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LETTER REPORT REGARDING INTERIM MEASURE MONITORING PLAN FOR BIOVENTING AND BIOSLURPING AT SOLID WASTE MANAGEMENT UNITS 6 AND 7 NS MAYPORT FL

6/30/1998

HARDING LAWSON ASSOCIATES

Harding Lawson Associates

June 30, 1998

2504.04

Commanding Officer
Attn: Adrienne Wilson, Code 1852
Southern Division Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston SC 29418

SUBJECT: Interim Measure Monitoring Plan for Bioventing and Bioslurping at Solid Waste Management Units 6 and 7 U.S. Naval Station, Mayport, Florida Contract No. N62467-89-D-0317/028

Dear Adrienne:

This Interim Measure (IM) monitoring plan superceeds the work plan for monitoring the recovery of light nonaqueous phase liquid (LNAPL) at solid waste management units (SWMUs) 6 and 7 (Figures 1 and 2 in Attachment A) that was provided in Appendix D of the *Resource Conservation and Recovery Act (RCRA) Corrective Measure Study for Group II SWMUs, U.S. Naval Station (NAVSTA), Mayport, Florida* (ABB Environmental Services, Inc. [ABB-ES], 1996a). The IM is being conducted under the RCRA Corrective Action Program for NAVSTA Mayport. Because the IM is concerned with the remediation of petroleum-related compounds, this IM monitoring plan was also written to be consistent with the regulatory requirements promulgated under Chapter 62-770, Florida Administrative Code (FAC), Petroleum Contaminated Site Cleanup Criteria, effective September 23, 1997.

This monitoring plan describes methodology for assessing the effectiveness of the recovery of LNAPL during the IM, and will serve as part of the data that are necessary to determine whether or not the IM is successful. The monitoring program also provides a compliance point monitoring program for assessing whether or not recovery of petroleum-related constituents dissolved in groundwater is required, and if a human health and/or ecological risk assessment is necessary.

Introduction. The presence of LNAPL at SWMUs 6 and 7 is documented in the report dated January 1996, entitled *RCRA Facility Investigation (RFI), Group II SWMUs, NAVSTA, Mayport, Florida* (ABB-ES, 1996b). A recommendation for conducting an IM to recover the LNAPL was presented in the RFI report. A correction action objective (CAO) to remove LNAPL in excess of 0.01 foot in the vicinity of SWMUs 6 and 7 was presented in the *Corrective Measure Study Group II SWMUs* (ABB-ES, 1996a).

The IM to remove the LNAPL was initially implemented using five 36-inch-diameter sumps with surface skimming pumps that recovered both groundwater and LNAPL (ABB-ES, 1994 and Bechtel Environmental, Inc. [Bechtel], 1995). This recovery system was replaced with a bioslurping and bioventing system that relies on the physical removal of LNAPL and groundwater, and enhanced biodegradation by the introduction of air, which increases the percentage of oxygen in subsurface soil. The bioslurping and

bioventing system was designed by Battelle (Battelle, 1996, 1997a, 1997b, and 1998), and constructed during November 1997 to January 1998 by Bechtel (Bechtel, 1998). Bechtel is also conducting operation and maintenance (O&M) activities on the bioslurping and bioventing system.

This monitoring program presents four objectives that should be met for the IM to be considered successful, and that will serve as triggers to determine whether or not the recovery of petroleum-related constituents dissolved in groundwater is required, and if a human health and/or ecological risk assessment is necessary.

The four objectives are listed below.

1) The IM must remove LNAPL to a thickness of less than 0.01 foot (ABB-ES, 1996a).

2) The IM must minimize the lateral migration of the LNAPL, thereby preventing the discharge of LNAPL into the St. Johns River.

3) The IM must reduce the concentration of petroleum hydrocarbons and related organic chemicals in the vadose zone such that they do not exceed human health and leachability criteria, if applicable, specified in Chapter 62-770, FAC, Petroleum Contaminated Site Cleanup Criteria (effective September 23, 1997).

4) The IM must remove LNAPL so that it is not a source of dissolved petroleum-related constituents in groundwater that exceed Florida Department of Environmental Protection's (FDEP) groundwater (FDEP, 1994) and surface water (Chapter 62-302, FAC) quality criteria and/or present a threat to human and ecological receptors.

LNAPL thickness, groundwater-level measurements, and chemical analysis of soil and groundwater samples will be evaluated to assess the effectiveness of the IM with respect to the four objectives. Chemical analysis of the soil samples will be used to assess whether or not the bioventing has resulted in bioremediation of total recoverable petroleum hydrocarbons (TRPH) and petroleum-related volatile organic compounds (VOCs) and semivolatile organic compounds. Chemical analysis of groundwater samples will be used to assess whether or not biodegradation is occurring, and the need for conducting a human health and/or ecological risk assessment.

Monitoring should be continued for one year after it has been demonstrated that the IM monitoring objectives have been met. It is recommended that after this monitoring period the successful completion of the IM should be based on the following criteria:

- TRPH and petroleum-related organic compounds detected in subsurface soil samples should be less than human health and leachability criteria, if applicable, specified in Chapter 62-770, FAC, Petroleum Contaminated Site Cleanup Criteria (effective September 23, 1997).

