monitoring will be five years with a minimum of one year of monitoring. Quarterly monitoring may be terminated if the last two quarters (3rd and 4th) of the first year are below the GCTLs or two sequential quarterly monitoring events (after the first year) are below the GCTLs. An estimation of annual milestones for a period of five years for the reduction of concentrations for benzo(a)anthracene and TRPH are provided in Table 5-1, which also includes the estimated time required to achieve "No Further Action" status pursuant to Rule 62-770.680, FAC.

Table 5-1
Monitoring Milestone Objectives

SAR Addendum for Building 351
Naval Station Mayport
Mayport, Florida

Period	Compound	
	Benzo(a)anthracene (µg/L)	TRPH (mg/L)
End of Year 1	0.55	20.5
End of Year 2	0.45	15.5
End of Year 3	0.35	11
End of Year 4	0.25	6.5
End of Year 5	0.15	2

Notes:
The GTLC for benzo(a)anthracene is 0.2 µg/L.
The GCTL for TRPH is 5 mg/L.

5.1.1 Sampling Procedures and Methods

All sampling will be conducted in general accordance with the Quality Assurance SOPs for Laboratory Operations and Sample Collection Activities per Chapter 62-160, FAC. A copy of the SOPs Sections FS-2000 General Aqueous Sampling and FS-2200 Groundwater Sampling are provided as Attachment G. Prior to sampling, groundwater measurements of field parameters will include pH, specific conductivity, temperature, turbidity, dissolved oxygen (by meter and titration), and oxygen reduction potential.

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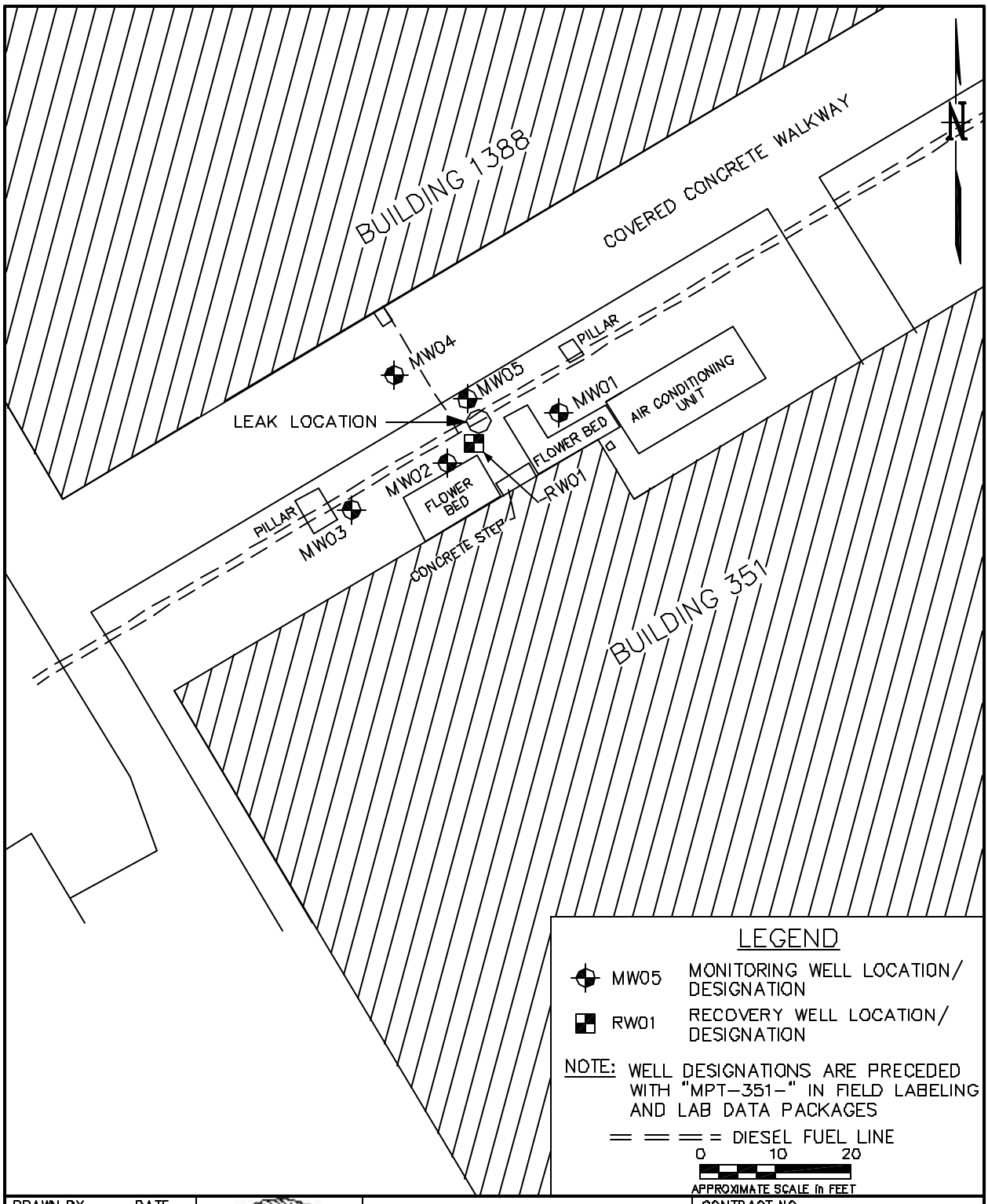


DRAWN BY LLK DATE 11/26/02		MONITORING AND RECOVERY WELL LOCATIONS SITE 351 SAR ADDENDUM MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 0500
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 5-1 REV. 0

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

Groundwater samples will be analyzed for KAG per Table B of Chapter 62-770, FAC. This group includes the following:

- VOCs – USEPA Method 8260B
  - Volatile organic halocarbons
  - Volatile aromatics
- PAHs – USEPA Method 8310
- EDB – USEPA Method 504.1
- TRPH – FL-PRO Method
- Lead – USEPA Method 239.2

5.2 REPORT PREPARATION

The contractor will generate quarterly monitoring reports detailing groundwater analytical results and groundwater flow gradient calculated during field activities. The reports will include time versus concentration graphs to analyze constituent trends. The reports should include recommendations for future monitoring events. Water levels will be taken prior to each sampling event, and potentiometric maps will be generated and presented.

REFERENCES

FDEP (Florida Department of Environmental Protection), 1990. *No Further Action and Monitoring Only Guidelines for Petroleum Contaminated Sites*. Guidance document issued by Bureau of Waste Cleanup, Technical Review Section. October.

FDEP, 2001. DEP-SOP-001/01. Sections FS-2000, General Aqueous Sampling and FS-2200, Groundwater Sampling.

USEPA (United States Environmental Protection Agency), 1997. *Standard Operating Procedures*.

TtNUS (Tetra Tech NUS, Inc.), 2001. *Site Assessment Report for Building 351, Naval Station Mayport, Mayport, Florida*. Prepared for Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina. January.

APPENDIX A

FDEP SAR ADDENDUM LETTER

Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

March 5, 2001

Ms. Beverly Washington
Department of the Navy, Petroleum Program
Southern Division - Naval Facilities Engineering Command
PO Box 190010
2155 Eagle Drive
North Charleston, SC 29419-9010

file: 351sar1.doc

RE: Site Assessment Report Tank Site 351, Naval Station Mayport, Mayport, FL

Dear Ms. Washington:

I have reviewed the above document dated February 14, 2001 (received February 14, 2001). Information furnished in the report indicates that one well (351-MW05) sample contained total xylenes above the Natural Attenuation Default Concentration. This well has been sampled only once. I suggest that the well be resampled for volatile and semivolatile petroleum constituents. Following that, please prepare a SAR Addendum with recommendations for the site. As we have discussed, if the total xylenes are 200 ug/L or less, please prepare a Monitoring for Natural Attenuation Plan according to Chapter 62-770.690, F.A.C.

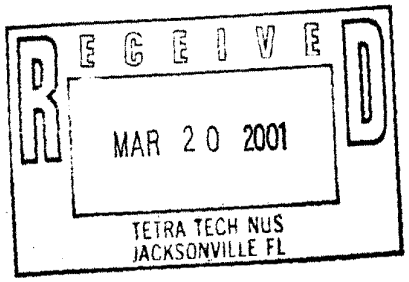
If further clarification is required or if you have any questions, please contact me at 850-921-4230.

Sincerely,

James H. Cason, P.G.
Remedial Project Manager

CC: Jan Bouvier, NAVSTA Mayport
Mark Peterson, TetraTech, Jacksonville

TJB B JJC JHC ESN ESN



CTO 122
2.1

APPENDIX B

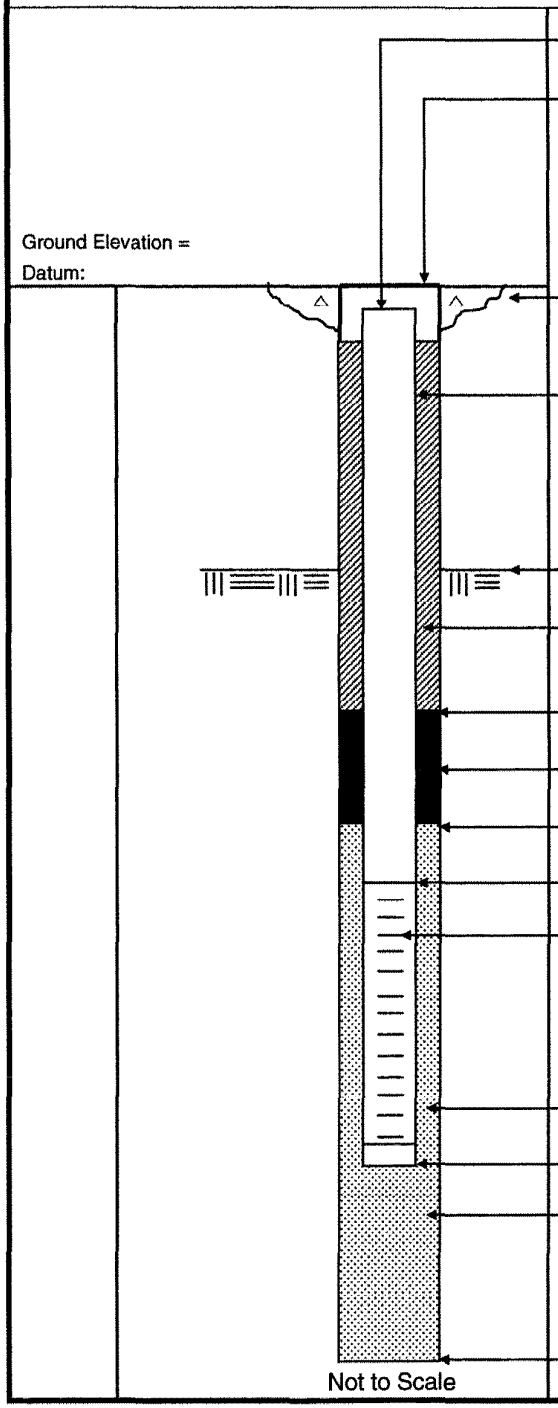
WELL COMPLETION RECORDS

Tetra Tech NUS, Inc.

WELL No.: MPT-351-RW01

WELL CONSTRUCTION DETAIL

PROJECT:	CTO 122/ Bld 351	DRILLING Co.:	Transamerican	BORING No.:	RW-01
PROJECT No.:	N0500	DRILLER:	George Hearne	DATE COMPLETED:	06/12/02
SITE:	Bld 351	DRILLING METHOD:	H.S.A.	NORTHING:	
GEOLOGIST:	LK	DEV. METHOD:	Submersible	EASTING:	



Elevation / Depth of Top of Riser:		NA /
Elevation / Height of Top of Surface Casing:		NA /
I.D. of Surface Casing:	NA	
Type of Surface Casing:	8" manhole	
Type of Surface Seal:	QUIKRETE	
I.D. of Riser:	4"	
Type of Riser:	PVC	
Borehole Diameter:	10"	
Elevation / Depth Top of Rock:		/ NA
Type of Backfill:	TYPE 1 PORTLAND GROUT	
Elevation / Depth of Seal:		/ 1.5
Type of Seal:	30/65 SAND	
Elevation / Depth of Top of Filter Pack:		/ 2.5
Elevation / Depth of Top of Screen:		/ 3.0
Type of Screen:	PVC	
Slot Size x Length:	0.010 -INCH	
I.D. of Screen:	4"	
Type of Filter Pack:	20/30	
Elevation / Depth of Bottom of Screen:		/ 13.0
Elevation / Depth of Bottom of Filter Pack:		/ 13.0
Type of Backfill Below Well:		
Elevation / Total Depth of Borehole:		/ 13.5

APPENDIX C

FIELD DATA SHEETS, AFVR DATA SHEETS, AND DISPOSAL MANIFESTS

DN:0500:4.4:08

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: cto 122 **Project No.:** 0500
Location: mayport **Personnel:** CM & PL
Weather Conditions: Clear Hot **Measuring Device:** Dipper-T
Tidally Influenced: Yes ___ No ___ **Remarks:**

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments
MW 04	10/28/02		9.52		4.99			
MW 05	"				4.52			
MW 02	"		8.90		4.35			
MW 01	"		8.94		4.35			
MW 03	"		8.76		4.20			

* All measurements to the nearest 0.01 foot

Page ___ of ___

CTO 122

Take H2O levels AT 365

FIGURE 7-1

DOCUMENTATION OF FIELD CALIBRATION

SITE NAME: Bldg 351 **PROJECT NO.:** (CTO122)

Date of Calibration	Instrument Name and Model	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot Number)	Remarks/ Comments
				Pre-Calibration	Post-Calibration	Pre-Calibration	Post-Calibration		
10-28-02	Photovac	ED-HF-346	cm		100ppm		100ppm		
10-28-02	Horiba (U-22)	9292064	cm			4.12	3.97	#3128 Exp 5-14-04	
10-28-02	Horiba (U-22)	9012074	cm			4.13	3.97	1 1 1	

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MPT-Building 351 / CTO 122
PROJECT NUMBER: N0500. GJ005A175

WELL ID.: MPT-~~122~~-MW05-01 (351)
DATE: 10/~~2~~8/2002

Time (Hrs.)	Water Level (Ft. below TOC)	Cum Vol	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1415	4.52	0	200	—	—	—	—	—	—	Start Purge
1420	4.82	1	200	6.63	0.546	179	3.23	29.3	-88	
1425	4.73	2	200	6.70	0.561	146	2.07	27.6	-104	
1430	4.68	3	200	6.66	0.543	115	1.97	26.9	-107	
1435	4.67	4	200	6.67	0.523	111	1.90	26.1	-112	
1438	4.67	45	200	6.67	0.535	111	1.82	25.6	-116	
1440	4.69	5	200	6.67	0.522	110	1.80	25.5	-118	
1443	4.66	45	200	6.67	0.513	110	1.79	25.5	-121	
1445	4.66	60	200	6.67	0.505	108	1.77	25.4	-122	
~~1455~~ 1500 = Sample Time										

SIGNATURE(S): Charles Mc

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project Site Name:	*MPT-Building 351 / CTO 122*	Sample ID No.:	MPT-~~122~~ 351-MW05-01
Project No.:	*N0424. KR0050215*	Sample Location:	MW05
		Sampled By:	~~DS~~ & CM
[ ] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[ ] Other Well Type:		[X] Low Concentration	
[ ] QA Sample Type:		[ ] High Concentration	

SAMPLING DATA

Date: 10/~~3~~8/2002	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1455	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	
Method: Low Flow Peristaltic	brown/black	6.67	0.505	25.4	108	1.77	-122	

PURGE DATA

Date: 10/~~3~~8/2002	Time	pH	S.C.	Temp (°C)	Turbidity	DO	ORP	Other
Method: Low Flow Peristaltic								
Monitor Reading (ppm): 0								
Well Casing Diameter: ~~2~~ 1"								
Well Casing Material: **PVC**								
Total Well Depth (TD): 7.2								
Static Water Level (WL): 4.52								
One Casing Volume(gal/L): 7.20 ~~1.9 (SFT)~~								
Start Purge (hrs): 1415								
End Purge (hrs): 1445								
Total Purge Time (min): 30								
Total Vol. Purged (gal/L): 3.5								

See Attached Low Flow Purge Data Sheet

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
		2	
EPA 504.1	*sodium thois...*	*~~2~~ 3-40ml vials*	✓
Lead (unfiltered)	*HNO3*	*1-500mL HDPE*	✓
SW- 846 8260 - VOH & VOC	*HCl*	*3-40ml vials*	✓
PAH	*~*	*2-1L Amber*	✓
FL-PRO	*H2SO4*	*2-1L Amber*	✓

OBSERVATIONS / NOTES

Laboratory: **STL -Pittsburg**
450 William Pitt Way
Pittsburg, PA 15238

Veronica Bortot
phone: (412)820-8380
fax: (412) 820-2080

BG = 0ppm
BZ = 0ppm

Circle if Applicable:		Signature(s): Charles Mets
MS/MSD	Duplicate ID No.: MPT-351-DUP01-01	

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MPT-Building 351 / CTO 122
PROJECT NUMBER: N0500. GJ005A175

WELL ID.: MPT-~~122~~-351-MW02-01
DATE: 10/18/2002

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1420	4.35	400	—	—	—	—	—	—	START PURGE
1425	4.40	2 400	7.42	0.622	0.5	1.21	22.01	13	
1430	4.41	4 400	7.36	0.612	0.3	0.72	22.05	6	
1435	4.41	6 400	7.34	0.608	0.6	0.53	22.06	2	
1440	4.41	8 400	7.33	0.605	0.8	0.48	22.08	-2	
1445	4.41	10 400	7.34	0.604	1.0	0.58	22.15	-2	
1450	4.41	12 400	7.34	0.603	0.6	0.63	22.17	-1	
1455	4.41	14 400	7.34	0.601	0.7	0.62	22.21	0	
1500	4.41	16 400	7.35	0.599	0.4	0.59	22.18	0	END PURGE

SIGNATURE(S):

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project Site Name:	*MPT-Building 351 / CTO 122*	Sample ID No.:	MPT-~~122~~ 351-MW02-01
Project No.:	*N0424. KR0050215*	Sample Location:	MW02
		Sampled By:	~~DS & CM~~ PL
[ ] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[ ] Other Well Type:		[X] Low Concentration	
[ ] QA Sample Type:		[ ] High Concentration	

SAMPLING DATA

Date: 10/18/2002	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1500	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	
Method: Low Flow Peristaltic	Clear	7.35	0.599	22.18	0.4	6.59	0	

PURGE DATA

Date: 10/18/2002	Time	pH	S.C.	Temp (°C)	Turbidity	DO	ORP	Other
Method: Low Flow Peristaltic								
Monitor Reading (ppm): 0								
Well Casing Diameter: **2"**								
Well Casing Material: **PVC**								
Total Well Depth (TD): 12.5								
Static Water Level (WL): 4.35								
One Casing Volume(gal/L): 5.3								
Start Purge (hrs): 1420								
End Purge (hrs): 1500								
Total Purge Time (min): 40								
Total Vol. Purged (gal): 16								

See Attached Low Flow Purge Data Sheet

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
EPA 504.1	*sodium thois...*	*3-40ml vials*	✓
Lead (unfiltered)	*HNO3*	*1-500mL HDPE*	✓
SW- 846 8260 - VOH & VOC	*HCl*	*3-40ml vials*	✓
PAH	*~*	*2-1L Amber*	✓
FL-PRO	*H2SO4*	*2-1L Amber*	✓

OBSERVATIONS / NOTES

Laboratory: **STL -Pittsburg**
450 William Pitt Way
Pittsburg, PA 15238

Veronica Bortot
phone: (412)820-8380
fax: (412) 820-2080

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MPT-Building 351 / CTO 122
PROJECT NUMBER: N0500. GJ005A175

WELL ID.: MPT-~~122~~-MW04-01 (351)
DATE: 10/~~8~~8/2002

CUM Vol	Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0	0900	4.99	400							Start Purge
2	0905	5.05	400	6.73	0.228	4.3	6.17	23.5	130	
4	0910	5.05	400	7.23	0.233	2.1	2.95	24.0	-57	
8	0915	5.05	400	7.32	0.238	2.3	2.74	24.2	-78	
10	0925	5.05	400	7.42	0.244	2.2	2.57	24.2	-97	
11	0928	5.05	400	7.46	0.245	2.4	2.61	24.2	-103	
12	0930	5.05	400	7.46	0.245	2.3	2.52	24.2	-105	
13	0933	5.05	400	7.48	0.246	2.4	2.47	24.2	-106	
	1210 = Sample Time									

SIGNATURE(S): Charles Mott

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project Site Name:	*MPT-Building 351 / CTO 122*	Sample ID No.:	MPT-~~122~~ 351-MW04-01
Project No.:	*N0424. KR0050215*	Sample Location:	MW04
		Sampled By:	~~DSC~~ CM
[ ] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[ ] Other Well Type:		[X] Low Concentration	
[ ] QA Sample Type:		[ ] High Concentration	

SAMPLING DATA

Date: 10/~~28~~/2002	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: ~~10-28-02~~ 1210	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	
Method: Low Flow Peristaltic	clear	7.48	0.246	24.2	2.4	2.47	-106	

PURGE DATA

Date: ~~10-28-02~~ 10/~~28~~/2002	Time	pH	S.C.	Temp (°C)	Turbidity	DO	ORP	Other
Method: Low Flow Peristaltic								
Monitor Reading (ppm): 0 ppm								
Well Casing Diameter: 2"								
Well Casing Material: PVC								
Total Well Depth (TD): 11.80								
Static Water Level (WL): 4.99								
One Casing Volume(gal): 4.3								
Start Purge (hrs): 0900								
End Purge (hrs): 0933								
Total Purge Time (min): 33								
Total Vol. Purged (gal): 13								

See Attached Low Flow Purge Data Sheet

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
EPA 504.1	*sodium thois...*	*3-40ml vials*	✓
Lead (unfiltered)	*HNO3*	*1-500mL HDPE*	✓
SW- 846 8260 - VOH & VOC	*HCl*	*3-40ml vials*	✓
PAH	*~*	*2-1L Amber*	✓
FL-PRO	*H2SO4*	*2-1L Amber*	✓

OBSERVATIONS / NOTES

Laboratory: **STL -Pittsburg**
450 William Pitt Way
Pittsburg, PA 15238

Veronica Bortot
phone: (412)820-8380
fax: (412) 820-2080

BG = 0 ppm
BZ = 0 ppm

Circle if Applicable:		Signature(s): Charles Mott
MS/MSD	Duplicate ID No.:	

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project Site Name:	*MPT-Building 351 / CTO 122*	Sample ID No.:	MPT-~~122~~ 351-MW01-01
Project No.:	*N0424. KR0050215*	Sample Location:	MW01
		Sampled By:	~~DS~~ & CM
[ ] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[ ] Other Well Type:		[X] Low Concentration	
[ ] QA Sample Type:		[ ] High Concentration	

SAMPLING DATA

Date: 10/8/2002	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1105	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	
Method: Low Flow Peristaltic	Clear	7.47	0.437	23.3	3.4	1.64	2	———

PURGE DATA

Date: 10/8/2002	Time	pH	S.C.	Temp (°C)	Turbidity	DO	ORP	Other
Method: Low Flow Peristaltic								
Monitor Reading (ppm): 0								
Well Casing Diameter: 2"								
Well Casing Material: PVC								
Total Well Depth (TD): 12.90								
Static Water Level (WL): 4.35								
One Casing Volume(gal): 5.6								
Start Purge (hrs): 1000								
End Purge (hrs): 1057								
Total Purge Time (min): 57								
Total Vol. Purged (gal): 17								

See Attached Low Flow Purge Data Sheet

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
EPA 504.1	*sodium thois...*	*3-40ml vials*	✓
Lead (unfiltered)	*HNO3*	*1-500mL HDPE*	✓
SW- 846 8260 - VOH & VOC	*HCl*	*3-40ml vials*	✓
PAH	*~*	*2-1L Amber*	✓
FL-PRO	*H2SO4*	*2-1L Amber*	✓

OBSERVATIONS / NOTES

Laboratory: **STL -Pittsburg**
450 William Pitt Way
Pittsburg, PA 15238

Veronica Bortot
phone: (412)820-8380
fax: (412) 820-2080

BG = 0 ppm
B2 = 0 ppm

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	Charles Mett

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MPT-Building 351 / CTO 122
PROJECT NUMBER: N0500. GJ005A175

WELL ID.: MPT-~~122~~ 351-MW01-01
DATE: 10/~~2~~8/2002

CUM VOL	Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0	1000	4.35	3~~2~~00	—	—	—	—	—	—	START Purge
1.5	1005	4.40	~~3~~00	7.48	0.446	3.6	4.01	24.1	-12	
3	1010	4.41	~~3~~00	7.49	0.447	4.0	2.54	24.0	-13	
6	1020	4.41	300	7.48	0.446	3.8	1.77	23.5	-12	
9	1030	4.41	300	7.47	0.445	3.7	1.70	23.3	-10	
12	1040	4.41	300	7.47	0.438	3.3	1.67	23.3	-4	
15	1050	4.41	300	7.47	0.438	3.2	1.65	23.3	-0	
16	1053	4.41	300	7.48	0.439	3.2	1.64	23.3	1	
17	1057	4.41	300	7.47	0.437	3.4	1.64	23.3	2	End Purge
	1105 = Sample Time									

SIGNATURE(S): Charles Mer

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project Site Name:	*MPT-Building 351 / CTO 122*	Sample ID No.:	MPT-~~122~~ 351-MW03-01
Project No.:	*N0424. KR0050215*	Sample Location:	MW03
		Sampled By:	~~DS & CM~~ PL
[ ] Domestic Well Data		C.O.C. No.:	
[X] Monitoring Well Data		Type of Sample:	
[ ] Other Well Type:		[X] Low Concentration	
[ ] QA Sample Type:		[ ] High Concentration	

SAMPLING DATA

Date: 10/18/2002	Color	pH	S.C.	Temp.	Turbidity	DO	ORP	Other
Time: 1130	Visual	Standard	mS/cm	°C	NTU	mg/l	mV	
Method: Low Flow Peristaltic	Clear	7.57	1.05	22.87	3.8	6.43	-242	

PURGE DATA

Date: 10/18/2002	Time	pH	S.C.	Temp (°C)	Turbidity	DO	ORP	Other
Method: Low Flow Peristaltic								
Monitor Reading (ppm): 0								
Well Casing Diameter: 2"								
Well Casing Material: PVC								
Total Well Depth (TD): 12.9								
Static Water Level (WL): 4.20								
One Casing Volume(gal/L): 5.6								
Start Purge (hrs): 0900								
End Purge (hrs): 0945								
Total Purge Time (min): 45								
Total Vol. Purged (gal): 18								

See Attached Low Flow Purge Data Sheet

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
EPA 504.1	*sodium thois...*	*3-40ml vials*	✓
Lead (unfiltered)	*HNO3*	*1-500mL HDPE*	✓
SW- 846 8260 - VOH & VOC	*HCl*	*3-40ml vials*	✓
PAH	*~*	*2-1L Amber*	✓
FL-PRO	*H2SO4*	*2-1L Amber*	✓

OBSERVATIONS / NOTES

Laboratory: **STL -Pittsburg**
450 William Pitt Way
Pittsburg, PA 15238

Veronica Bortot
phone: (412)820-8380
fax: (412) 820-2080

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

16.8

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: MPT-Building 351 / CTO 122
PROJECT NUMBER: N0500. GJ005A175
WELL ID.: MPT-~~122~~ 351-MW03-01
DATE: 10/18/2002

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0900	4.20	400	–	–	–	–	–	–	START PURGE
0905	4.27	2.0 400	6.89	0.840	15.8	1.27	22.88	-75	
0910	4.30	4.0 400	7.06	0.945	10.7	0.82	22.88	-132	
0915	4.30	6.0 400	7.26	0.889	8.6	0.56	22.88	-175	
0920	4.30	8.0 400	7.39	0.93	7.6	0.58	22.88	-200	
0925	4.30	10.0 400	7.47	0.97	6.8	0.52	22.89	-217	
0930	4.30	12.0 400	7.51	0.99	4.7	0.49	22.88	-223	
0935	4.30	14.0 400	7.56	1.00	4.5	0.48	22.89	-231	
0940	4.30	16.0 400	7.50	1.03	4.1	0.44	22.87	-230	
0945	4.30	18.0 400	7.57	1.05	3.8	0.43	22.87	-242	
1130 =	Sample Time								

SIGNATURE(S):

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. | Manifest Doc. No. | 2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address — Mayport Naval Station
4. Generator's Phone ( )

5. Transporter 1 Company Name: Allwaste Services | 6. US EPA ID Number: F L 2 0 0 0 0 2 6 5 9 1 | A. Transporter's Phone: (713) 592 1001

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address: IWS, 1640 Talleyrand Ave., Jacksonville, FL 32206 | 10. US EPA ID Number | C. Facility's Phone: (800) 447 3592

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. Non Haz, Non Reg. Groundwater PCW (Petroleum Contaminated Water)	001	T	1122	G
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

This PCW does not contain levels of Hazardous Constituents above those found in the Source of the PCW

Profile # 021605

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name | Signature | Month | Day | Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: [illegible] Wilson Jr. | Signature | Month: 07 | Day: 14 | Year: 02

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month | Day | Year

Printed by J. J. KELLER & ASSOCIATES, INC.
Neenah, WI 54957-0368

GENERATOR'S COPY

12-BLS-C5 Rev. 12/98

Please print or type.
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. | Manifest Doc. No. | 2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address
4. Generator's Phone ( )

5. Transporter 1 Company Name | 6. US EPA ID Number | A. Transporter's Phone

7. Transporter 2 Company Name | 8. US EPA ID Number | B. Transporter's Phone

9. Designated Facility Name and Site Address | 10. US EPA ID Number | C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
a. Non-Hazardous; Non-Regulated Construction Materials	001	T	2228	G
b.				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

Profile # 021868

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name | Signature | Month | Day | Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month | Day | Year

Printed by J. J. KELLER & ASSOCIATES, INC.
Neenah, WI 54957-0368

GENERATOR'S COPY

12-BLS-C5 Rev. 12/98

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.	Manifest Doc. No.	2. Page 1 of 1
	2.1.8.68	

GENERATOR

3. Generator's Name and Mailing Address: Building 351-US.NAVAL STATION MAYPORT, FL

4. Generator's Phone: (904) 281-0400

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
HillVac		770 [redacted] 592-1001
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone

9. Designated Facility Name and Site Address	10. US EPA ID Number	C. Facility's Phone
IWS JACKSONVILLE, FL		

11. Waste Shipping Name and Description	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol
a. Non-Hazardous, Non-Regulated U.S.T.	001	TT	2078	G
b. Corrective Action Groundwater				
c.				
d. [redacted] IWS A 071868				

D. Additional Descriptions for Materials Listed Above	E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year
DAVID SIEFKEN As Agent for US Navy Mayport		1	16	03

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year
George Waddell	George Waddell	1	18	03

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year
[illegible]		01	18	03

TRANSPORTER #1

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

July 22, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

Subject: **Enhanced Fluid Recovery (EFR®) Results** Event 1
Building 351
Mayport Naval Station
Mayport, Florida

Dear Mr. Peterson:

Please find attached the data summary for the initial EFR® event conducted at the subject site on July 18, 2002. The following summarizes the results of this EFR® event.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were not detected prior to, or upon completion of, conducting this EFR® event. This EFR® event was performed for a duration of eight hours at one extraction point, consisting of monitor well MW06. A calculated total of 4.1 pounds of petroleum hydrocarbons (approximately equivalent to 1.7 pounds carbon – 0.6 equivalent gallon of fuel oil) was removed during this EFR® event.

The hydrocarbon removal rate ranged from 0.3 to 1.7 pounds per hour during this EFR® event. The removal rate decreased from 1.7 to 0.3 pounds per hour during the initial 4.5 hours of extraction and remained in the range of 0.3 to 0.5 pound per hour during the final 3.5 hours of the event. Offgas concentrations ranged from 280 to 1,000 parts per million by volume (PPM_V). Vapor flow rates ranged from 49 to 83 cubic feet per minute (CFM) [35 to 76 dry standard cubic feet per minute (DSCFM)] during this EFR® event. The vacuum readings recorded at MW06 ranged from 3 to 6 inches of mercury, as detailed in the EFR® Field Data Sheet.

105 Weatherstone Drive, Suite 610 - Woodstock, Georgia 30188
(770) 592-1001 - Fax (770) 592-1801
www.ecovacservices.com

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR® in the vadose zone. Vacuum influence was detected at distances up to 15 feet from extraction well MW06. The differential pressure data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.58 inches of water	6 feet
MW05	-0.40 inches of water	7 feet
MW01	-0.11 inches of water	10 feet
MW04	-0.03 inches of water	15 feet
MW03	0.00 inches of water	20 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR®. Downward inflections of the water table were detected at all adjacent wells, however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.47 feet	6 feet
MW05	-0.50 feet	7 feet
MW01	-0.35 feet	10 feet
MW04	-0.25 feet	15 feet
MW03	-0.24 feet	20 feet

Approximately 2,078 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR® event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for this opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services

David M. Goodrich

David M. Goodrich, P.G.