- LNAPL should be demonstrated by product-level measurements to occur at a thickness of less than 0.01 foot in the SWMU 6 and 7 site area.

- Petroleum-related compounds detected in groundwater samples from the SWMU 6 and 7 site area should be less than Florida Groundwater Guidance Concentrations (FDEP, 1994).

- Petroleum-related compounds detected in groundwater samples collected from compliance point monitoring wells located prior to the discharge to the St. Johns River should be less

than Class III surface water quality criteria (Chapter 62-302, FAC). The Florida Groundwater Guidance Concentrations should be used as default values for chemicals that do not have a Class III surface water quality criteria value.

- Human health and/or ecological risk assessments, if conducted, indicate that risks to receptors are within criteria that are acceptable to the U.S. Environmental Protection Agency (USEPA) and FDEP (ie., an excess lifetime cancer risk [ELCR] of 1×0^{-4} to 1×10^{-6} for USEPA, and ELCR of 1×10^{-6} for FDEP, and a hazard quotient of 1 for USEPA and FDEP).

When it can be demonstrated that the above criteria have been met, a rehabilitation completion report should be completed for the IM at SWMUs 6 and 7.

Field activities that are necessary to collect the data of sufficient quality to meet the above objectives include the following:

- conducting LNAPL and water-level measurements at the locations of monitoring wells, extraction wells, and piezometers throughout the SWMU 6 and 7 site area;
- collecting soil samples from the vadose zone in the SWMU 6 and 7 site area; and
- collecting groundwater samples from monitoring wells hydraulically upgradient and downgradient from the SWMU 6 and 7 site area.

Below is a description of the field procedures for LNAPL and water-level measurements, soil and groundwater sampling procedures, and the analytical methods.

Characterization of LNAPL Thickness and Extent. Baseline LNAPL thickness and water table elevation measurements have been obtained and are documented in Battelle's report entitled *Full-Scale Bioslurper System Evaluation* (Battelle, 1998). Battelle recommended in the report that the measurement of LNAPL thickness and water level should be continued on a monthly basis. Because Bechtel (or the Navy's current Remedial Action Contractor [RAC]) is conducting the O&M of the bioslurping and bioventing system, they will make monthly (or more frequently, if required) LNAPL and water-level measurements (performance measurements). The performance measurements are used by the RAC to determine the operating sequence for different parts of the treatment area.

The locations of monitoring wells and piezometers installed during the RFI at NAVSTA Mayport are depicted on Figure 3. Extraction wells installed for the bioslurping and bioventing system and baseline product thickness contours are depicted in Attachment 1 of the Battelle *Full-Scale Bioslurper System Evaluation* (Battelle, 1998).

After the IM recovery system has been in operation for one year, the change in thickness and extent of LNAPL at SWMUs 6 and 7 will be evaluated by comparison of baseline measurements with the performance measurements. This comparison will be used to assess the overall effectiveness of the IM at reducing both the LNAPL thickness to less than 0.01 foot, and the LNAPL horizontal extent.

Water Table Elevation and LNAPL Thickness Measurements. Because groundwater table fluctuations occur during tidal cycles and seasonal changes, which may affect the presence or absence of LNAPL in monitoring wells near the edge of the LNAPL plume, these factors should be considered when conducting measurements for determining the extent of the LNAPL area. The groundwater-level measurement should

be made first in wells or piezometers closest to the St. Johns River, and then in an order of increasing distance from the river.

The depth to LNAPL and groundwater should be made by obtaining direct readings from a measuring tape that has an attached electric oil-water interface probe. The probe should be suspended into a well or piezometer and slowly lowered until either the LNAPL or water is encountered. The measurement should be recorded to a precision of 0.01 foot and referenced to the notch or designated point on the north side of a monitoring and/or extraction well or piezometer. The measuring tape should be properly decontaminated prior to conducting the event and after LNAPL and water-level measurements are made at each well or piezometer (USEPA, 1996).

Water table and LNAPL thickness readings should be documented in a field logbook for monitoring and/or extraction wells and piezometers in the vicinity of SWMUs 6 and 7. Table 1 in Attachment B provides a example of a form to be used when recording the measurements. It is anticipated that each measurement event should occur over one or two days. The water-level and LNAPL data should also be entered into a spreadsheet such as Microsoft Excel. It is anticipated that the NAVY RAC will provide the spreadsheet to Harding Lawson Associates (formerly ABB-ES).

Soil Sampling. Surface and subsurface soil samples are to be collected to demonstrate that the bioslurping and bioventing system successfully remediated the vadose zone soil (Figure 4). It is anticipated that only one sampling event should occur during the last quarter of the final year of groundwater monitoring.

Soil samples can be collected using equipment such as a TerraProbe℠ system or hand augers. The TerraProbe℠ system drives a threaded 1-inch outside diameter (OD) hollow steel rod assembly attached to a threaded 1-inch OD hollow stainless-steel sampler to the desired sampling depth. The hand auger is typically a 3-inch-diameter stainless-steel hand auger bucket attached to a 3-foot-long stainless-steel rod(s) that is manually turned to achieve the desired sampling depth. The sampling equipment should be decontaminated in general accordance with USEPA protocol (USEPA, 1996) prior to and between collecting each sample.

The soil sample depths at the SWMU 7 Sludge Lagoons should consist of intervals from the land surface to a depth of 1 foot and a 1-foot-interval immediately above the groundwater table that exists at the time the sampling activity is conducted. At areas outside of the SWMU 7 Sludge Lagoons, the sampling depth should consist of a 1-foot-interval immediately above the groundwater table that exists at the time the sampling activity is conducted.

The aliquot for analysis of VOCs should be transferred directly from the sampling equipment to a sample container with a Teflon™ lid to reduce the potential for volatilization. The soil remaining in sampler should be transferred to a decontaminated glass or stainless-steel bowl using a stainless-steel spoon. Aliquots of the sample for analysis of polynuclear aromatic hydrocarbons (PAHs) and TRPH should be homogenized and transferred to appropriate sample containers. Samples should be placed in coolers, refrigerated with ice, and sent overnight under chain-of-custody protocol to an off-site laboratory for analysis.

Groundwater Sampling. Groundwater sampling events should be conducted to obtain data to assess whether or not biodegradation is occurring (quarterly event) and the need to conduct human health and ecological risk assessments (biannual event). Groundwater samples should be collected using low-flow purging (typically a rate less than 1 liter per minute) and sampling with a peristaltic pump and disposable Teflon™ tubing dedicated to each well (USEPA, 1996). The Teflon™ tubing should be placed in the middle of the well screen interval. A groundwater sample should not be collected from a well(s) that contains LNAPL.

Prior to groundwater sample collection, the monitoring well should be purged to remove stagnant water in the well casing without causing the suspension of silts and clays. Both purging and sampling should be conducted at a flow rate that results in a turbidity of 10 nephelometric turbidity units (NTUs) or less.

Purging should be considered complete when a minimum of three well volumes of water is removed, and the groundwater parameters (temperature, pH, specific conductance, salinity, dissolved oxygen, oxidation potential, and turbidity) have stabilized (within 10 percent of previous three measurements). This purging process ensures good conductance between the well and the surrounding aquifer matrix.

Groundwater samples should be collected before the material contacts the peristaltic pump and placed in precleaned containers supplied by the analytical laboratory. Sample aliquots should be filled in the order of TRPH first, PAHs second, and then VOCs. VOCs are collected last by slowly pulling the Teflon™ tubing out of the well to minimize agitation of the water in the monitoring well and then carefully transferring the contents of the tube to a VOC vial with a Teflon™ septa cap. The groundwater samples should be placed in a cooler, refrigerated with ice, and sent overnight under chain-of-custody protocol to an off-site laboratory for analysis.

Soil and Groundwater Analytical Methods. The analytical data packages for the quarterly and biannual events should be Naval Energy and Environmental Support Activity Level E (USEPA Level II). The analytical data should not be validated. Quality control samples for each set of 20 samples should consist of a trip blank for VOCs, and an equipment rinsate blank.

The following paragraphs describe the methods to be used for the soil sampling event, and the quarterly and biannual groundwater sampling events.

Soil Sampling Event. The surface and subsurface soil samples should be analyzed for VOCs (USEPA Method 8021B), PAHs (USEPA Method 8100), and TRPH (Florida-Petroleum Organics Residual [FL-PRO] method).

Quarterly Groundwater Sampling Events. Table 2 and Figure 3 illustrate the locations for the quarterly groundwater samples. The quarterly groundwater samples should be analyzed for the following:

- methane (modified USEPA Method 8015),
- carbon dioxide (field measurement, Hach 24437-00),
- nitrate (field measurement, Hach 24608),
- sulfide (field measurement, Hach 22445-00),
- sulfate (field measurement, Hach 24589-00 or 24294-00),
- ferrous iron (field measurement, Hach 25140-25),
- pH (field measurement),
- dissolved oxygen (field measurement), and
- oxidation-reduction potential (field measurement).

Biannual Groundwater Sampling Events. Table 2 and Figure 3 illustrate the locations for collecting the biannual groundwater samples. Groundwater samples should be analyzed for the following:

- VOCs (USEPA Method 8021B),
- PAHs (USEPA Method 8100),
- TRPH (FL-PRO method), and
- the analytes in the quarterly sampling list.

Annual IM Report. A report on the IM should be prepared at the end of each year of system operation. The report should provide a summary of the monthly LNAPL measurements, and the results of the quarterly and biannual sampling events. The report should also assess whether or not the CAO and IM monitoring plan objectives were met.

The final annual IM report should contain the results of the soil sampling event. The soil sample analytical results should be compared to the FDEP residential, industrial, and leaching values promulgated under Chapter 62-770, FAC, Petroleum Contaminated Site Cleanup Criteria, effective September 23, 1997. The remediation of vadose zone soil should be considered successful if the target analytes are detected at concentrations that are less than their respective FDEP residential soil cleanup goals or leaching criteria.