EFR® FIELD DATA SHEET

Client: TetraTech NUS	Facility Name: Building 351	Facility ID#:	Event #: 1
Facility Address: U.S. Naval Station Mayport - Mayport, Florida		Technician: M. Patterson	Date: 7/18/02

Extraction Well(s)	Time hh:mm	Extraction Well-head Vacuum (in. Hg)								Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp. °F	Flow Rate DSCFM	Offgas Conc. PPM_V	Hydro-Carbon Removal Rate (lbs/hour)	Interval Hydro-Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
		Inlet	MW06															
Start Time:	7:30																	
MW06	7:45	20	3							1,700	83	110	76	1,000	1.7	0.4	0.9	0.2
"	8:00	20	3							1,500	74	126	64	700	1.1	0.3	0.5	0.1
"	8:15	20	3							1,500	74	130	62	580	0.9	0.2	0.4	0.1
**note	8:30	20	3							1,500	74	136	61	360	0.5	0.1	0.2	0.1
"	9:00	21	3							1,100	54	130	46	500	0.6	0.3	0.3	0.1
"	9:30	21	3							1,000	49	130	42	500	0.5	0.3	0.2	0.1
"	10:00	21	3							1,100	54	136	44	460	0.5	0.3	0.2	0.1
"	10:30	21	3							1,100	54	136	44	440	0.5	0.2	0.2	0.1
"	11:00	20	3							1,250	61	136	50	320	0.4	0.2	0.2	0.1
"	11:30	20	3							1,300	64	136	52	280	0.4	0.2	0.2	0.1
"	12:00	20	3							1,000	49	140	39	280	0.3	0.1	0.1	0.1
"	12:30	20	4							1,200	59	156	42	300	0.4	0.2	0.1	0.1
***note	13:00	20	4							1,200	59	150	44	340	0.4	0.2	0.2	0.1
"	13:30	17	6							1,300	64	170	38	400	0.5	0.3	0.2	0.1
"	14:00	17	6							1,300	64	172	37	380	0.5	0.2	0.2	0.1
****note	14:30	20	3							1,200	59	170	35	360	0.4	0.2	0.1	0.1
"	15:00	20	3							1,200	59	166	37	340	0.4	0.2	0.1	0.1
"	15:30	20	3							1,200	59	160	40	280	0.3	0.2	0.1	0.1

Well #:	MW06
Breather Port:	0
Stinger Depth:	4.5 to 0 @ 8:30

Well Gauging Data:			Before EFR® Event			After EFR® Event			Corr. DTW
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)	Change (ft)
MW01	2"		-	4.65	0.00	-	5.00	0.00	-0.35
MW02	2"		-	4.61	0.00	-	5.08	0.00	-0.47
MW03	2"		-	4.45	0.00	-	4.69	0.00	-0.24
MW04	2"		-	5.25	0.00	-	5.50	0.00	-0.25
MW05	1"		-	4.80	0.00	-	5.30	0.00	-0.50
MW06	4"	12.45	-	4.60	0.00	-	4.72	0.00	-0.12

Vacuum Truck Information	
Subcontractor:	AllVac
Truck Operator:	G.Waddell
Truck No.:	143 Becker*
Vacuum Pump:	Twin LC-44s
Tank Capacity (gal.):	2,894
Stack I.D. (inches):	3.0

Recovery/Disposal Information	
Gal. Liquid/Event:	2,078
Disposal Facility:	IWS
Lbs.Hydrocarbons:	4.1
Cumul.Lbs.Hydrocarb.:	4.1
Lbs.Carbon/Event:	1.7
Cumul.Lbs.Carbon:	1.7
Equiv.Gal./Event:	0.6
Cumul.Equiv.Gal.:	0.6
Calibration Gas:	500 ppm Hexane
Gas Mol. Wgt. (g/mole):	130

ECOVAC SERVICES

Comments:
* Operated one vacuum pump at 700 RPM throughout the event
** Reduced liquid flow from well by partially closing gate valve and removing stingers at 8:30
*** Fully opened gate valve at 13:00
**** Added stinger (4.5 ft.) back at 14:00

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
Event #: 1 Date: 7/18/02
Facility Name: Building 351
Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

		Well Designation:				
		MW02	MW05	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	7 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Differential Pressure Readings (inches of water):				
7:45	0.25 hr.	-0.45	-0.36	-0.10	-0.02	0.00
8:00	0.5 hr.	-0.54	-0.40	-0.11	-0.02	0.00
8:30	1 hr.	-0.58	-0.40	-0.11	-0.03	0.00
9:00	1.5 hrs.	-0.29	-0.19	-0.03	-0.01	0.00
10:00	2.5 hrs.	-0.28	-0.18	-0.02	0.00	-
11:00	3.5 hrs.	-0.33	-0.22	-0.03	0.00	-
12:00	4.5 hrs.	-0.35	-0.26	-0.06	0.00	-
13:00	5.5 hrs.	-0.52	-0.33	-0.10	0.00	-
14:00	5.5 hrs.	-0.84	-0.52	-0.18	-	-
15:00	6.5 hrs.	-0.74	-0.43	-0.16	-	-
Maximum Change:		-0.58	-0.40	-0.11	-0.03	0.00

GROUNDWATER DRAWDOWN DATA

		Well Designation:				
		MW02	MW05	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	7 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Depth to Liquid (feet below top of casing):				
Prior to EFR®		4.61	4.80	4.65	5.25	4.45
13:00	5.5 hrs.	-	-	-	5.45	4.60
15:30	8 hrs.	5.08	5.30	5.00	5.50	4.69
Maximum Change:		-0.47	-0.50	-0.35	-0.25	-0.24

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

2nd event

October 16, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

Subject: **Enhanced Fluid Recovery (EFR®) Results**
Event No. 3
Building 351
Mayport Naval Station
Mayport, Florida

Dear Mr. Peterson:

Please find attached the data summary for the third EFR® event conducted at the subject site on September 24, 2002. The previous EFR® events were performed at the subject site on July 18, 2002 and August 20, 2002. The following summarizes the results of EFR® at this site.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were not detected prior to, or upon completion of, conducting this or the previous EFR® events. This EFR® event was performed for a duration of eight hours at one extraction point, consisting of monitor well MW06.

A calculated total of 0.4 pound of petroleum hydrocarbons (approximately equivalent to 0.2 pound carbon - 0.1 equivalent gallon of fuel oil) was removed during this EFR® event. This removal of petroleum hydrocarbons represents a decrease from the removals achieved during the second event (i.e. a calculated total of 0.6 pound of petroleum hydrocarbons - approximately 0.1 equivalent gallon of fuel oil) and during the initial event (i.e. a calculated total of 4.1 pounds of petroleum hydrocarbons - approximately 0.6 equivalent gallon of fuel oil).

The hydrocarbon removal rate fluctuated in the range of 0.03 to 0.10 pound per hour throughout this EFR® event. These removal rates were within the range of removal rates achieved during the second event (i.e. 0.03 to 0.48 pound per hour) and represent a decrease from the removal rates achieved during the initial event (i.e. 0.3 to 1.7 pounds per hour).

Offgas concentrations ranged from 40 to 140 parts per million by volume (PPM_V). The offgas concentrations recorded during the previous events ranged from 40 to 1,000 PPM_V. Vapor flow rates ranged from 34 to 39 cubic feet per minute (CFM) [30 to 34 dry standard cubic feet per

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minute (DSCFM)] during this EFR® event. The vapor flow rates recorded during the previous events ranged from 39 to 83 CFM. The vacuum readings recorded at MW06 remained stable at 1 inch of mercury throughout this event, as detailed in the EFR® Field Data Sheet.

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR® in the vadose zone. The differential pressure data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.33 inches of water	6 feet
MW01	-0.05 inches of water	10 feet
MW04	-0.05 inches of water	15 feet
MW03	0.00 inches of water	20 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR®. Downward inflections of the water table were detected at all adjacent wells; however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.30 feet	6 feet
MW05	-0.31 feet	7 feet
MW01	-0.26 feet	10 feet
MW04	-0.17 feet	15 feet
MW03	-0.14 feet	20 feet

Approximately 1,922 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR® event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for the continued opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services

David M. Goodrich

David M. Goodrich, P.G.

EFR® FIELD DATA SHEET

Client: TetraTech NUS	Facility Name: Building 351	Facility ID#:	Event #: 3
Facility Address: U.S. Naval Station Mayport - Mayport, Florida		Technician: K. Vitovic	Date: 9/24/02

Extraction Well(s)	Time hh.mm	Extraction Well-head Vacuum (in. Hg)								Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp °F	Flow Rate DSCFM	Offgas Conc. PPMv	Hydro-Carbon Removal Rate (lbs/hour)	Interval Hydro-Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
Start Time:	6:15	Inlet	MW06															
MW06	6:30	24	1							700	34	90	33	120	0.08	0.02	0.04	0.01
"	6:45	24	1							700	34	96	32	120	0.08	0.02	0.04	0.01
"	7:00	24	1							700	34	106	32	140	0.10	0.02	0.05	0.01
"	7:15	24	1							700	34	114	31	120	0.08	0.02	0.04	0.01
"	7:45	24	1							700	34	116	31	100	0.07	0.04	0.03	0.02
"	8:15	24	1							700	34	120	30	100	0.07	0.04	0.03	0.02
"	8:45	24	1							800	39	122	34	80	0.06	0.03	0.03	0.02
"	9:15	24	1							800	39	126	34	100	0.08	0.04	0.04	0.02
"	10:15	24	1							800	39	128	34	60	0.05	0.05	0.02	0.02
"	11:15	24	1							800	39	132	33	60	0.05	0.05	0.02	0.02
"	12:15	24	1							800	39	134	33	40	0.03	0.03	0.01	0.01
"	13:15	24	1							800	39	136	32	40	0.03	0.03	0.01	0.01
"	14:15	24	1							800	39	134	33	40	0.03	0.03	0.01	0.01

Well #:	MW06
Breather Port:	0
Stinger Depth:	5

Well Gauging Data:			Before EFR® Event			After EFR® Event			Corr. DTW
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)	Change (ft)
MW01	2"		-	4.31	0.00	-	4.57	0.00	-0.26
MW02	2"		-	4.28	0.00	-	4.58	0.00	-0.30
MW03	2"		-	4.11	0.00	-	4.25	0.00	-0.14
MW04	2"		-	4.91	0.00	-	5.08	0.00	-0.17
MW05	1"		-	4.49	0.00	-	4.80	0.00	-0.31
MW06	4"	12.45	-	4.25	0.00	-	5.61	0.00	-1.36

Vacuum Truck Information	
Subcontractor:	AllVac
Truck Operator:	K. Vitovic
Truck No.:	147
Vacuum Pump:	Twin LC-44s
Tank Capacity (gal.):	2,894
Stack I.D. (inches):	3.0

Recovery/Disposal Information	
Gal. Liquid/Event:	1,922
Disposal Facility:	IWS
Lbs.Hydrocarbons:	0.4
Cumul.Lbs.Hydrocarb.	5.1
Lbs.Carbon/Event:	0.2
Cumul.Lbs.Carbon:	2.2
Equiv.Gal./Event:	0.1
Cumul.Equiv.Gal.:	0.8

Calibration Gas:	500 ppm Hexane
Gas Mol. Wgt. (g/mole):	130

ECOVAC SERVICES

Comments: * Operated two vacuum pump at 800 RPM throughout the event

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
Event #: 3 Date: 9/24/02
Facility Name: Building 351
Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

		Well Designation:			
		MW02	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Differential Pressure Readings (inches of water):			
7:15	1.0 hr.	-0.24	-0.02	-0.03	0.00
8:15	2.0 hrs.	-0.27	-0.04	-0.05	0.00
9:15	3.0 hrs.	-0.28	-0.05	-0.04	0.00
10:15	4.0 hrs.	-0.29	-0.03	-0.02	0.00
11:15	5.0 hrs.	-0.31	-0.04	-0.02	0.00
12:15	6.0 hrs.	-0.33	-0.05	0.00	0.00
Maximum Change:		-0.33	-0.05	-0.05	0.00

GROUNDWATER DRAWDOWN DATA

		Well Designation:				
		MW02	MW05	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	7 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Depth to Liquid (feet below top of casing):				
Prior to EFR®		4.28	4.49	4.31	4.91	4.11
13:15	7.0 hrs.	4.58	4.80	4.57	5.08	4.25
Maximum Change:		-0.30	-0.31	-0.26	-0.17	-0.14

ECOVAC SERVICES

The World Leader in Mobile Dual-Phase/Multi-Phase Extraction

3rd event

September 4, 2002

Mr. Mark Peterson
TetraTech NUS
7018 A.C. Skinner Parkway
Suite 250
Jacksonville, Florida 32256

Subject: **Enhanced Fluid Recovery (EFR®) Results**
Event No. 2
Building 351
Mayport Naval Station
Mayport, Florida

Dear Mr. Peterson:

Please find attached the data summary for the second EFR® event conducted at the subject site on August 20, 2002. The previous EFR® event was performed at the subject site on July 18, 2002. The following summarizes the results of EFR® at this site.

SUMMARY OF RESULTS

Separate phase hydrocarbons (SPH) were not detected prior to, or upon completion of, conducting this or the previous EFR® events. This EFR® event was performed for a duration of eight hours at one extraction point, consisting of monitor well MW06.

A calculated total of 0.6 pound of petroleum hydrocarbons (approximately equivalent to 0.3 pound carbon - 0.1 equivalent gallon of fuel oil) was removed during this EFR® event. This removal of petroleum hydrocarbons represents a decrease from the removal achieved during the initial event (i.e. a calculated total of 4.1 pounds of petroleum hydrocarbons - approximately 0.6 equivalent gallon of fuel oil).

The hydrocarbon removal rate ranged from 0.03 to 0.48 pound per hour with a trend of decreasing removal rates throughout this EFR® event. These removal rates ranged lower than the removal rates achieved during the initial event (i.e. 0.3 to 1.7 pounds per hour).

Offgas concentrations ranged from 40 to 400 parts per million by volume (PPM_V). The offgas concentrations recorded during the previous event ranged from 280 to 1,000 PPM_V. Vapor flow rates ranged from 39 to 59 cubic feet per minute (CFM) [32 to 54 dry standard cubic feet per minute (DSCFM)] during this EFR® event. The vapor flow rates recorded during the previous

event ranged from 49 to 83 CFM. The vacuum readings recorded at MW06 remained stable at 1 inch of mercury throughout this event, as detailed in the EFR® Field Data Sheet.

Differential pressure readings were recorded throughout this event to assess the vacuum influence induced by EFR® in the vadose zone. The differential pressure data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.89 inches of water	6 feet
MW01	-0.25 inches of water	10 feet
MW04	-0.06 inches of water	15 feet
MW03	-0.01 inches of water	20 feet

Groundwater levels were recorded to assess the groundwater drawdown induced by EFR®. Downward inflections of the water table were detected at all adjacent wells; however, these data may have been biased by tidal fluctuations. The groundwater drawdown data are detailed in the attached table and summarized below:

Monitor Well	Maximum Change	Approximate Distance From MW06
MW02	-0.41 feet	6 feet
MW05	-0.44 feet	7 feet
MW01	-0.35 feet	10 feet
MW04	-0.24 feet	15 feet
MW03	-0.22 feet	20 feet

Approximately 2,228 gallons of liquid (SPH was not detected in the vacuum truck tank prior to offloading) were recovered during this EFR® event and transported to Industrial Water Services' treatment facility (Jacksonville, Florida) for disposal.

Thank you for the continued opportunity to team with TetraTech NUS in serving the environmental needs of the U.S. Navy. We look forward to working with you again in the future to provide innovative and cost effective environmental solutions at this and other sites.

Sincerely,

EcoVac Services

David M. Goodrich

David M. Goodrich, P.G.