Results and Evaluation of LNAPL Thickness and Water-Level Measurements. The effectiveness of the IM to manage the lateral migration of the LNAPL and removal to a thickness of less than 0.01 foot should be based on the volume of LNAPL recovered over time, and LNAPL thickness. Product thickness maps for each monitoring event should be produced to illustrate variations in LNAPL thickness and areal extent. Potentiometric surface maps should also be produced for each monitoring event to illustrate variations in the groundwater flow direction. The LNAPL and water-level measurements should be converted to elevations relative to the National Geodetic Vertical Datum of 1929, and used to construct thickness maps of the LNAPL and potentiometric maps of the water table zone of the surficial aquifer. It is preferable that the thickness and potentiometric maps be contoured using a program such as SURFER®, as was done by Battelle (Battelle, 1998).

Results and Evaluation of Quarterly Groundwater Sampling Events. The results from the quarterly groundwater sampling events for biodegradation parameters should be summarized in a table and used to evaluate the effectiveness of the IM to enhanced biodegradation and to estimate the volume of petroleum-related compounds remediated (e.g. the dissolved oxygen concentration and a decrease in TRPH concentrations).

Results and Evaluation of Biannual Groundwater Sampling Events. Because groundwater beneath SWMUs 6 and 7 discharges to the St. Johns River, analytical results from the biannual monitoring event(s) should be compared (screened against) to groundwater and surface water quality criteria. Groundwater screening criteria should include background groundwater concentrations (ABB-ES, 1995), Florida Groundwater Guidance Concentrations (FDEP, 1994), and the most recent version of the USEPA Region III Risk-Based Concentrations (USEPA, 1998). Surface water screening criteria should include surface water background concentrations (ABB-ES, 1995), Ambient Water Quality Criteria (USEPA, 1991), and State of Florida Class III marine surface water quality criteria (Chapter 62-302, FAC).

Human health and/or ecological risk assessments may be necessary either during or at the conclusion of the IM. The results of human health and ecological risk assessments along with comparison of the detected chemical concentration to the aforementioned applicable promulgated and guidance criteria should be used to assess whether or not remediation is necessary for hydrocarbon-related compounds dissolved in groundwater.

The need for recovery of dissolved petroleum hydrocarbons in groundwater and/or a human health or ecological risk assessment should be based on the following:

- detection of LNAPL at compliance point monitoring wells MPT-S-MW02S, MPT-2-MW03S, MPT-9-MW02S, and MPT-8-MW17S, located along the St. Johns River, and

- detection of VOC or PAH target analytes at concentrations that exceed the screening concentrations in groundwater samples collected from the compliance point monitoring wells (MPT-S-MW02S, MPT-2-MW03S, MPT-9-MW02S, and MPT-8-MW17S).

The purpose of the monitoring program is to assess the success of the IM and determine whether or not additional evaluations or remedial efforts are necessary. As a result, the monitoring program does not specifically address the type or level of analyses required for conducting human health or ecological risk assessments. Therefore, the IM monitoring results for LNAPL thickness, potentiometric surface, and quarterly and biannual groundwater sampling events should be used, if necessary, to design a sampling and analysis plan that would address the specific data requirements for human health and/or ecological risk assessments.

This may include collecting groundwater samples from a specific monitoring well(s) and conducting the sampling and analysis as described in the *RCRA Facility Investigation Workplan* (ABB-ES, 1991), and the *RCRA Corrective Action Program General Information Report* (ABB-ES, 1995). Specific data for the ecological risk assessment may also include groundwater and/or sediment samples for chemical characterization and toxicity testing using aquatic and/or benthic animals.

If you have any comments or questions concerning this work plan, or should any additional information become available for this site that would affect the scope of work, please contact us.

Yours very truly,

HARDING LAWSON ASSOCIATES

Francis K. Lesesne, P.G.
Technical Lead

Terry Hansen, P.G.
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pmw
MPT-S6&7.IMP

Enclosures

cc: Mr. Randy Bishop, NAVSTA Mayport
Ms. Martha Berry, USEPA
Mr. Jim Cason, FDEP
Ms. Paula Wynn, Bechtel Environmental, Inc.