EFR® FIELD DATA SHEET

Client: TetraTech NUS	Facility Name: Building 351	Facility ID#:	Event #: 2
Facility Address: U.S. Naval Station Mayport - Mayport, Florida		Technician: K. Vitovic	Date: 8/20/02

Extraction Well(s)	Time hh:mm	Extraction Well-head Vacuum (in. Hg)								Offgas Velocity ft/min	Flow Rate CFM	Stack Gas Temp. °F	Flow Rate DSCFM	Offgas Conc. PPMv	Hydro-Carbon Removal Rate (lbs/hour)	Interval Hydro-Carbons Removed (pounds)	Carbon Removal Rate (lbs/hour)	Interval Carbon Removed (pounds)
Start Time:	6:30	Inlet	MW06															
MW06	6:45	21	1							1,200	59	106	54	400	0.48	0.12	0.24	0.06
"	7:00	21	1							1,200	59	110	54	260	0.32	0.08	0.16	0.04
"	7:15	21	1							1,200	59	112	53	120	0.15	0.04	0.07	0.02
"	7:30	21	1							1,200	59	114	53	80	0.10	0.02	0.05	0.01
"	8:00	21	1							1,200	59	116	53	60	0.07	0.04	0.04	0.02
"	8:30	21	1							1,000	49	116	44	60	0.06	0.03	0.03	0.01
"	9:00	21	1							1,000	49	116	44	60	0.06	0.03	0.03	0.01
"	9:30	21	1							1,000	49	116	44	60	0.06	0.03	0.03	0.01
"	10:30	21	1							1,000	49	118	44	60	0.06	0.06	0.03	0.03
"	11:30	21	1							1,000	49	124	43	40	0.04	0.04	0.02	0.02
"	12:30	21	1							800	39	134	33	40	0.03	0.03	0.01	0.01
"	13:30	21	1							800	39	136	32	60	0.05	0.05	0.02	0.02
"	14:30	21	1							800	39	136	32	40	0.03	0.03	0.01	0.01

Well #:	MW06
Breather Port:	0
Stinger Depth:	5

Well Gauging Data:			Before EFR® Event			After EFR® Event			Corr. DTW
Well No.	Diam.	TD (ft)	DTS (ft)	DTW (ft)	SPH (ft)	DTS (ft)	DTW (ft)	SPH (ft)	Change (ft)
MW01	2"		-	4.87	0.00	-	5.22	0.00	-0.35
MW02	2"		-	4.85	0.00	-	5.26	0.00	-0.41
MW03	2"		-	4.67	0.00	-	4.89	0.00	-0.22
MW04	2"		-	5.46	0.00	-	5.70	0.00	-0.24
MW05	1"		-	5.06	0.00	-	5.50	0.00	-0.44
MW06	4"	12.45	-	4.81	0.00	-	4.81	0.00	0.00

Vacuum Truck Information	
Subcontractor:	AllVac
Truck Operator:	K. Vitovic
Truck No.:	147
Vacuum Pump:	Twin LC-44s
Tank Capacity (gal.):	2,894
Stack I.D. (inches):	3.0

Recovery/Disposal Information	
Gal. Liquid/Event:	2,228
Disposal Facility:	IWS
Lbs.Hydrocarbons:	0.6
Cumul.Lbs.Hydrocarb.:	4.7
Lbs Carbon/Event.	0.3
Cumul.Lbs.Carbon:	2.0
Equiv.Gal./Event.	0.1
Cumul.Equiv.Gal.:	0.7
Calibration Gas:	500 ppm Hexane
Gas Mol. Wgt (g/mole):	130

ECOVAC SERVICES

Comments: * Operated one vacuum pump at 700 RPM throughout the event

Differential Pressure and Groundwater Drawdown Data Recorded During EFR®
Event #: 2 Date: 8/20/02
Facility Name: Building 351
Facility Address: U.S. Naval Station Mayport - Mayport, Florida

DIFFERENTIAL PRESSURE DATA

		Well Designation:			
		MW02	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Differential Pressure Readings (inches of water):			
7:30	1.0 hr.	-0.78	-0.19	-0.03	0.00
8:00	1.5 hrs.	-0.81	-0.21	-0.04	0.00
8:30	2.0 hrs.	-0.81	-0.21	-0.05	0.00
9:30	3.0 hrs.	-0.84	-0.23	-0.06	0.00
10:30	4.0 hrs.	-0.85	-0.22	-0.04	0.00
11:30	5.0 hrs.	-0.88	-0.23	-0.05	-0.01
12:30	6.0 hrs.	-0.89	-0.25	-0.03	0.00
Maximum Change:		-0.89	-0.25	-0.06	-0.01

GROUNDWATER DRAWDOWN DATA

		Well Designation:				
		MW02	MW05	MW01	MW04	MW03
Nearest Extraction Well:		MW06	MW06	MW06	MW06	MW06
Approximate Distance:		6 feet	7 feet	10 feet	15 feet	20 feet
Time	Elapsed Time	Depth to Liquid (feet below top of casing):				
Prior to EFR®		4.85	5.06	4.87	5.46	4.67
13:30	7.0 hrs.	5.26	5.50	5.22	5.70	4.89
Maximum Change:		-0.41	-0.44	-0.35	-0.24	-0.22

APPENDIX D

AIR EMISSIONS CALCULATIONS

Emissions Calculations Based on OVA Readings (Form 2)

Remedial Action Plan
Building 351
Naval Station Mayport
Mayport, Florida

1st Event

INPUT

Average Ambient Air Temperature During MDES Event	°F	90
Relative Humidity During MDES Event	%	40
Velocity of Emissions at Stack (V)	feet/sec	12.5
Diameter of Stack	feet	0.25
Stack Temperature in Degrees Rankin (Ro), Ro = Fo + 460	R°	578
Average OVA Reading (measured from stack)	**ppm**	435

CALCULATIONS:

For lb. of water per lb. of dry air use temperature and humidity (B_{wsw})		0.012
values obtained from Psychiometric Chart		
Water Vapor % by Volume (B_{ws})	% vapor	0.01886
Velocity of Emissions at Stack (V)	feet/sec	12.5
Cross Sectional Area of discharge stack at sampling location (A)	$feet^2$	0.0490625
Flow at Dry Standard Cubic Feet Per Minute (Qstd)	DSCFM	32.9797
Average OVA reading measured directly from stack (PPM_w)	ppm	435
OVA reading from stack as "dry" concentration (PPM_d)	ppm	443.364
Number of carbons in calibration gas, for FID, methane (K)		1
Vol. concentration of VOC emissions as carbon, dry basis, STP (PPM_c)	ppm_v	443.364
Mass concentration of VOC emissions as carbon ($C_{c:m}$)	mg/dsm^3	221.221
Mass concentration of VOC emissions as carbon, dry basis, STP (C_c)	lb/dscf	1.3811E-05
Pollutant mass removal rate of VOCs as carbon (PMR_c)	lb/hr	0.02733
Pollutant mass removal rate of VOCs as gasoline (PMR_g)	lb/hr	0.03163

Emissions Rate of VOC's as gasoline in lbs/hr = 0.03163

Prepared by: _____ Checked by: _____

Notes:

1.) Average OVA reading obtained from Form 1, entered into Input Column: Average OVA reading measured directly from stack. Data entry location annotated by bold writing.

Equation to Determine Flow

B_{ws} = (B_{wsw}/18-lbmole H_20) / [1/28.84 lb-mole dry air) + (B_{wsw}/ 18 lb-mole H_20)

Q_{std} = (60 sec/min) (1-B_{ws}) (V) (A) (528 R^o / T_s)

Where:

Q_{std} = flow at DSCFM

B_{wsw} = lb. of water per lb. of dry air

B_{ws} = water vapor % by volume

V = velocity in ft/sec

A = cross sectional area of discharge stack in sq. ft. at sampling location

T_s = stack temperature in degrees Rankin (R^o), $R^o = F^o + 460$

Step 1: Determine lb. of water per lb. of dry air (B_{wsw}).

for B_{wsw}: Use psychiometric chart and obtain lb. of water per lb. of dry air by using temperature and relative humidity.

B_{wsw} = **0.012** from psychiometric chart (assume 90° F and 40% relative humidity)

Step 2: Determine water vapor percent by volume (B_{ws}).

for B_{ws}: = (B_{wsw}/18 lb-mole H_20) / [1/28.84 lb-mole dry air) + (B_{wsw}/ 18 lb-mole H_20)

B_{ws}= (0.012/18 lb-mole H_20) / [1/28.84 lb-mole dry air) + (0.012/ 18 lb-mole H_20)]

B_{ws}= **0.01886** water vapor % by volume

Step 3: Determine flow at dry standard cubic feet per minute, DSCFM, (Q_{std}).

for Q_{std}: = (60 sec/min) (1-B_{ws}) (V) (A) (528 R^o / T_s)

V = 12.5 ft/sec (V is an input parameter mesured from stack)

A = 0.04906 ft^2 (A is an input parameter mesured from stack)
(diameter of stack = 0.4 feet = $\pi r^2 = 3.14^* (0.2)^2$)

T_s = 580 R^o (T_s is an input parameter measured from stack)
(temp. at stack = 120 F^o = 460 + 120 = 580 R^o)

Q_{std} = (60 sec/min) (1-0.01886398) (8.3 ft/sec) (0.1256 ft^2) (528 R^o/ 580 R^o)

Q_{std} = **32.8659** DSCFM

Equations to Determine Pollutant Mass Removal Rate as Gasoline (PMR_g)

PPM_w = $PPM_{measured}$
PPM_d = $(PPM_w) / (1-B_{ws})$
PPM_c = (PPM_d) (K)
$C_{c:m}$ = PPM_c (M_c/K_3)
C_c = $C_{c:m}$ $(62.43 \times 10^{-9}$ lb-m^3 / mg-$ft^3)$
PMR_c = C_c (Q_{std}) (60 min/hr)
PMR_g = (PMR_c) (M_g/M_{cg})

Where:
$PPM_{measured}$ = obtained directly from OVA or TVA (use average value)
PPM_w = "wet" concentration
PPM_d = "dry" concentration
K = number of carbons in calibration gas (**methane K=1**, propane K=3, hexane K=6)
PPM_c = PPM_v, volumetric concentration of VOC emissions as carbon, dry basis, at STP
$C_{c:m}$ = mg/dsm^3, mass concentration of VOC emissions as carbon
M_c = 12.01 mg/mg-mole, molecular wt. of carbon
K_3 = 24.07 $dsm^3/10^6$ mg-mole, mass to volume factor at STP
C_c = lb/dscf, mass concentration of VOC emissions as carbon, dry basis, at STP
PMR_c = lb/hr, pollutant mass removal rate of VOCs as carbon
PMR_g = lb/hr, pollutant mass removal rate of VOCs as gasoline
M_g = 103 mg/mg-mole, molecular weight of gasoline
M_{cg} = 89 mg/mg-mole, weight of carbon in gasoline molecule

Step 4: Obtain average PPM reading from Form 1, this is the "wet" concentration (PPM_w).

for PPM_w: = $PPM_{measured}$ (Form 1, average OVA reading)
for example calculation, say average concentration of 1000 ppm
PPM_w = **7400** ppm

Step 5: Determine the "dry" concentration (PPM_d).

for PPM_d: $(PPM_w) / (1-B_{ws})$
PPM_d= (1000 ppm) / (1- 0.0189)
PPM_d= **7542.277** ppm

Step 6: Determine the volumetric concentration of VOC emissions as carbon (PPM_c).

for PPM_c: (PPM_d) * (K)
PPM_c= (1019.227 ppm)*(1)
where calibration gas for F.I.D. is typically methane, therefore K = 1
PPM_c= **7542.277**

Step 7: Determine the mass concentration of VOC emissions as carbon ($C_{c:m}$).

for $C_{c:m}$: $(PPM_c) * (M_c/K_3)$

$C_{c:m}$= (1019.227) * (12.01 mg/mg-mole/24.07 dsm/10^6mg-mole)

where M_c = 12.01 mg/mg-mole, the molecular weight of carbon

where K3 = 24.07 $dsm^3/10^6$mg-mole, mass to volume conversion factor at STP

$C_{c:m}$= **3763.305** mg/dsm^3

Step 8: Determine the mass concentration of VOC emissions as carbon, dry basis, at STP (C_c).

for C_c: $(C_{c:m}) * (62.43 \times 10^{-9}$ lb-m^3/mg-ft^3)

C_c= (508.555 mg/dsm^3) * (62.43 x 10^{-9} lb-m^3/mg-ft^3)

where 62.43 x 10^{-9} lb-m^3/mg-ft^3 is the conversion factor

C_c= **0.00023494** lb/dscf

Step 9: Determine the pollutant mass removal rate of VOCs as carbon (PMR_c).

for PMR_c: $(C_c) * (Q_{std})$ (60 min/hr)

PMR_c= (3.1749E-05 lb/dscf) * (55.868dscfm) * (60 min/hr)

PMR_c= **0.4633** lb/hr

Step 10: Determine the pollutant mass removal rate of VOCs as gasoline (PMR_g).

for PMR_g: $(PMR_c) * (M_g/M_{cg})$

PMR_g= (0.1064 lb/hr as carbon) * (103 mg/mg-mole / 89 mg/mg-mole)

PMR_g= **0.53618** lb/hr

APPENDIX E

AFVR EVENT PHOTOGRAPHS

Photograph 1. A photo of the site and recovery well RW-1 during the AFVR event.

Photograph 2. View showing RW-1 and MW-5 during AFVR operations. The green cover in the center is the location of the broken product line. Note the cap on MW-5. This is the type of device of which the pressure gradient is measured from.

Photograph 3. A photograph showing the vacuum truck used to used to remove the liquid and vapor phase hydrocarbons.

Photograph 4. A view showing the emissions stack attached to the vacuum truck.

APPENDIX F

LABORATORY ANALYTICAL REPORTS FOR GROUNDWATER

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. PETERSON**	**DATE:**	**JANUARY 22, 2003**
FROM:	**ETHAN G. LEE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – SELECT METALS**
NS MAYPORT – CTO 122
SAMPLE DELIVERY GROUP (SDG) – 290213

SAMPLES: 1/SOIL/

MPT-351-IDW-SOIL

6/AQUEOUS/

MPT-351-DU01-01	MPT-351-MW01-01	MPT-351-MW02-01
MPT-351-MW03-01	MPT-351-MW04-01	MPT-351-MW05-01

Overview

The sample set for NS Mayport, CTO 122, SDG 290213, consists of one (1) soil and six (6) aqueous environmental samples. One (1) field duplicate pair (MPT-351-DU01-01 / MPT-351-MW05-01) is included in this SDG.

The soil sample was analyzed for RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). The aqueous samples were analyzed for total lead. The sample was collected by Tetra Tech NUS October 28, 2002 and analyzed by Severn Trent Laboratories. Metals analyses were conducted using method SW846 6010B. Mercury analyses were conducted using method SW846 7471A.

Metals analyses were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) methodology.

These data were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Recoveries
• Laboratory Blank Analyses
* • Field Duplicate Analyses
* • Detection Limits

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

Laboratory Blank Analyses

The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Barium	1.2 ug/L	0.60 mg/kg
Chromium	1.6 ug/L	0.80 mg/kg
Lead[(1)]	2.3 ug/L	11.5 ug/L

[(1)] Maximum concentration present in aqueous preparation blank.

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids, and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. Positive results in the aqueous samples less than the action level for lead were qualified as nondetected (U) as a result of blank contamination. The remaining analytes were not qualified because the sample values were greater than the action level.

Additional Comments

Sample MPT-351-DU01-01 was not listed on the chain of custody (COC), but it was received by the laboratory. The sample was mistakenly left off the COC.

Executive Summary

Laboratory Performance: Lead was present in the laboratory preparation blank.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", July 2002 and the NFESC document entitled "Navy IRCDQM" (September 1999).

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
Ethan G. Lee
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

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

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
N01 = Internal Standard Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 0500

SDG: 290213 MEDIA: SOIL DATA FRACTION: M

nsample	MPT-351-IDW-SOIL
samp_date	10/28/2002
lab_id	C2J290213008
qc_type	NM
units	MG/KG
Pct_Solids	83
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
ARSENIC	0.64		
BARIUM	2.3		
CADMIUM	0.060		
CHROMIUM	1.8		
LEAD	1.7		
MERCURY	0.014	U	
SELENIUM	0.28	U	
SILVER	0.051	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-DU01-01
samp_date	10/28/2002
lab_id	C2J290213007
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	MPT-351-MW05-01

Parameter	Result	Val Qual	Qual Code
LEAD	2.9	U	A

nsample	MPT-351-MW01-01
samp_date	10/28/2002
lab_id	C2J290213001
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
LEAD	1.6	U	A

nsample	MPT-351-MW02-01
samp_date	10/28/2002
lab_id	C2J290213005
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
LEAD	1.5	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW03-01	nsample	MPT-351-MW04-01	nsample	MPT-351-MW05-01
samp_date	10/28/2002	samp_date	10/28/2002	samp_date	10/28/2002
lab_id	C2J290213003	lab_id	C2J290213004	lab_id	C2J290213006
qc_type	NM	qc_type	NM	qc_type	NM
units	UG/L	units	UG/L	units	UG/L
Pct_Solids	0	Pct_Solids	0	Pct_Solids	0
DUP_OF:		DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
LEAD	1.9	U	A

Parameter	Result	Val Qual	Qual Code
LEAD	1.6	U	A

Parameter	Result	Val Qual	Qual Code
LEAD	3.4	U	A

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO: **M. PETERSON** **DATE:** **JANUARY 22, 2003**

FROM: **EDWARD SEDLMYER** **COPIES:** **DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION- VOA/PAH/PETROLEUM HYDROCARBON**
CTO 122, NS MAYPORT
SDG 290213

SAMPLES: 7/Aqueous

MPT-351-MW01-01	MPT-351-MW03-01	MPT-351-MW04-01	MPT-351-MW02-01
MPT-351-MW05-01	MPT-351-DU01-01	*TRIP BLANK	

1/Soil

*MPT-351-IDW-SOIL

OVERVIEW

The sample set for CTO 122, NS Mayport, SDG 290213 consists of five (5) aqueous environmental samples, one (1) trip blank, one (1) soil environmental sample, and one (1) field duplicate. The samples were analyzed for volatile organic compounds (VOCs), 1,2-dibromoethane (EDB), polynuclear aromatic hydrocarbons (PAHs), and petroleum hydrocarbons. The samples indicated by (*) were analyzed for VOAs only. One (1) field duplicate pair was included in this SDG: MPT-351-DU01-01 / MPT-351-MW05-01.

The samples were collected by TetraTech NUS on October 28, 2002 and analyzed by STL Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8260B, 8310, modified 8015 (Florida-PRO), and 504.1 analysis and reporting protocols. The data contained in this SDG were validated with regard to the following parameters:

* • Data completeness
* • Holding times
• Initial/continuing calibrations
• Laboratory method and trip blank results
* • Field Duplicate Results
• Detection Limits

The symbol (*) indicates that 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.

Volatiles

Methylene chloride was detected in the trip blank. No action was taken because methylene chloride was not detected in any of the associated samples.