APPENDIX A

FIGURES

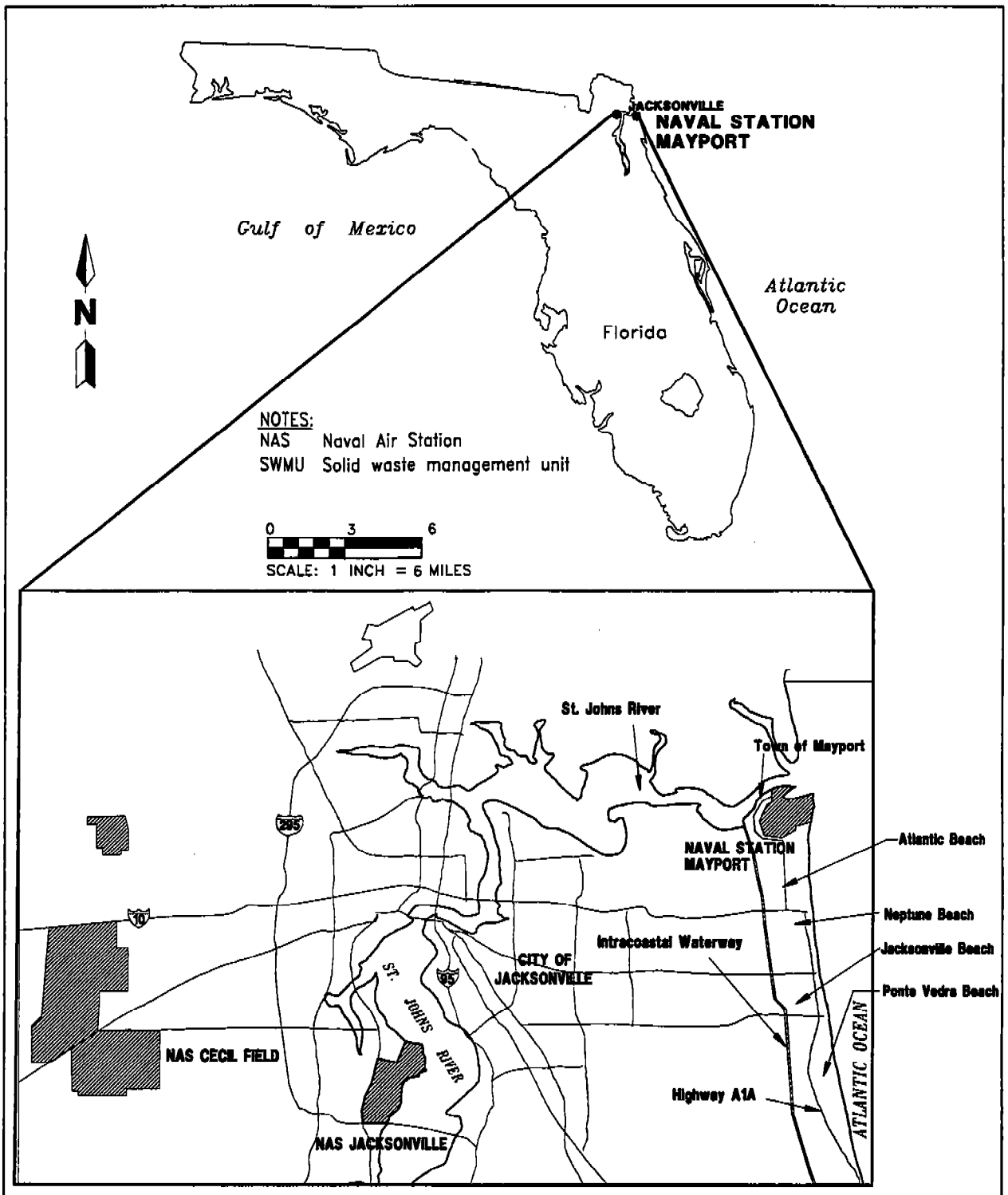
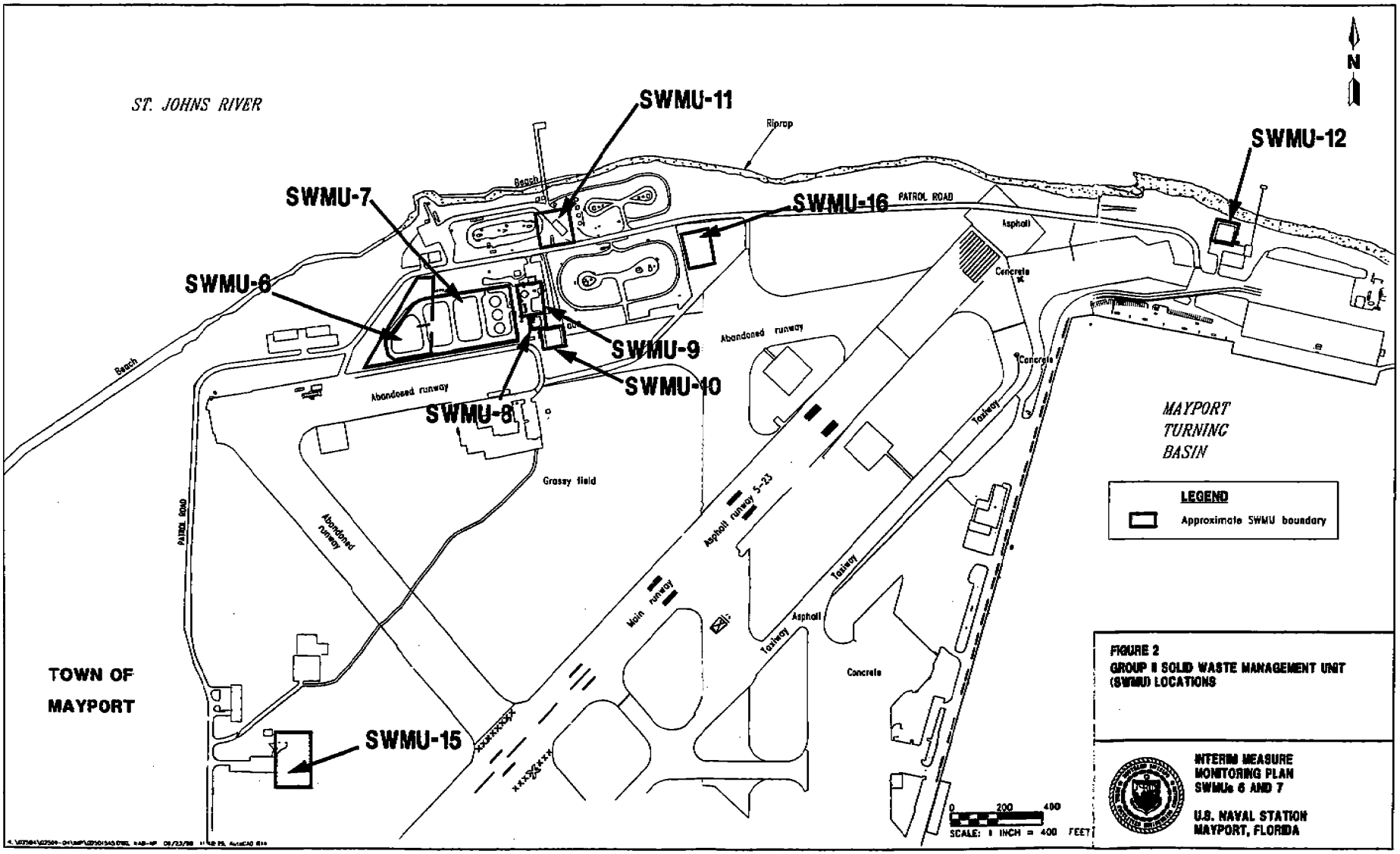