The continuing calibration associated with the aqueous samples and analyzed on 11/04/02 @14:54 on instrument HP5 had a percent difference (%D) that exceeded the 25% quality control limit for 2-chloroethyl vinyl ether and had a response factor less than 0.05 the quality control limit. The non-detected results reported for 2-chloroethyl vinyl ether for all aqueous samples were qualified as rejected, "UR".

EDB

No qualification of the data was necessary.

PAHs

The %D between analytical columns for the PAH analyses exceeded 25% for positive results reported for several compounds in the following samples and the results have been qualified as estimated, "J":

Sample Number	Compound	% Difference	Qualification
MPT-351-MW03-01	Acenaphthene	213.6%	J
	Phenanthrene	58.4%	J
	2-Methylnaphthene	107.5%	J
MPT-351-MW04-01	Pyrene	161.4%	J
MPT-351-MW05-01	Fluorene	36.7%	J
	Phenanthrene	176.7%	J
	Pyrene	545.2%	J
	Benzo(a)anthracene	179.2%	J
MPT-351-DU01-01	Acenaphthene	456.5	J
	Phenanthrene	227.9%	J
	Pyrene	545.2%	J
	Benzo(a)anthracene	145.1%	J
	Benzo(k)fluoranthene	373.2%	J

Petroleum Hydrocarbons

No qualification of the data was necessary.

Additional Comments:

Positive results less than the reporting limit (RL) were qualified as estimated, J, due to uncertainty near the detection limit.

The following table illustrates differences between the laboratory's RL and the Required Quantitation Limit (RQL) for aqueous samples listed in the Statement of Work (SOW):

Compound	RL	RQL
Bromodichloromethane	1 ug/L	0.6 ug/L
Bromomethane	2 ug/L	1 ug/L
Dibromochloromethane	1 ug/L	0.4 ug/L
cis-1,3-Dichloropropene	1 ug/L	0.2 ug/L
trans-1,3-dichloropropene	1 ug/L	0.2 ug/L
Chloroethane	2 ug/L	1 ug/L
Chloromethane	2 ug/L	1 ug/L

1,1,2,2-Tetrachloroethane	1 ug/L	0.2 ug/L
2-Chloroethylvinyl ether	5 ug/L	1 ug/L
Vinyl chloride	2 ug/L	1 ug/L
Total xylenes	3 ug/L	1 ug/L

Sample MPT-351-DU01-01 was not documented on the chain-of-custody and was added by the laboratory.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Continuing calibration %D and response factor noncompliance. Percent difference between detectors noncompliance.

Other factors affecting data quality: Several samples required dilution due to high concentrations of TPH. Reported detection limits greater than required detection limits stated in the S.O.W.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (10/99) and the NFESC guidelines IRCDQM (Sept., 1999). 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

Edward Sedlmyer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

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Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

APPENDIX A

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J = GFAA PDS - GFAA MSA's $r < 0.995$
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L = Instrument Calibration Range Exceedance
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N = Internal Standard Noncompliance
N01 = Internal Standard Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
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S = Pesticide/PCB Resolution
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U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 0500

SDG: 290213 MEDIA: SOIL DATA FRACTION: OV

nsample	MPT-351-IDW-SOIL
samp_date	10/28/2002
lab_id	C2J290213008
qc_type	NM
units	UG/KG
Pct_Solids	83
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	5	U	
1,1,2,2-TETRACHLOROETHANE	5	U	
1,1,2-TRICHLOROETHANE	5	U	
1,1-DICHLOROETHANE	5	U	
1,1-DICHLOROETHENE	5	U	
1,2-DIBROMOETHANE	5	U	
1,2-DICHLOROETHANE	5	U	
1,2-DICHLOROPROPANE	5	U	
2-CHLOROETHYL VINYL ETHER	10	U	
BENZENE	5	U	
BROMODICHLOROMETHANE	5	U	
BROMOFORM	5	U	
BROMOMETHANE	10	U	
CARBON TETRACHLORIDE	5	U	
CHLOROBENZENE	5	U	
CHLORODIBROMOMETHANE	5	U	
CHLOROETHANE	10	U	
CHLOROFORM	5	U	
CHLOROMETHANE	10	U	
CIS-1,2-DICHLOROETHENE	5	U	
CIS-1,3-DICHLOROPROPENE	5	U	
ETHYLBENZENE	5	U	
METHYL TERT-BUTYL ETHER	5	U	
METHYLENE CHLORIDE	5	U	
TETRACHLOROETHENE	5	U	
TOLUENE	5	U	
TOTAL XYLENES	15	U	
TRANS-1,2-DICHLOROETHENE	5	U	
TRANS-1,3-DICHLOROPROPENE	5	U	
TRICHLOROETHENE	5	U	

nsample	MPT-351-IDW-SOIL
samp_date	10/28/2002
lab_id	C2J290213008
qc_type	NM
units	UG/KG
Pct_Solids	83
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	10	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-DU01-01
samp_date	10/28/2002
lab_id	C2J290213007
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	MPT-351-MW05-01

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	0.8	J	P
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3.4		
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

nsample	MPT-351-DU01-01
samp_date	10/28/2002
lab_id	C2J290213007
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	MPT-351-MW05-01

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

nsample	MPT-351-MW01-01
samp_date	10/28/2002
lab_id	C2J290213001
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	1	U	
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3	U	
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW01-01
samp_date	10/28/2002
lab_id	C2J290213001
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

nsample	MPT-351-MW02-01
samp_date	10/28/2002
lab_id	C2J290213005
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	1	U	
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3	U	
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

nsample	MPT-351-MW02-01
samp_date	10/28/2002
lab_id	C2J290213005
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW03-01
samp_date	10/28/2002
lab_id	C2J290213003
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	1	U	
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3	U	
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	2.4		

nsample	MPT-351-MW03-01
samp_date	10/28/2002
lab_id	C2J290213003
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

nsample	MPT-351-MW04-01
samp_date	10/28/2002
lab_id	C2J290213004
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLORCETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	1	U	
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3	U	
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW04-01
samp_date	10/28/2002
lab_id	C2J290213004
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

nsample	MPT-351-MW05-01
samp_date	10/28/2002
lab_id	C2J290213006
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	0.02	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	0.39	J	P
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	2	U	
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3.3		
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

nsample	MPT-351-MW05-01
samp_date	10/28/2002
lab_id	C2J290213006
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	TRIP BLANK
samp_date	10/28/2002
lab_id	C2J290213002
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,1,1-TRICHLOROETHANE	1	U	
1,1,2,2-TETRACHLOROETHANE	1	U	
1,1,2-TRICHLOROETHANE	1	U	
1,1-DICHLOROETHANE	1	U	
1,1-DICHLOROETHENE	1	U	
1,2-DIBROMOETHANE	1	U	
1,2-DICHLOROETHANE	1	U	
1,2-DICHLOROPROPANE	1	U	
2-CHLOROETHYL VINYL ETHER	5	UR	C
BENZENE	1	U	
BROMODICHLOROMETHANE	1	U	
BROMOFORM	1	U	
BROMOMETHANE	2	U	
CARBON TETRACHLORIDE	1	U	
CHLOROBENZENE	1	U	
CHLORODIBROMOMETHANE	1	U	
CHLOROETHANE	2	U	
CHLOROFORM	1	U	
CHLOROMETHANE	2	U	
CIS-1,2-DICHLOROETHENE	1	U	
CIS-1,3-DICHLOROPROPENE	1	U	
ETHYLBENZENE	1	U	
METHYL TERT-BUTYL ETHER	1	U	
METHYLENE CHLORIDE	1.2	J	P
TETRACHLOROETHENE	1	U	
TOLUENE	1	U	
TOTAL XYLENES	3	U	
TRANS-1,2-DICHLOROETHENE	1	U	
TRANS-1,3-DICHLOROPROPENE	1	U	
TRICHLOROETHENE	1	U	

nsample	TRIP BLANK
samp_date	10/28/2002
lab_id	C2J290213002
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
VINYL CHLORIDE	2	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-DU01-01
samp_date	10/28/2002
lab_id	C2J290213007
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	MPT-351-MW05-01

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	3.6		
2-METHYLNAPHTHALENE	1	U	
ACENAPHTHENE	0.83	J	PU
ACENAPHTHYLENE	1	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.75	J	U
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.11	J	PU
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	1.2		
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.17	J	PU
PYRENE	1.1	J	U

nsample	MPT-351-MW01-01
samp_date	10/28/2002
lab_id	C2J290213001
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	1	U	
2-METHYLNAPHTHALENE	1	U	
ACENAPHTHENE	1	U	
ACENAPHTHYLENE	1	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.2	U	
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.2	U	
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	0.2	U	
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.2	U	
PYRENE	0.2	U	

nsample	MPT-351-MW02-01
samp_date	10/28/2002
lab_id	C2J290213005
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	1	U	
2-METHYLNAPHTHALENE	1	U	
ACENAPHTHENE	1	U	
ACENAPHTHYLENE	1	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.2	U	
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.2	U	
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	0.2	U	
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.2	U	
PYRENE	0.2	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW03-01
samp_date	10/28/2002
lab_id	C2J290213003
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	9.2		
2-METHYLNAPHTHALENE	1.6	J	U
ACENAPHTHENE	0.98	J	PU
ACENAPHTHYLENE	1	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.2	U	
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.2	U	
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	1.9		
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.26	J	U
PYRENE	0.2	U	

nsample	MPT-351-MW04-01
samp_date	10/28/2002
lab_id	C2J290213004
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	1	U	
2-METHYLNAPHTHALENE	1	U	
ACENAPHTHENE	1	U	
ACENAPHTHYLENE	1.5		
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.2	U	
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.2	U	
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	0.2	U	
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.2	U	
PYRENE	0.034	J	PU

nsample	MPT-351-MW05-01
samp_date	10/28/2002
lab_id	C2J290213006
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	4.2		
2-METHYLNAPHTHALENE	1	U	
ACENAPHTHENE	1	U	
ACENAPHTHYLENE	1	U	
ANTHRACENE	0.2	U	
BENZO(A)ANTHRACENE	0.62	J	U
BENZO(A)PYRENE	0.2	U	
BENZO(B)FLUORANTHENE	0.2	U	
BENZO(G,H,I)PERYLENE	0.2	U	
BENZO(K)FLUORANTHENE	0.2	U	
CHRYSENE	0.2	U	
DIBENZO(A,H)ANTHRACENE	0.2	U	
FLUORANTHENE	0.2	U	
FLUORENE	1.1	J	U
INDENO(1,2,3-CD)PYRENE	0.2	U	
NAPHTHALENE	1	U	
PHENANTHRENE	0.24	J	U
PYRENE	1	J	U

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-DU01-01
samp_date	10/28/2002
lab_id	B214238*5
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	MPT-351-MW05-01

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	20		

nsample	MPT-351-MW01-01
samp_date	10/28/2002
lab_id	B214238*1
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	0.3	U	

nsample	MPT-351-MW02-01
samp_date	10/28/2002
lab_id	B214238*17
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	0.3	U	

PROJ_NO: 0500

SDG: 290213 MEDIA: WATER DATA FRACTION:

nsample	MPT-351-MW03-01
samp_date	10/28/2002
lab_id	B214238*2
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	0.69		

nsample	MPT-351-MW04-01
samp_date	10/28/2002
lab_id	B214238*3
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	0.3	U	

nsample	MPT-351-MW05-01
samp_date	10/28/2002
lab_id	B214238*4
qc_type	NM
units	MG/L
Pct_Solids	0
DUP_OF:	

Parameter	Result	Val Qual	Qual Code
TOTAL PETROLEUM HYDROCARBONS	25		

APPENDIX G

FDEP SOPs

FS 2000. GENERAL AQUEOUS SAMPLING

1. COMMON PROCEDURES

The following procedures are applicable to the collection of all water samples.

1.1. Refer to FS 1000 for procedures that are common to all types of sample collection.

1.2. Collection Techniques

1.2.1. When filling a sample container that already contains premeasured preservative, slowly pour the sample down the side of the container so that the preservative does not splatter. If the preservative is concentrated acid, and the sample water is added too quickly, the reaction between the water and the acid can generate enough heat to burn unprotected skin.

1.2.2. Collect grab samples (single, discrete samples) unless directed by permit, program, or approved sampling plan or work plan to collect composite samples.

1.3. Collecting Filtered/Dissolved Samples

1.3.1. For certain studies or projects, it may be necessary to obtain dissolved (i.e., filtered) samples. Identify all analytes in samples that are filtered as "dissolved" or "filtered" in field notes or laboratory transmittal forms and on final reports.

1.3.2. Collect both filtered and unfiltered samples from the same water in a collection device (e.g., bailer, intermediate container) or consecutively if sampling from a pump.

1.3.3. Collect dissolved metals in groundwater according to the procedures discussed in FS 2225. **Do not** collect filtered samples from metals from groundwater sources unless:

1.3.3.1. The FDEP has required or approved the protocol and the FDEP program allows the use of the procedure; or

1.3.3.2. The organization is documenting that a filtered groundwater sample is as or more representative of the groundwater quality. In this case, collect **both** unfiltered and filtered samples for analysis. Submit the results of both samples the FDEP for review.

1.3.4. If collecting filtered samples from static surface water sources (i.e., subsurface samples from lakes, ponds, lagoons or ocean), use the sampling protocols that are specified for groundwater (FS 2225) since exposure to air can change the concentration of metals in solution.

1.3.5. If sampling from moving sources (i.e., rivers or streams) or just below the surface, filtered samples may be collected into an intermediate container and filtered with syringe-type or tripod-type filtration units or by using vacuum filtration.

1.3.6. Filtration, when performed, must begin within 15 minutes of sample collection.

1.3.7. Collect dissolved groundwater samples for metals with a one-piece molded construction 1 µm filter unless otherwise specified by an FDEP program. Use a 0.45 µm filter when filtering all other constituents **including** metals in surface water.

1.3.8. The filter must be compatible with the analyte to be filtered (e.g., zero carbon content for carbon analysis; non-protein binding filters for nitrogen).

1.3.9. Equipment blanks, when collected, must be processed through the filtration apparatus and analyzed for the analytes of interest.

1.4. pH Preserved Samples: The pH of all pH-preserved samples (except volatile organics) must be verified in the field. If samples are routinely collected from the same sample location, a pH check is not required each time sample are collected.

1.4.1. If the frequency of sample collection at a specified location is greater than once per month (i.e. weekly or daily), check the pH of **at least one** sample per parameter group according to the following schedule:

1.4.1.1. Weekly sampling: 1 pH check per month

1.4.1.2. Daily sampling: 1 pH check per week

1.4.2. For all other sample collection frequencies, pH checks may be reduced as follows:

1.4.2.1. During the first sampling event at a particular site, check **all** samples (except volatile organics) that are pH-adjusted, and

1.4.2.2. During subsequent visits to a particular site, check **at least one** sample per parameter group that must be pH-adjusted.

THE FOLLOWING ARE SPECIAL CONSIDERATIONS FOR VARIOUS ANALYTE GROUPS:

FS 2001. pH Preserved Samples

1. SAMPLE CONTAINERS

1.1. Use properly cleaned sample containers (see FC 1300).

1.2. Inspect all containers for defects or contamination. Discard if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with the chemical specified by the method or preservation charts (Tables FS 1000-4 to FS 1000-8).

3.2. The chemical reagents must be pure enough so that the reagent does not contribute contamination or interferences to the analytes of interest.

3.3. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a 24-hour composite or for analysis of lead and copper for drinking water compliance (see FS 2301, section 2).

3.4. The pH of the acidified sample must meet the pH criterion of the applicable preservation chart (see Tables FS 1000-4 to FS 1000-8). **Do not over acidify the sample.**

3.5. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.6. Preserve the sample by adding an accurately measured amount of preservative to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.6.1. Tightly cap the sample container and gently tip the container two to three times to distribute the chemical.

3.6.2. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH meets the required level. **Do not put the pH paper directly into the sample container.**

3.6.3. If the pH does not meet the required level, add additional measured amounts of preservative and test with narrow range pH paper (see section 3.6.2 above) until the pH meets the pH requirement.

3.6.4. Record the total amount of preservative that was added to the sample. This documentation is necessary for the next site visit, since additional acid may need to be added to the sample on subsequent visits.

3.6.5. Cooling to 4°C may be required.

3.7. Acidify at least one of the equipment blanks with the **greatest** amount of preservative that was required in the sample set and note the amount in field documentation.

3.8. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2002. Metals

1. SAMPLE CONTAINERS

1.1. Use properly cleaned containers (see FC 1300).

1.2. Visually inspect the containers and caps for defects or contamination. Do not use if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve sample with a grade of nitric acid (HNO_3) that is suitable for use for metals analysis unless the sample will be analyzed for Chromium VI (see section 3.4 below).

3.1.1. Samples collected for lead and copper for drinking water compliance do not require acid preservation (see FS 2301, section 2). The laboratory must be informed, however, that the samples are unpreserved.

3.2. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a 24-hour composite or for analysis of lead and copper for drinking water compliance (see FS 2301, section 2).

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. Do not add acid to samples that are to be analyzed for Chromium VI.

3.5. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.6. Preserve the sample by adding an accurately measured amount of concentrated HNO_3 or 1+1 HNO_3 to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.6.1. Cap the sample container tightly and shake to distribute the acid.

3.6.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.6.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see FS 2001, section 3.6.2) until the pH has been reduced to just below 2 pH units. **Do not over acidify the sample by adding more acid than is needed.**

3.6.4. Record the total amount of acid that was added to the sample.

3.6.5. Cooling to 4°C is not required but samples should be protected from direct sunlight.

3.7. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.8. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2003. Extractable Organics

1. SAMPLE CONTAINERS

1.1. Most samples are collected in glass containers with Teflon-lined caps. Note: Teflon containers are also acceptable. There are some exceptions such as collecting samples in amber glass (e.g., nitroamines, nitroaromatics, etc.). If in doubt, verify the proper container type in Tables FS 1000-4 through FS 1000-8.

1.2. Visually inspect glass bottles to assure that there are no glass or liner defects. If defects are present and/or the sample containers do not appear clean, the bottles must be discarded.

1.3. Collect composite samples from automatic sample collection devices in refrigerated glass containers through Teflon tubing.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container without touching the interior Teflon liner.

2.2. Carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. Fill bottle with sample to almost full capacity.

3. PRESERVATION

3.1. In general, these types of samples must be preserved by cooling to 4°C.

3.1.1. Some analyte groups require a chemical preservation. See Tables FS 1000-4 through FS 1000-8 for any additional preservation.

3.1.2. If the samples for pesticides cannot be extracted within 72 hours of collection, the sample pH must be in the range of 5 to 9. If needed, adjust sample to the specified pH range with sodium hydroxide or sulfuric acid.

3.1.3. Add sodium thiosulfate if residual chlorine is present.

3.2. Place samples on **wet** ice within 15 minutes of sample collection. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Put the sample bottle in an untreated plastic sample bag and place on wet ice immediately.

4.3. Complete the field notes.

4.4. Make notes on the lab transmittal form and the field records about any sample that appears highly contaminated or exhibits other abnormal characteristics (i.e., foaming, odor, etc.).

FS 2004. Volatile Organics

1. SAMPLE CONTAINERS

1.1. Use a glass sample vial that is sealed with a Teflon-coated septum.

1.2. Collect **at least two** vials of each sample. Some laboratories may require three or more vials, therefore verify the laboratory's policy on the number of vials they require unless the laboratory provides the sampling kit.

1.3. Inspect the vials for glass or septum defects (e.g., rim must not have nicks or visible depressions and the septum must not be deformed). Do not use if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Special precautions for petroleum sources:

2.1.1. If possible, transport and store fuels in a separate vehicle from empty vials and collected samples. If vials and collected samples must be transported in the same vehicle as fuel, store the fuels as far away from the vials as possible.

2.1.2. Place all fuel or exhaust sources downwind of the sampling location.

2.1.3. Position all petroleum-fueled engines (including the vehicle) downwind of the sampling operations.

2.2. Do not allow the sampling equipment or hands to touch the rim of the sample container.

2.3. **DO NOT PRERINSE VOC VIALS.**

2.4. Do not aerate the sample during sample collection.

2.5. If preservation is required, proceed to section 3 below unless the laboratory supplied vials with premeasured quantities of acid, and the sample does not need to be dechlorinated (3.2 below).

2.5.1. If no preservation is required, or if the vials are prepreserved (see 2.5 above), slowly and carefully allow the sample to flow down the **side** of the vial to minimize turbulence. Fill the vial until the surface tension holds the water in a "convex meniscus."

2.5.2. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

2.5.3. If using a bailer, the bailer must be equipped with a controlled flow bottom assembly.

3. PRESERVATION

3.1. Preserve the sample **during** the sample collection process.

3.2. Dechlorination: Some treated water samples (drinking water and treated wastewater) may contain residual chlorine that must be removed with a declorination agent such as sodium thiosulfate or ascorbic acid. This process must occur **before** any additional preservatives (i.e., acid) are added. The dechlorination agent must be **in the vial** before the sample is added.

3.2.1. Laboratories may supply vials with premeasured quantities of declorination agent. If acid preservation **is not required**, fill the vials (see section 2.5.1 above) and proceed to section 4 below.

3.2.2. For chlorinated drinking water samples, add 3 mg sodium thiosulfate per 40 mL vial.

3.2.3. If the chlorine level is unknown, the concentration must be measured (see FT 2000). For sources other than drinking water (e.g., chlorinated effluent), 10 mg sodium thiosulfate per 40 mL vial will remove up to 5 ppm Cl_2.

3.3. Acid Preservation

3.3.1. Chlorinated Samples

3.3.1.1. If acid preservation is required, carefully fill the vial with sample, but not to a convex meniscus as described in section 2.5.1 above.

3.3.1.2. Add four drops of concentrated HCl (more acid may be needed if the sample is known to contain high levels of bicarbonate or is otherwise buffered).

3.3.1.3. Add additional sample to create a convex meniscus.

NOTE: If the sample reacts with the acid by generating gas, do not submit preserved samples for analysis. Instead, collect unpreserved samples (seven-day holding time must be met).

3.3.2. Unchlorinated Samples

3.3.2.1. The laboratory may supply vials with premeasured quantities of acid. In this case, proceed to section 2.5.1 above. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

3.3.2.2. If the samples are preserved in the field, follow the procedure in section 3.3 above.

4. CAPPING THE VIAL

4.1. Fill the vial so that the sample surface is above the container rim (convex meniscus).

4.2. **Immediately** cap the vial with the Teflon seal contacting the sample. Some sample may overflow while tightening the cap.

4.3. If acid has been added to the sample, tip the vial gently two or three times to distribute the preservative.

4.4. Turn the vial over and tap it to check for the presence of bubbles.

4.4.1. If bubbles are present, and the total volume of the bubbles is less than 5 mm in diameter, the sample may be submitted.

4.4.2. If the total volume of the bubbles is greater than 5 mm in diameter, discard the vial and fill a new one.

4.4.3. **Do not open a vial to add additional sample.**

5. SAMPLE PACKING

5.1. Label each vial with an appropriate field ID number and preservation (e.g., preserved with acid, sodium thiosulfate/acid, etc.).

5.2. Wrap each vial in a protective material (e.g., bubble wrap).

5.3. Place the set of vials in a small, sealable, untreated plastic bag unless the laboratory supplies an alternate method of packing.

5.4. Place samples on **wet** ice within 15 minutes of sample collection. Do not freeze. If samples are cooled to at least 4°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

5.5. Protect samples from environmental contamination during storage and transport to the laboratory.

5.6. As an added measure, FDEP recommends wrapping the set of replicate samples in bubble wrap and sealing them in a container. This procedure will add further protection from potential contamination.

6. DOCUMENTATION

6.1. Label all the vials.

6.2. Complete field records.

6.3. Make note in the field records of any samples that appear highly contaminated or appear to effervesce when acid is added.

FS 2005. Bacteriological Sampling

1. SAMPLE CONTAINERS

1.1. Collect the samples in properly sterilized containers.

1.1.1. Presterilized Whirl-pak bags (or equivalent) are generally used.

1.1.2. If Whirl-pak bags are not used, the sample container must have a volume of at least 125 mL.

1.1.3. If using bottles, the caps must be sterilized. If the caps are lined, there must be documentation to show that the liner does not produce toxic compounds when sterilized.

1.3. Bottles and caps must be sterilized according to procedures in FC 1220 or purchased presterilized from a commercial vendor.

2. SAMPLE COLLECTION PROCEDURES

2.1. Unless a composite is specified by permit, all samples must be grab samples.

2.2. Do not open the container once it has been sealed.

2.3. Do not rinse sample container before collecting the sample.

2.4. Use aseptic techniques to collect the sample:

2.4.1. If an intermediate container is used, thoroughly rinse the container with the sample water. FDEP recommends that microbiological samples be the last samples collected with the sampling device.

2.4.2. Do not put fingers into the mouth of the container or on the interior of the cap.

2.4.3. Do not disinfect the sample equipment or sampling port with alcohol or flame unless directed by the program. If alcohol is used, the port must be completely dried and rinsed thoroughly with sample water before collecting the sample.

2.5. Rinse the sampling equipment with sample water before collecting the sample. Therefore, collect microbiological samples at the end of a sampling sequence.

2.6. Wells with In-Place Plumbing, Spigots and/or Faucets

2.6.1. Turn on spigots and flush at maximum velocity (see FS 2301, section 3.3).

2.6.2. After flushing, reduce the water flow to approximately 500 mL/min and allow the water to flow for a few minutes before collecting samples.

2.6.3. **Do not stop the flow before or during the filling process.**

2.7. Surface Water Sample Collection

2.7.1. Hold a rigid container near the base and plunge neck downward, below the surface. Turn container until the neck points slightly upward with the mouth directed toward the current. Fill to within about 1/2 inch of the top and cap immediately.

2.7.2. Whirl-pak bags (or equivalent)

2.7.2.1. Open the bag by zipping off the top and pulling the white tabs to open the bag. Hold the bag behind the wire ties, attach to a long handle and plunge neck downward and up in one sweeping arc; or

2.7.2.2. Zip off the top of the bag. Hold bag so that the mouth and wire ties are in front of the hands and fingers. Immerse the bag, and open the bag into the current.

2.7.2.3. Bring the bag to the surface, and press out excess water.

2.7.2.4. Seal the bag by folding the open ends at least three times and securely twisting the wire ties.

2.7.3. When using an intermediate sampling device (bailer, DO dunker, niskin bottle, etc.), obtain sufficient sample in the sample collection device to completely fill the sample container. Begin pouring sample out of the device BEFORE collecting into the container. Continue to pour sample out of the device, place container under flowing stream, and fill. **Do not stop the flow before or during the filling process.**

3. PRESERVATION

3.1. Preserve samples according to Tables FS 1000-4 through FS 1000-8.

3.2. Place all samples on wet ice immediately after sample collection.

3.3. If the water contains residual chlorine, add a dechlorinating agent such as sodium thiosulfate to the sample container.

3.3.1. The final concentration of sodium thiosulfate must be approximately 100 milligrams per liter (mg/L) in the sample (add 0.1 mL of a 10% solution of thiosulfate to a 125 mL sample).

4. HOLDING TIME

4.1. The holding time for microbiological samples is very short. Let the laboratory know the approximate time that samples will be collected and when they are expected to be delivered to the laboratory.

4.2. The holding time begins at the time (hours and minutes) the sample is collected.

4.3. For non-potable sources, the sample analysis (preparation) must begin within six hours of sample collection.

5. DOCUMENTATION

5.1. Label each sample container with an appropriate field ID number.

5.2. Place samples on **wet** ice within 15 minutes of sample collection. Samples may not be frozen, and the temperature must not exceed 6°C (except drinking water compliance samples which may be received with temperatures up to 10°C).

5.3. Complete field records.

5.4. Make note in the field records of any unusual sample appearances or sampling conditions.

FS 2006. Oil and Grease (O&G) and Total Recoverable Petroleum Hydrocarbons (TRPHs)

1. SAMPLE CONTAINERS

1.1. Collect samples for O&G and TRPHs in 1-liter wide mouth amber glass bottles.

1.2. The cap must have a Teflon liner.

1.3. Visually inspect glass bottles and caps for defects. Do not use if defects are present or containers do not appear clean.

2. SELECTION OF SAMPLING POINTS

2.1. Oil and grease may be present in wastewater as a surface film, an emulsion, a solution, or as a combination of these forms. Since it is very difficult to collect a representative ambient sample for oil and grease analysis, the sampler must carefully evaluate the location of the sampling point.

2.1.1. Select a point of greatest mixing.

2.1.2. For compliance samples at a facility, collect samples from a point that best represents oil and grease concentrations.

3. SAMPLE COLLECTION PROCEDURES

3.1. All samples must be grab samples.

3.1.1. If composite data are required, collect individual grab samples over the specified time period.

3.1.2. Submit all samples for analysis.

3.1.3. Average the concentrations of the results to determine the average concentration over time.

3.2. Do not collect the sample by skimming the surface.

3.3. Collect a discrete sample that will be used for analysis. This sample may not be used for any other test.

3.4. Remove the cap from the glass bottle without touching the interior of the container or lid.

3.5. Do not rinse the sampling device or the sample container with sample water.

3.6. Collect the sample directly into the container.

3.6.1. If intermediate sampling equipment is needed, do not allow the sampling equipment to touch the rim of the sample container.

3.6.2. Do not use automatic samplers to collect these types of samples.

3.6.3. Fill the bottle with the sample water to almost full capacity.

3.6.4. Add preservatives (see section 4 below).

3.6.5. Quickly cap the container and tighten securely.

4. PRESERVATION

4.1. Preserve the sample within 15 minutes of sample collection.

4.2. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

4.3. Preserve the sample by adding an accurately measured amount of sulfuric or hydrochloric acid to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

4.3.1. Tightly cap the sample container and shake to distribute the acid.

4.3.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

4.3.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 4.3.2 above) until the pH has been reduced to below 2 pH units.

4.3.4. Record the total amount of acid that was added to the sample.

4.4. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

4.5. After the sample has been preserved, screw the cap on tightly.

4.6. Immediately place the sample on **wet** ice after preserving with acid. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

5. DOCUMENTATION

5.1. Label each vial with an appropriate field ID number.

5.2. Protect glass container from breakage ("bubble wrap" is recommended).

5.3. Complete field records.

5.4. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2007. Radiological Sampling (Excludes Radon)

1. SAMPLE CONTAINERS

1.1. Use polyethylene, polyvinyl chloride (PVC), or Teflon containers.

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. On unknown sites, survey the area with a beta-gamma survey instrument, such as a Geiger-Müller meter.

2.1.1. If radiation levels are above instrument background, consult a radiation safety specialist to determine appropriate safety procedures.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with a suitable grade of nitric acid (HNO_3).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.5. Preserve the sample by adding an accurately measured volume of concentrated HNO_3 or 1+1 HNO_3 to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.5.1. Tightly cap the sample container and shake to distribute the acid.

3.5.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.5.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 3.5.2 above) until the pH has been reduced to just below 2 pH units.

3.5.4. Record the total amount of acid that was added to the sample.

3.5.5. Cooling to 4°C is not required.

3.6. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.7. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2008. Radon Sampling

Radon is a gas and is easily removed from water sources. Therefore, follow the same precautions and care used to collect volatile organic samples. Minimize contact with air during sample collection. Other sample collection techniques may be appropriate, depending on the analytical technique. Follow the procedures specified in the analytical method if they are different from the protocol outlined below.

1. SAMPLE CONTAINERS

1.1. Use glass sample vials containing a premeasured portion of the scintillation "cocktail."

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

1.3. Collect at least two samples.

2. PRESERVATION: The scintillation cocktail is the only required preservative.

3. SAMPLE COLLECTION PROCEDURES

Obtain specific sample collection instructions from the laboratory that will analyze the samples. These instructions must include proper handling as well as sample size and packing instructions. The following are general instructions for collecting the samples:

3.1. Carefully fill a syringe (usually 10 mL) with sample water so that air bubbles are not pulled in with the sample before, during or after filling.

3.2. Place the tip of the syringe BELOW the scintillation cocktail and slowly dispense the sample BENEATH the cocktail surface.

3.3. Replace the lid and cap tightly.

3.4. Generally, the vial is used in the laboratory analytical instrument and labels or ID numbers on the sides of the containers may interfere with the analysis. Check with the laboratory for proper placement of labels or field ID numbers.

3.5. Ship in an upright position in the shipping containers that have been provided by the laboratory. If none are provided, protect vials from breakage ("bubble wrap" is recommended), segregate replicate samples in separate plastic bags, and ship to the laboratory in an upright position.

4. DOCUMENTATION

4.1. Complete the field notes.

4.2. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2009. Cyanide Sampling

Cyanide is a very reactive and unstable species and is highly toxic. Samples suspected of containing cyanide must be handled very carefully.

1. SAMPLE CONTAINERS

1.1. Use polyethylene or glass sample containers.

1.2. Use properly cleaned containers (see FC 1300).

1.3. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Some pretreatment may be necessary **before** adding the sodium hydroxide preserving agent (see sections 3.2 and 3.3 below).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. Preserve samples with sodium hydroxide to a pH greater than 12.

3.4. Preserve the sample by adding an accurately measured amount of a sodium hydroxide solution or sodium hydroxide pellets to the container. Use a graduated container or pipet to add the solution.

3.4.1. Tightly cap the sample container and shake to distribute the acid.

3.4.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is greater than 12. **Do not put the pH paper directly into the sample container.**

3.4.3. If the pH is less than 12, add additional measured amounts of the preservative and test with narrow range pH paper (see section 3.4.2 above) until the pH has been raised to above 12 pH units.

3.4.4. Record the total amount of preservative that was added to the sample.

3.5. After the sample has been preserved, screw the cap on tightly.

3.6. Immediately put the sample on **wet** ice. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

3.7. Sulfides tend to be a regional problem in Florida and can cause interference with cyanide analyses.

3.7.1. Test all samples for sulfides with test papers or kits. However, these tests may not detect sulfides in low enough concentrations to be useful.