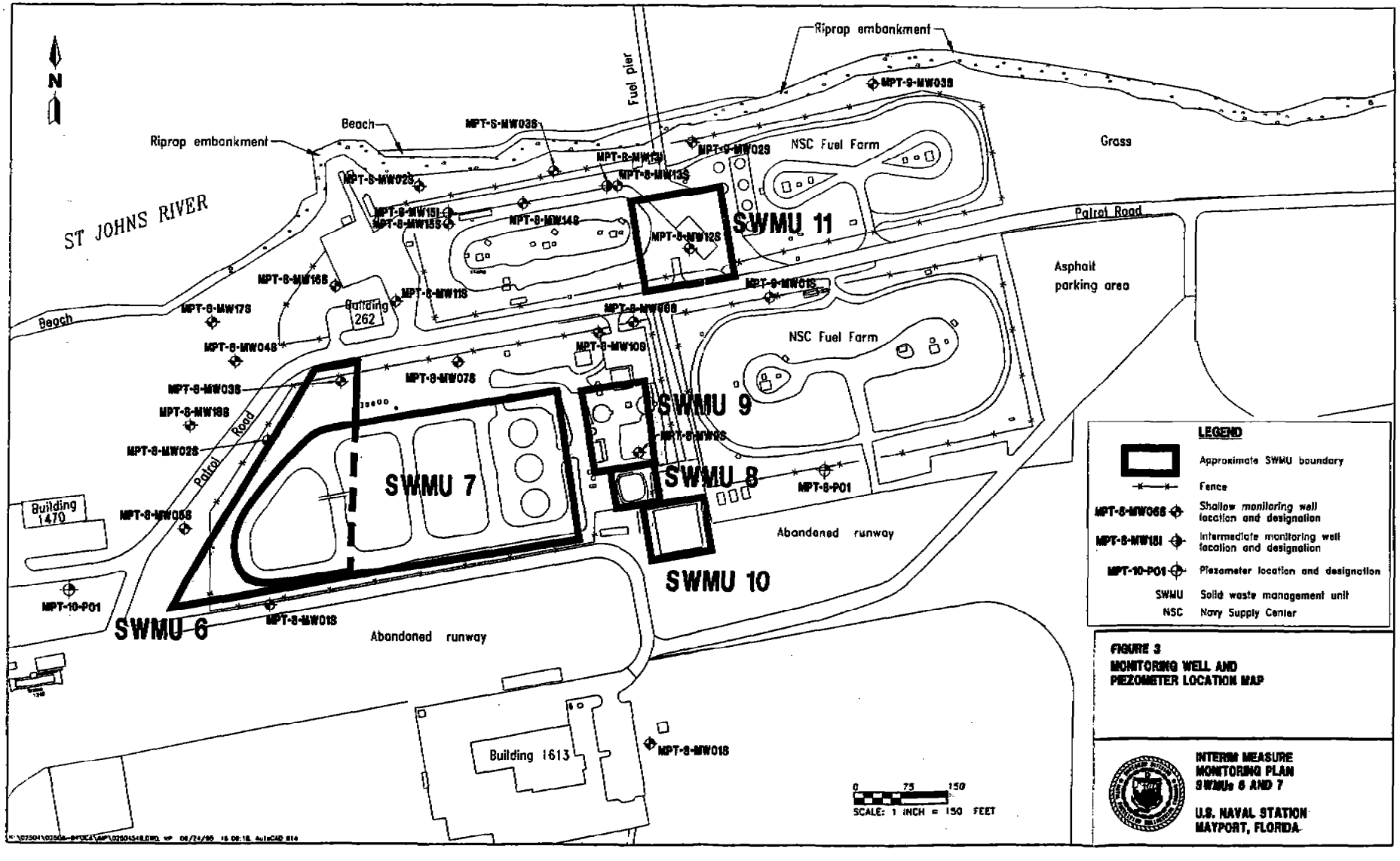
FIGURE 1
FACILITY LOCATION MAP

INTERIM MEASURE MONITORING PLAN
SWMUs 6 AND 7

U.S. NAVAL STATION
MAYPORT, FLORIDA

K:\02504\02504-04\IMP\02504544.DWG, NAB-NP 06/23/98 11:27:12, AutoCAD R14


ST. JOHNS RIVER
SWMU-11
Riprap
SWMU-12
SWMU-7
SWMU-16
PATROL ROAD
Beach
SWMU-6
SWMU-9
SWMU-10
SWMU-8
Abandoned runway
Grassy field
Asphalt runway 5-23
Main runway
Taxiway
Asphalt
Concrete
MAYPORT TURNING BASIN
TOWN OF MAYPORT
SWMU-15
N
LEGEND
Approximate SWMU boundary
0 200 400
SCALE: 1 INCH = 400 FEET
FIGURE 2
GROUP II SOLID WASTE MANAGEMENT UNIT (SWMU) LOCATIONS
INTERIM MEASURE MONITORING PLAN SWMUs 6 AND 7
U.S. NAVAL STATION MAYPORT, FLORIDA


N
Riprap embankment
Beach
Riprap embankment
Fuel pier
Grass
ST JOHNS RIVER
NSC Fuel Farm
SWMU 11
Patrol Road
Asphalt parking area
Building 262
Beach
NSC Fuel Farm
SWMU 9
SWMU 7
SWMU 8
Road
Patrol
Building 1470
Abandoned runway
SWMU 10
SWMU 6
Abandoned runway
Building 1613
MPT-S-MW03S
MPT-S-MW02S
MPT-S-MW15I
MPT-S-MW15S
MPT-S-MW14S
MPT-S-MW12S
MPT-S-MW16S
MPT-S-MW11S
MPT-S-MW17S
MPT-S-MW04S
MPT-S-MW07S
MPT-S-MW10S
MPT-S-MW03S
MPT-S-MW19S
MPT-S-MW02S
MPT-S-MW05S
MPT-S-P01
MPT-10-P01
MPT-S-MW01S
0 75 150
SCALE: 1 INCH = 150 FEET
LEGEND
Approximate SWMU boundary
Fence
MPT-S-MW06S Shallow monitoring well location and designation
MPT-S-MW15I Intermediate monitoring well location and designation
MPT-10-P01 Piezometer location and designation
SWMU Solid waste management unit
NSC Navy Supply Center
FIGURE 3
MONITORING WELL AND PIEZOMETER LOCATION MAP
INTERIM MEASURE MONITORING PLAN SWMUs 6 AND 7
U.S. NAVAL STATION MAYPORT, FLORIDA