3.7.2. Samples that may or may not contain sulfides must be preserved in one of two ways: (1) samples are tested for sulfides, preserved with NaOH to a pH>12 and sent to the lab for analysis within 24 hours; or (2) samples are tested for sulfides and pretreated as follows:

3.7.2.1. Samples with visible particulates must be filtered. Keep this filter.

3.7.2.2. Test the sample for sulfides (see precautionary note in section 3.7.1 above).

3.7.2.3. Remove sulfide by adding cadmium (or lead) nitrate (or carbonate) powder to the sample (filtrate) to precipitate the sulfides.

3.7.2.4. Test for presence of sulfides. Repeat steps described in sections 3.7.2.2 and 3.7.2.3 above, until the test shows no sulfides are present.

3.7.2.5. Remove the precipitate (sulfides) from the sample by filtration and discard this filter.

3.7.2.6. Reconstitute the sample by adding the solids collected on the original filter (see section 3.7.2.1 above) back to the filtrate.

3.7.2.7. Add NaOH until the sample pH is greater than 12 (see section 3.3 above) and cool to 4°C on wet ice.

3.7.2.8. Maximum holding time is now 14 days.

3.8. All samples known to contain oxidizing agents (chlorine) must first be tested as follows:

3.8.1. Test sample with KI-starch paper.

3.8.2. Add a few crystals of ascorbic acid, mix sample and retest.

3.8.3. Continue to add ascorbic acid until the test is negative.

3.8.4. Add an additional 0.6 grams of ascorbic acid per liter of sample to remove chlorine.

3.9. Preserve at least one of the equipment blanks with all the reagents and the **greatest** amount of sodium hydroxide that was required in the sample set and note the amount in field documentation.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1. Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. Use of alternative, FDEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2. The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3. Use the following FDEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement

1.4. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

1.4.1. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

1.4.2. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells.

1.4.3. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

FS 2201. Equipment and Supplies

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents and preservatives may be necessary.

1. PUMPS: All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface.

1.1. Above-Ground Pumps

1.1.1. Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

1.1.1.1. A variable speed peristaltic pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.1.1.2. Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

1.1.2. Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. **Do not use** this type of pump to collect groundwater samples.

1.1.2.1. When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

1.1.2.2. See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

1.2. Submersible Pumps

1.2.1. Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

1.2.1.1. A variable speed submersible pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.2.1.2. Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

1.2.1.3. Install a check valve at the output side of the pump to prevent backflow.

1.2.1.4. If purging **and** sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

1.2.2. Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

1.2.2.1. A variable speed bladder pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.2.2.2. The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

1.2.2.3. The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

1.2.2.4. If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP.
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.

1.2.2.5. Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

2. BAILERS:

2.1. Purging: FDEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by an FDEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager. If a bailer is used, follow FS 2213, section 4 with no deviations.

2.2. Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

2.3. Construction and Type:

2.3.1. Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.3.1.1. Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

2.3.2. Use disposable bailers when sampling grossly contaminated sample sources.

2.3.3. FDEP recommends using dual check valve bailers when collecting samples.

2.3.4. Use bailers with a controlled flow bottom when collecting volatile organic samples.

2.3.5. Use bailers that can be pressurized when collecting filtered samples for metals.

2.4. Contamination Prevention:

2.4.1. Keep the bailer wrapped (foil, butcher paper, etc.) until just before use.

2.4.2. Use protective gloves to handle the bailer once it is removed from its wrapping.

2.4.3. Handle the bailer by the lanyard to minimize contact with the bailer surface.

3. LANYARDS

3.1. Lanyards must be made of non-reactive, non-leachable material. They may be cotton twine, nylon, stainless steel, or may be coated with Teflon, Polyethylene or PP.

3.2. Discard cotton twine, nylon, and non-stainless steel braided lanyards after sampling each monitoring well.

3.3. Decontaminate stainless steel, coated Teflon, Polyethylene and PP lanyards between monitoring wells (see FC 1003). They do not need to be decontaminated between purging and sampling operations.

FS 2210. GROUNDWATER PURGING

FS 2211. Water Level and Purge Volume Determination

Collect groundwater samples from fresh water from the aquifer. The amount of water that must be purged from a well is determined by the volume of water and/or field parameter stabilization.

1. GENERAL EQUIPMENT CONSIDERATIONS

1.1. Selection of appropriate purging equipment depends on the analytes of interest, the well diameter, transmissivity of the aquifer, the depth to groundwater and other site conditions.

1.2. Use a pump to purge the well unless no other equipment can be used or there is non-aqueous phase liquid in the well or non-aqueous phase liquid is suspected to be in the well.

1.2.1. FDEP does not recommend using bailers because improper bailing:

- Introduces atmospheric oxygen which may precipitate metals (i.e., iron) or cause other changes in the chemistry of the water in the sample (i.e., pH)
- Agitates groundwater which may bias volatile and semi-volatile organic analyses due to volatilization
- Agitates the water in the aquifer and resuspends fine particulate matter
- Surges the well loosening particulate matter in the annular space around the well screen
- May introduce dirt into the water column if the sides of the casing wall are scraped

1.2.2. Bailers may be used if approved by an FDEP program, or if bailer use is specified in a permit, contract or FDEP order (see Table FS 2200-3). If used, bailers must be of appropriate type and construction, and the user must follow the procedure outlined in 2213, section 4 with no deviations. If in doubt about the appropriateness of

using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

2. INITIAL INSPECTION

2.1. Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well.

2.2. Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.3. It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.4. Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1. Decontaminate all equipment before use.

3.2. Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing.

3.3. Record the measurement.

3.4. Electronic Probe

3.4.1. Decontaminate all equipment before use.

3.4.1.1. Follow the manufacturer's instructions for use.

3.4.1.2. Record the measurement.

3.5. Chalked Line Method

3.5.1. Decontaminate all equipment before use.

3.5.2. Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.5.3. Record the length of the tape relative to the reference point (see section 3.2 above).

3.5.4. Remove the tape and note the length of the wetted portion.

3.5.5. Record the length.

3.5.6. Determine the depth to water by subtracting the length of the wetted portion (section 3.5.4 above) from the total length (section 3.5.3 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1. Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.2. The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1. Calculate the total volume of water in gallons in the well using the following equation:

V = (0.041)d x d x h

Where: V = volume in gallons
d = well diameter in inches
h = height of the water column in feet

5.2. The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

V = [Gallons per Foot of Water] x h

Where: V = volume in gallons
h = height of the water column in feet

Casing Internal Diameter	Approximate Gallons per Foot of Water
0.75"	0.02
1"	0.04
1.25"	0.06
2"	0.16
3"	0.37
4"	0.65
5"	1.02
6"	1.47
12"	5.88

5.3. Record all measurements and calculations in the field records.

6. PURGING EQUIPMENT VOLUME

6.1. Calculate the total volume of the pump, associated tubing and flow cell, if used, using the following equation:

V = p + ((0.041)d x d x l) + fc

Where: V = volume in gallons
p = volume of pump in gallons
d = tubing diameter in inches
l = length of tubing in feet
fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24 hour time interval unless a shorter time period is required by a FDEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

FS 2212. Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. Equipment selection must comply with construction and configuration requirements specified in Table FS 2200-1 and the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Therefore, you must measure the volume during the purging operation.

1.1. Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2. Estimate the volume based on pumping rate. This technique may be used only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1. Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2. Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5 or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3. Make new measurements (section 1.2.1 above) each time the pumping rate is changed.

1.3. Use a totalizing flow meter.

1.3.1. Record the reading on the totalizer prior to purging.

1.3.2. Record the reading on the totalizer at the end of purging.

1.3.3. Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4. Record in the field records the times that purging begins and ends.

2. PURGING MEASUREMENT FREQUENCY

2.1. When purging a well that has the well screen fully submerged and the pump or intake tubing is placed within the well casing above the well screen or open hole, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.2. When purging a well that has the pump or intake tubing placed within a fully submerged well screen or open hole, purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow cell (if used) prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3)

minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow cell, if used, prior to collecting a sample.

2.3. When purging a well that has a partially submerged well screen, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3) minutes apart.

3. PURGING COMPLETION: Purging is considered complete if any one of the following three (3) criteria are satisfied:

3.1. Three (3) consecutive measurements in which the three (3) parameters listed below are within the stated limits, Dissolved Oxygen is no greater than 20 percent of saturation at the field measured temperature, and Turbidity is no greater than 20 Nephelometric Turbidity Units (NTUs).

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading

Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.2. If it is impossible to get Dissolved Oxygen at or below 20 percent of saturation at the field measured temperature, or Turbidity at or below 20 NTUs, then three (3) consecutive measurements of Temperature, pH, Specific Conductance and the parameter(s) Dissolved Oxygen and/or Turbidity that does not meet the requirements in section 3.1 above must be within the limits listed below:

- Temperature: + 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ± 0.2 mg/L or 10%, whichever is greater
- Turbidity: ± 5 NTUs or 10%, whichever is greater

Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.

- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the Turbidity to be high and any procedures that will be used to minimize Turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.3. If after five (5) well volumes, three (3) consecutive measurements of the field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen, and Turbidity are not within the limits stated in section 3.2 above, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. It is at the discretion of the project leader whether or not to collect a sample or to continue purging.

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the FDEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the FDEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.4. One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.4.1. If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

3.4.1.1. Place the pump or tubing intake within the well screened interval.

3.4.1.2. Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.

3.4.1.3. Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

3.4.1.4. Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

3.4.1.5. Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).

3.4.1.6. Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222)..

4. Collect samples immediately after purging is complete. The time period between completing the purge and sampling cannot exceed six (6) hours. If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample. If the measured values are not within 10 percent of the previous measurements, re-purge the well. The exception is "dry" wells (see section 3.4 above).

5. LANYARDS

5.1. Securely fasten lanyards, if used, to any downhole equipment (bailers, pumps, etc.).

5.2. See FS 2201, section 3 for acceptable lanyard types and use.

5.3. Use bailer lanyards in such a way that they do not touch the ground surface.

FS 2213. Wells Without Plumbing

1. TUBING/PUMP PLACEMENT

1.1. If you are attempting to minimize the volume of purge water, the pump will be used for both purging and sampling, the well screen interval is less than or equal to 10 feet, and the well screen is fully submerged, position the intake hose or pump at the midpoint of the screened or open hole interval.

1.2. If monitoring well conditions do not allow minimizing of the purge water volume (see 1.1 above) or you intend to collect samples with equipment different than that used to purge, position the pump or intake hose near the top of the water column. This will ensure that all stagnant water in the casing is removed.

1.3. If the well screen or borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump midway between the measured water level and the bottom of the screen. Otherwise position the pump as described in 1.2 above.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1. Variable Speed Peristaltic Pump

2.1.1. Wear sampling gloves to position the decontaminated pump and tubing.

2.1.2. Attach a short section of tubing to the discharge side of the pump and into a graduated container.

2.1.3. Attach one end of a length of new or precleaned tubing to the pump head flexible hose.

2.1.4. Place the tubing per one of the options in FS 2213, section 1 above.

2.1.5. Change gloves before beginning purging.

2.1.6. Measure the depth to groundwater at frequent intervals.

2.1.7. Record these measurements.

2.1.8. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.1.9. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.1.10. If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.1.11. Record the purging rate each time the rate changes.

2.1.12. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.1.13. Record this measurement.

2.1.14. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2. Variable Speed Centrifugal Pump

2.2.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.2.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.2.3. Place the decontaminated suction hose so that water is always pumped from the top of the water column.

2.2.4. Change gloves before beginning purging.

2.2.5. Equip the suction hose with a foot valve to prevent purge water from re-entering the well.

2.2.6. Measure the depth to groundwater at frequent intervals.

2.2.7. Record these measurements.

2.2.8. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.2.9. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.2.10. If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.2.11. Record the purging rate each time the rate changes.

2.2.12. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.2.13. Record this measurement.

2.2.14. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3. Variable Speed Electric Submersible Pump

2.3.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.3.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.3.3. Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.

2.3.4. Change gloves before beginning purging.

2.3.5. Measure the depth to groundwater at frequent intervals.

2.3.6. Record these measurements.

2.3.7. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.3.8. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.3.9. If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.3.10. Record the purging rate each time the rate changes.

2.3.11. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.3.12. Record this measurement.

2.3.13. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4. Variable Speed Bladder Pump

2.4.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.4.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.4.3. Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.

2.4.4. Change gloves before beginning purging.

2.4.5. Measure the depth to groundwater at frequent intervals.

2.4.6. Record these measurements.

2.4.7. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.4.8. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.4.9. If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.4.10. Record the purging rate each time the rate changes.

2.4.11. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.12. Record this measurement.

2.4.13. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1. Variable Speed Electric Submersible Pump

3.1.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2. Wear sampling gloves.

3.1.3. Measure the depth to groundwater at frequent intervals.

3.1.4. Record these measurements.

3.1.5. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.6. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.

3.1.7. Record the purging rate each time the rate changes.

3.1.8. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.9. Record this measurement.

3.2. Variable Speed Bladder Pump

3.2.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2. Wear sampling gloves.

3.2.3. Measure the depth to groundwater at frequent intervals.

3.2.4. Record these measurements.

3.2.5. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.6. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.

3.2.7. Record the purging rate each time the rate changes.

3.2.8. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.9. Record this measurement.

4. BAILERS: FDEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by an FDEP program, or specified in a permit, contract or FDEP order (see Table FS 2200-3 and FS 2211, section 1.3.2). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

4.1. Minimize handling the bailer as much as possible.

4.1.1. Wear sampling gloves.

4.1.2. Remove the bailer from its protective wrapping just before use.

4.1.3. Attach a lanyard of appropriate material (see FS 2201, section 3).

4.1.4. Use the lanyard to move and position the bailer.

4.2. Lower and retrieve the bailer slowly and smoothly.

4.2.1. Lower the bailer carefully into the well to a depth approximately a foot above the water column.

4.2.1.1. When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see 4.2.2 below).

4.2.2. Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

4.2.3. Allow time for the bailer to fill with aquifer water as it descends into the water column.

4.2.3.1. Carefully raise the bailer. Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

4.3. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

4.3.1. Record the volume of the bailer.

4.4. Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3 have been satisfied.

4.4.1. Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

FS 2214. Wells With Plumbing (permanently installed pumps or production wells)

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc.

1. Remove all hoses, aerators and filters (if possible).

2. Open the spigot and purge sufficient volume to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3 have been met.

3. Reduce the flow rate to approximately 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples.

FS 2215. Airstrippers and Remedial Treatment Systems

1. Collect influent and effluent samples from air stripping units as described in FS 2214 above.
2. Remove any tubing from the sampling port and flush for one to two minutes.

FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.

2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.

3. EQUIPMENT CONSIDERATIONS

3.1. Some pumps may be used for sampling groundwater. Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps as long as the pump remains in contact with the water in the well at all times.

3.2. Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.

3.3. In order to avoid contaminating the sample or loss of analytes from the sample:

3.3.1. Handle the sampling equipment as little as possible.

3.3.2. Minimize the equipment that is exposed to the sample.

3.4. Dedicated Sampling Equipment

3.4.1. Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

3.4.2. Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).

3.4.3. All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.

3.4.4. Cleaning/Decontamination

3.4.4.1. Clean or make sure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.

3.4.4.2. Clean or make sure any permanently mounted tubing is clean before installation.

3.4.4.3. Change or clean tubing when the pump is withdrawn for servicing.

3.4.4.4. Clean any replaceable or temporary parts as specified in FC 1000.

3.4.4.5. Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.

3.4.4.6. Clean or make sure dedicated bailers are clean before placing them into the well.

3.4.4.7. Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.4.4.8. Suspend dedicated bailers above the water column if they are stored in the well.

FS 2221. Wells Without Plumbing

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC bodied pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if flexible interior-wall Teflon, Polyethylene or PP tubing is used in the pump head, or through a peristaltic pump with a vacuum trap (see Figure FS 2200-1 for specific configuration) is used. Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

1.1. Peristaltic Pump

1.1.1. Volatile Organics:

1.1.1.1. Remove the drop tubing from the inlet side of the pump.

1.1.1.2. Submerse the drop tubing into the water column.

1.1.1.3. Prevent the water in the tubing from flowing back into the well.

1.1.1.4. Remove the drop tubing from the well.

1.1.1.5. Carefully allow the groundwater to gravity drain into the sample vials. Avoid turbulence. Do not aerate the sample.

1.1.1.6. Repeat steps 1.1.1.2 through 1.1.1.5 until enough vials are filled.

Alternatively

1.1.1.7. Use the pump to fill the drop tubing.

1.1.1.8. Quickly remove the tubing from the pump.

1.1.1.9. Prevent the water in the tubing from flowing back into the well.

1.1.1.10. Remove the drop tubing from the well.

1.1.1.11. Carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample.

1.1.1.12. Repeat steps 1.1.1.7 through 1.1.1.11 until enough vials are filled.

Or:

1.1.1.13. Use the pump to fill the drop tubing

1.1.1.14. Withdraw the tubing from the well.

1.1.1.15. Reverse the flow on the peristaltic pumps to deliver the sample into the vials at a slow, steady rate.

1.1.1.16. Repeat steps 1.1.1.13 through 1.1.1.15 until enough vials are filled.

1.1.2. Extractable Organics

1.1.2.1. If the tubing in the pump head is Polyethylene or PP, or is Teflon lined, the samples may be collected through the pump.

1.1.2.2. If the tubing in the pump head is not Polyethylene or PP, or is not Teflon lined, use the pump and vacuum trap method.

- Assemble the components of the pump and trap according to Figure FS 2200-1.
- The sample container should be the trap.
- All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**
- Connect the outflow tubing from the container to the influent side of the peristaltic pump.
- Turn the pump on and reduce the flow rate to a smooth and even flow.
- Discard a small portion of the sample to allow an air space.
- Preserve (if required), label and complete the field notes.

1.1.3. Inorganics

1.1.3.1. Inorganic samples may be collected from the effluent tubing. There are a few restrictions on tubing type (see Table FS 2200-1).

1.1.3.2. If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.3.3. Preserve (if required), label and complete field notes.

1.2. Variable Speed Bladder Pump

1.2.1. If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2. After purging to a smooth even flow, reduce the flow rate.

1.2.3. When sampling for volatile organic compounds, reduce the flow rate to 100-200 mL/minute, if possible.

1.3. Variable Speed Submersible Pump

1.3.1. The housing must be stainless steel.

1.3.2. If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3. After purging to a smooth even flow, reduce the flow rate.

1.3.4. When sampling for volatile organic compounds, reduce the flow rate to 100-200 mL/minute, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 2.2), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

2.1. General Considerations

2.1.1. Minimize handling the bailer as much as possible.

2.1.1.1. Wear sampling gloves.

2.1.1.2. Remove the bailer from its protective wrapping just before use.

2.1.1.3. Attach a lanyard of appropriate material (see FS 2201, section 3).

2.1.1.4. Use the lanyard to move and position the bailers.

2.1.2. Do not allow the bailer or lanyard to touch the ground.

2.1.3. Rinsing

2.1.3.1. If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2. If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3. If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in 2.2, Bailing Technique, below.

2.1.3.4. Discard the water appropriately.

2.1.3.5. **Do not** rinse the bailer if Oil & Grease, TRPHs, etc. (see FS 2006,) are to be collected.

2.2. Bailing Technique

2.2.1. Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2. Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3. Lower the bailer carefully into the well to a depth approximately a foot above the water column.

2.2.3.1. When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see 2.2.3 below).

2.2.4. Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5. Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6. Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1. Carefully raise the bailer (2.2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7. Lower the bailer to approximately the same depth each time.

2.2.8. Collect the sample.

2.2.8.1. Install a device to control the flow from the bottom of the bailer and discard the first few inches of water.

2.2.8.2. Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container.

2.2.8.3. Discard the last few inches of water in the bailer.

2.2.9. Repeat steps 2.2.1 through 2.2.9 for additional samples.

2.2.10. As a final step measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1. Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: FDEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, FDEP believes that these wells may never provide legitimate data as they may have become (permanently) chemically damaged by the product being in contact with the well casing for an extended period of time.

FDEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1. Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1. Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2. Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3. Monitoring Well

3.1.3.1. If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2. Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3. Pour a portion of the product into a glass sample container.

3.1.3.4. This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4° C.

3.1.4. Excavation

3.1.4.1. If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2. Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3. Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4. If sufficient water is available, a bailer can be used.

3.1.4.5. Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6. Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7. Follow all applicable OSHA regulations.

3.1.5. Equipment that is dedicated to sampling non-aqueous phase liquid does not need to be cleaned according to the standard, full decontamination protocols. Acrylic or PVC bailers that are never used for trace contaminant sampling may be cleaned as listed below. It is recommended that all cleaning be done in the lab, office or base of operations and not in the field.

3.1.5.1. Disassemble bailers and intermediate vessels and soak in hot, sudsy tap water using a brush to clean away all particulates and greasy films.

3.1.5.2. Rinse with hot tap water.

3.1.5.3. Thoroughly rinse with analyte free water.

3.1.5.4. An optional acid rinse may be used to strip the equipment of any hard to clean residues.

3.1.5.5. The solvent rinse is not mandatory since this equipment is not used for contaminant sampling, other than the product itself. It is not recommended on clear acrylic.

3.2. Sampling Below Product

3.2.1. This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of FDEP or its designee.

3.2.2. These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3. There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4. These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5. Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6. Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1. Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2. Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3. Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

FS 2222. Sampling Low Permeability Aquifers or Wells that have Purged Dry

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4.1. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collected samples as soon as sufficient sample water is available.

2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.

3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

FS 2223. Wells With In-Place Plumbing

If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. Collect the samples directly into the appropriate containers.

FS 2224. Airstripper and Remedial Treatment System Sampling

Reduce the flow rate to less than 500 mL/minute and begin sample collection. Collect the samples directly into the appropriate containers.

FS 2225. Filtering Groundwater Samples

1. FILTERING GROUNDWATER FOR METALS: Filtered groundwater samples can only be collected after approval from the FDEP program or project manager. If filtering is approved, the FDEP program or permit may require both filtered and unfiltered samples to be collected and reported. Unless specified by the program, use a 1 micrometer (µm) filter.

1.1. Use a disposable, high capacity, 1 µm in-line filter.

1.1.1. Flush the filter with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

or

1.1.2. Insert the filter on the high pressure side (i.e., on the delivery side) of the pump. Hold the filter upright with the inlet and outlet vertical. Pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.2. Use a variable speed pump that can be fitted with an in-line filter on the outlet end. Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep; bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.2.1. Install new or precleaned silastic tubing in the variable speed peristaltic pump head at each monitoring well.

1.2.2. Use new or precleaned delivery tubing at each monitoring well.

1.3. Collect filtered samples by either of the methods outlined below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump of appropriate configuration is not available. Do not agitate the sample or expose it to atmospheric oxygen. **Do not** pour the sample into any intermediate vessel for subsequent filtration.

1.3.1. Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

or

1.3.2. Collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.4. **Do not** use the following equipment for filtering groundwater samples for metals:

1.4.1. Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.4.2. Any type of syringe or barrel filtration apparatus.

1.4.3. Any filter that is not encased in a one-piece, molded unit.

FS 2230. REFERENCES

1. Florida Department of Environmental Protection, DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities, DEP QA-001/92, September 1992.

2. U.S. Environmental Protection Agency, Region 4, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996.

Appendix FS 2200
Tables, Figures and Forms

Table FS 2200–1	Equipment for Collecting Groundwater Samples
Table FS 2200-2	Dissolved Oxygen Saturation
Table FS 2200-3	Allowable Uses for Bailers
Figure FS 2200-1	Pump and Trap for Extractable Organics
Form FD 9000-24	Groundwater Sampling Log

Table FS 2200-1
Equipment for Collecting Groundwater Samples

Activity	Equipment Type
Well Purging	Variable speed centrifugal pump Variable speed submersible pump Variable speed bladder pump Variable speed peristaltic pump Bailer with lanyard: **Not Recommended**
Well Stabilization	pH meter DO meter Conductivity meter Thermometer/Thermistor Turbidimeter Flow-through cell Multi-function meters
Sample Collection	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Bailer with lanyard (See Table FS 2200-3)
Filtration	Variable speed peristaltic pump Variable speed submersible pump Variable speed bladder pump Pressurized bailer 1.0 µm high capacity molded filter
Groundwater Level	Electronic sensor Chalked tape

Table FS 2200-2
Dissolved Oxygen Saturation

TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L	TEMP	D.O.	mg/L
deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%	deg C	SAT.	20%
15.0	10.084	2.017	19.0	9.276	1.855	23.0	8.578	1.716	27.0	7.968	1.594
15.1	10.062	2.012	19.1	9.258	1.852	23.1	8.562	1.712	27.1	7.954	1.591
15.2	10.040	2.008	19.2	9.239	1.848	23.2	8.546	1.709	27.2	7.940	1.588
15.3	10.019	2.004	19.3	9.220	1.844	23.3	8.530	1.706	27.3	7.926	1.585
15.4	9.997	1.999	19.4	9.202	1.840	23.4	8.514	1.703	27.4	7.912	1.582
15.5	9.976	1.995	19.5	9.184	1.837	23.5	8.498	1.700	27.5	7.898	1.580
15.6	9.955	1.991	19.6	9.165	1.833	23.6	8.482	1.696	27.6	7.884	1.577
15.7	9.934	1.987	19.7	9.147	1.829	23.7	8.466	1.693	27.7	7.870	1.574
15.8	9.912	1.982	19.8	9.129	1.826	23.8	8.450	1.690	27.8	7.856	1.571
15.9	9.891	1.978	19.9	9.111	1.822	23.9	8.434	1.687	27.9	7.842	1.568
16.0	9.870	1.974	20.0	9.092	1.818	24.0	8.418	1.684	28.0	7.828	1.566
16.1	9.849	1.970	20.1	9.074	1.815	24.1	8.403	1.681	28.1	7.814	1.563
16.2	9.829	1.966	20.2	9.056	1.811	24.2	8.387	1.677	28.2	7.800	1.560
16.3	9.808	1.962	20.3	9.039	1.808	24.3	8.371	1.674	28.3	7.786	1.557
16.4	9.787	1.957	20.4	9.021	1.804	24.4	8.356	1.671	28.4	7.773	1.555
16.5	9.767	1.953	20.5	9.003	1.801	24.5	8.340	1.668	28.5	7.759	1.552
16.6	9.746	1.949	20.6	8.985	1.797	24.6	8.325	1.665	28.6	7.745	1.549
16.7	9.726	1.945	20.7	8.968	1.794	24.7	8.309	1.662	28.7	7.732	1.546
16.8	9.705	1.941	20.8	8.950	1.790	24.8	8.294	1.659	28.8	7.718	1.544
16.9	9.685	1.937	20.9	8.932	1.786	24.9	8.279	1.656	28.9	7.705	1.541
17.0	9.665	1.933	21.0	8.915	1.783	25.0	8.263	1.653	29.0	7.691	1.538
17.1	9.645	1.929	21.1	8.898	1.780	25.1	8.248	1.650	29.1	7.678	1.536
17.2	9.625	1.925	21.2	8.880	1.776	25.2	8.233	1.647	29.2	7.664	1.533
17.3	9.605	1.921	21.3	8.863	1.773	25.3	8.218	1.644	29.3	7.651	1.530
17.4	9.585	1.917	21.4	8.846	1.769	25.4	8.203	1.641	29.4	7.638	1.528
17.5	9.565	1.913	21.5	8.829	1.766	25.5	8.188	1.638	29.5	7.625	1.525
17.6	9.545	1.909	21.6	8.812	1.762	25.6	8.173	1.635	29.6	7.611	1.522
17.7	9.526	1.905	21.7	8.794	1.759	25.7	8.158	1.632	29.7	7.598	1.520
17.8	9.506	1.901	21.8	8.777	1.755	25.8	8.143	1.629	29.8	7.585	1.517
17.9	9.486	1.897	21.9	8.761	1.752	25.9	8.128	1.626	29.9	7.572	1.514
18.0	9.467	1.893	22.0	8.744	1.749	26.0	8.114	1.623	30.0	7.559	1.512
18.1	9.448	1.890	22.1	8.727	1.745	26.1	8.099	1.620	30.1	7.546	1.509
18.2	9.428	1.886	22.2	8.710	1.742	26.2	8.084	1.617	30.2	7.533	1.507
18.3	9.409	1.882	22.3	8.693	1.739	26.3	8.070	1.614	30.3	7.520	1.504
18.4	9.390	1.878	22.4	8.677	1.735	26.4	8.055	1.611	30.4	7.507	1.501
18.5	9.371	1.874	22.5	8.660	1.732	26.5	8.040	1.608	30.5	7.494	1.499
18.6	9.352	1.870	22.6	8.644	1.729	26.6	8.026	1.605	30.6	7.481	1.496
18.7	9.333	1.867	22.7	8.627	1.725	26.7	8.012	1.602	30.7	7.468	1.494
18.8	9.314	1.863	22.8	8.611	1.722	26.8	7.997	1.599	30.8	7.456	1.491
18.9	9.295	1.859	22.9	8.595	1.719	26.9	7.983	1.597	30.9	7.443	1.489

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

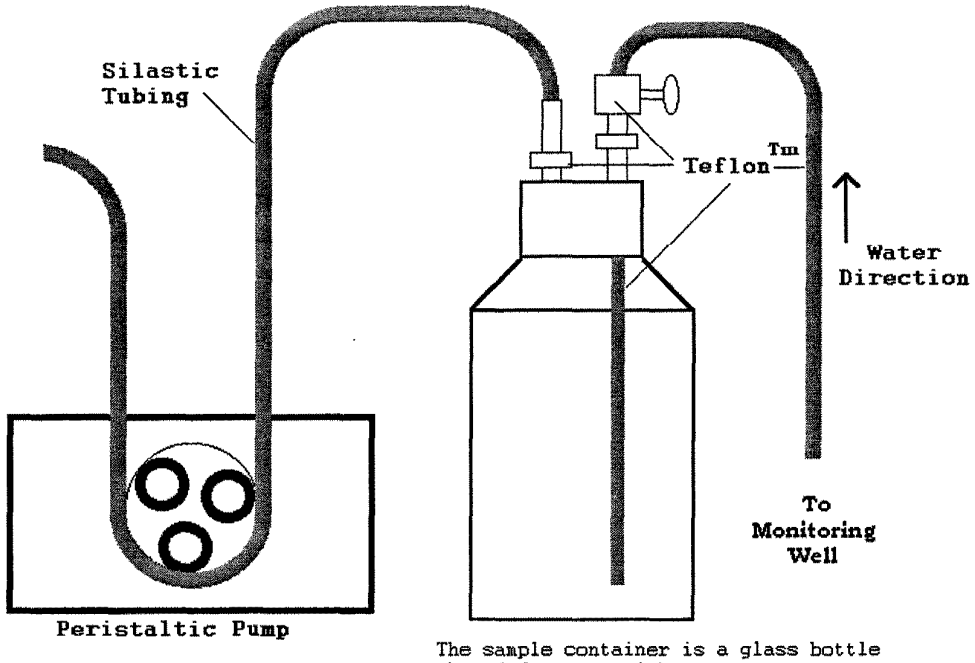
Table FS 2200-3
Allowable Uses for Bailers

ANALYTE GROUP(S)	PURGING (Not Recommended)	SAMPLING	
	Use:	Use:	Not Recommended:
Volatile Organics Extractable Organics Radionuclides, including Radon Metals Volatile Sufides	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If concentrations exceed action levels, the purpose is to monitor effective treatment, and the FDEP program allows the use of bailers; or If specified by FDEP permit, program, contract or order. or If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation.	If concentrations are near or below the stated action levels; or If a critical decision (e.g., clean closure) will be made based on the data; or If data are to demonstrate compliance with a permit or order.
Petroleum Hydrocarbons (TRPH) & Oil & Grease	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices.	Unless allowed by permit, program, contract or order.

Table FS 2200-3
Allowable Uses for Bailers

ANALYTE GROUP(S)	**PURGING** (Not Recommended)	**SAMPLING**	
	Use:	Use:	Not Recommended:
Biologicals Inorganic Non-Metallics Aggregate Organics Microbiological Physical and Aggregate Properties	If allowed by permit, program, contract or order or If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation.	If all analytes collected from the well can be collected with a bailer; or If collected after collecting all analytes that require the use of a pump.	Before collecting any analytes that must be collected with a pump.
Ultra-Trace Metals	Never	Never	

Figure FS 2200-1
Pump and Trap for Extractable Organics



The sample container is a glass bottle threaded to use either a permanent Teflon lined cap or a sampling cap with a Teflon insert similar to the design above.

Florida Department of Environmental Protection
GROUNDWATER SAMPLING LOG

SITE NAME:	SITE LOCATION:	
WELL NO:	SAMPLE ID:	DATE:

PURGING DATA

WELL DIAMETER (in):	TOTAL WELL DEPTH (ft):	STATIC DEPTH TO WATER (ft):	WELL CAPACITY (gal/ft):
1 WELL VOLUME (gal) = (TOTAL WELL DEPTH – DEPTH TO WATER) X WELL CAPACITY =			
= (–) X =			
PURGE METHOD:	PURGE INITIATED AT:	PURGE ENDED AT:	TOTAL VOL. PURGED (gal):

TIME	VOLUME PURGED (gal)	CUMUL. VOLUME PURGED (gal)	PURGE RATE (gpm)	DEPTH TO WATER (ft)	pH	TEMP. (°C)	COND. (µmhos)	DISSOLVED OXYGEN (mg/L)	TURBIDITY (NTUs)	COLOR	ODOR

WELL CAPACITY (Gallons per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION	SAMPLER(S) SIGNATURE(S)	
SAMPLING METHOD(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
FIELD DECONTAMINATION: Y N	FIELD-FILTERED: Y N	DUPLICATE: Y N

SAMPLE CONTAINER SPECIFICATION			SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD
NO.	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOLUME ADDED IN FIELD (mL)	FINAL pH	

REMARKS:

MATERIAL CODES: AG = AMBER GLASS; CG = CLEAR GLASS; PE = POLYETHYLENE; O = OTHER (SPECIFY)

NOTE: The above do not constitute all of the information required by Chapter 62-160, F.A.C.