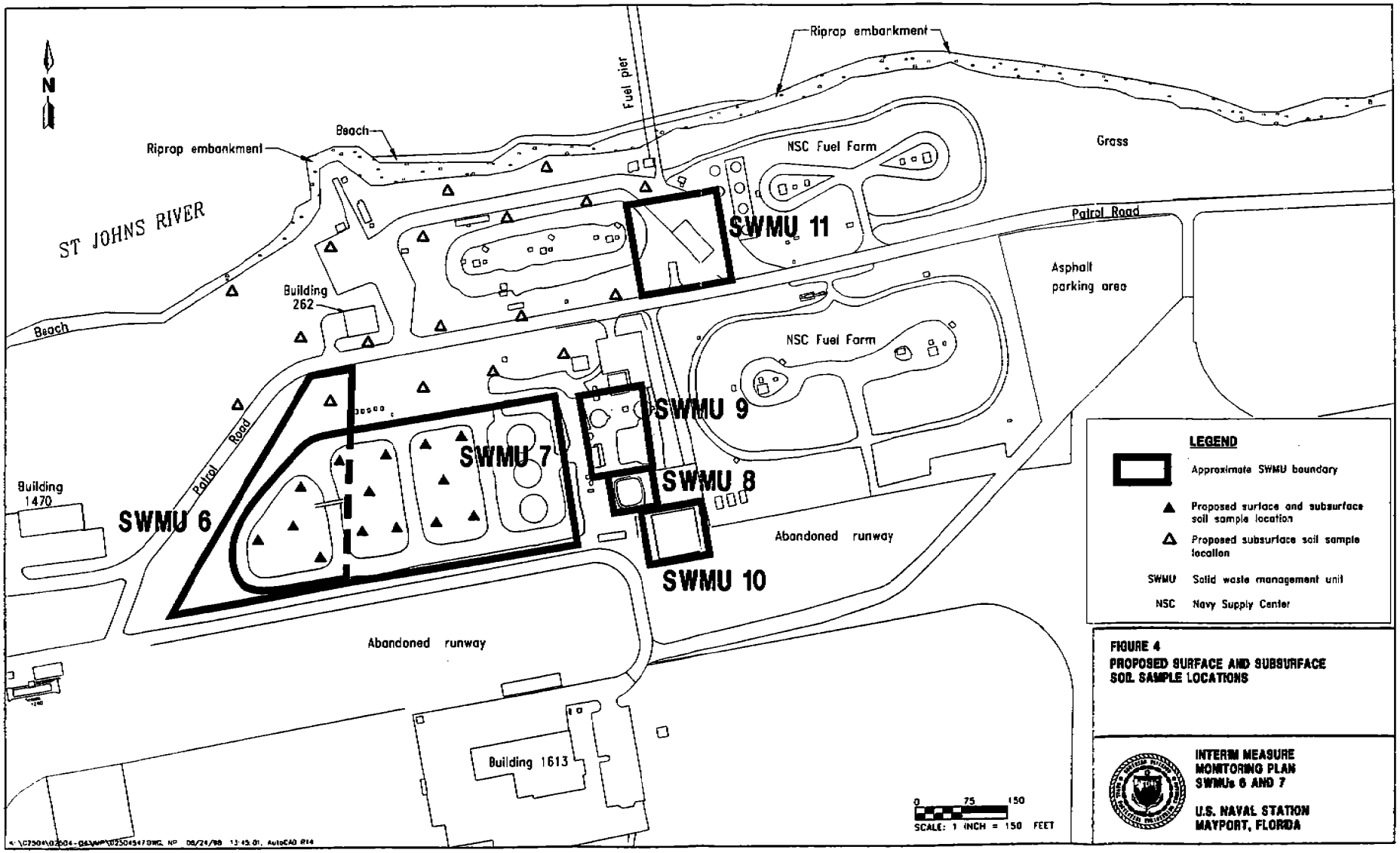


FIGURE 4
PROPOSED SURFACE AND SUBSURFACE SOIL SAMPLE LOCATIONS

INTERIM MEASURE MONITORING PLAN SWMUs 6 AND 7

U.S. NAVAL STATION MAYPORT, FLORIDA

APPENDIX B

TABLES

Table B-1
Example LNAPL and Water-Level Monitoring Form

Interim Measure Monitoring Plan for
Bioventing and Bioslurping at
Solid Waste Management Units 6 and 7
U.S. Naval Station
Mayport, Florida

Date: 1-1-96
Activity: Monthly Water/LNAPL Measurements Recordings
Sampler Identification: Mike Jaynes

Peak High Tide: 0900
Peak Low Tide: 1300
Page 1 of 1

Well Location	LNAPL Present? (Yes/No)	Top of Casing (TOC) (feet msl)	LNAPL Level from TOC (feet)	Water Level from TOC (feet)	LNAPL Thickness (feet)	Time of Measurement	Groundwater Sample Quarterly (Q) Biannual (B) or None (N)	Notes
MPT-9-MW03S	No	14.59	0.0	4.5	0.0	0730	N	
MPT-9-MW02S	Yes	10.08	10.01	10.21	0.2	0736	N	
MPT-8-MW03S	Yes	11.9	11.42	11.72	0.3	0743	N	
MPT-8-MW13S								
MPT-8-MW13I								
MPT-S-MW03S								
MPT-8-MW14S								
MPT-8-MW15S								
MPT-8-MW15I								
MPT-8-MW11S								
MPT-8-MW16S								
MPT-8-MW17S								
MPT-8-MW04S								
MPT-8-MW14S								
MPT-8-MW15S								

Analytical parameters include those specified in Section D.4 of the monitoring plan.

Notes: LNAPL = light nonaqueous phase-liquid.
msl = mean sea level; National Geodetic Vertical Datum of 1929.

Table 2
Summary of LNAPL and Water-Level Measurements and Groundwater Sampling Events

Interim Measure Monitoring Plan for
Bioventing and Bioslurping at
Solid Waste Management Units 6 and 7
U.S. Naval Station
Mayport, Florida

Well, Piezometer, or Recovery Sump Number	LNAPL and Groundwater-Level Measurement	Quarterly Sampling Event	Biannual Sampling Event
MPT-8-MW01S	Yes	Yes	Yes
MPT-8-MW02S	Yes	Yes	Yes
MPT-8-MW03S	Yes	Yes	Yes
MPT-8-MW04S	Yes	Yes	Yes
MPT-8-MW06S	Yes	No	No
MPT-8-MW07S	Yes	Yes	No
MPT-8-MW08S	Yes	Yes	No
MPT-8-MW09S	Yes	No	No
MPT-8-MW10S	Yes	Yes	Yes
MPT-8-MW11S	Yes	Yes	No
MPT-8-MW12S	Yes	Yes	No
MPT-8-MW13S	Yes	Yes	Yes
MPT-8-MW13I	Yes	Yes	Yes
MPT-8-MW14S	Yes	Yes	No
MPT-8-MW15S	Yes	Yes	Yes
MPT-8-MW15I	Yes	Yes	Yes
MPT-8-MW16S	Yes	Yes	Yes
MPT-8-MW17S	Yes	No	No
MPT-8-MW18S	Yes	Yes	No
MPT-8-P01S	Yes	No	No
MPT-10-P01S	Yes	No	No
MPT-S-MW01S	Yes	Yes	Yes
MPT-S-MW02S	Yes	Yes	Yes
MPT-S-MW03S	Yes	Yes	Yes
MPT-9-MW01S	Yes	No	No
MPT-9-MW02S	Yes	No	No
MPT-9-MW03S	Yes	No	No
MPT-8-ST01	Yes	No	No
MPT-8-ST02	Yes	No	No
MPT-8-ST03	Yes	No	No
MPT-8-ST04	Yes	No	No
MPT-8-ST05	Yes	No	No

Notes: LNAPL = light nonaqueous-phase liquid
MW = monitoring well
P = piezometer
ST = recovery sump

APPENDIX C

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REFERENCES

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