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DRAFT WORK PLAN GROUNDWATER SAMPLING ANALYSIS LANDFILL 2 FORT STORY  
VA  
5/1/1997  
MALCOLM PIRNIE

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## Draft Work Plan

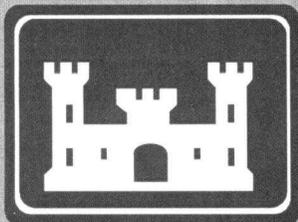
# GROUNDWATER SAMPLING AND ANALYSIS

Landfill No. 2  
Fort Story, Virginia

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**U. S. Army Corps of Engineers  
Baltimore District**

**May 1997**



0285-690

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**DRAFT WORK PLAN**

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**GROUNDWATER SAMPLING AND ANALYSIS  
LANDFILL No. 2**

**FORT STORY, VIRGINIA**

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**PREPARED FOR:**

**U.S. ARMY CORPS OF ENGINEERS  
BALTIMORE DISTRICT  
BALTIMORE, MARYLAND**

**MAY 1997**

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## 1.0 INTRODUCTION

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### 1.1 Site Location and Description

Fort Story is located in southeastern Virginia within the city of Virginia Beach, Virginia. Fort Story occupies an area of approximately 1,450 acres and is situated on Cape Henry which divides the waters of the Chesapeake Bay to the north and the Atlantic Ocean to the east. Figure 1 shows the location of Fort Story and Figure 2 shows the installation map.

Land features encountered at Fort Story consist of linear sand ridges, sand flats and wetland areas. The topography is dominated by a series of prominent linear, well-drained sand ridges that roughly bisect the Fort Story area. The central ridges trend parallel to the coastline and are characterized by maximum elevations in excess of 85 feet, National Geodetic Vertical Datum (NGVD) of 1929. A second series of sand ridges located on Fort Story are comprised of an active dune complex located adjacent to the coastline. The coastal sand ridges reach a maximum elevation in excess of 25 feet NGVD. Broad, poorly drained sand flats are located adjacent to the sand ridge areas. Land surface elevations in the sand flat areas typically range between 5 and 10 feet, NGVD. Wetland areas, which are common features of the sand flats, occur locally in closed depressions. South of the central sand ridges, the Fort Story topography consists of an extensively wooded, wetland area, formerly a back-bay, lagoonal feature. Most of the installation's facilities and operations are confined to the sand ridge and sand flats areas.

The chief potable water supply in the region is the surface water reservoir system operated by the City of Norfolk. To a minor extent, potable water is obtained from groundwater sources. Groundwater use at Fort Story is restricted to withdrawal from a single well located at the Lighter Amphibious Resupply Cargo (LARC) maintenance area. The unavailability of construction data for this well precludes a determination of which aquifer unit provides the groundwater withdrawn from this well. Water is obtained from the well for non-potable uses only.

The Virginia Department of Environmental Quality (DEQ), Division of Water, Tidewater Region, regulates wells in the region. Information obtained by Montgomery-Watson during performance of the PA/SI indicated that groundwater use is discouraged because of poor quality and withdrawal restrictions. High dissolved iron and manganese and total solids characterize the

groundwater in the deeper aquifers.

## **1.2 Site Background and Setting**

Fort Story began as a military installation in 1914. On March 10, 1914 the Virginia General Assembly ceded 343.1 acres, located at Cape Henry in Princess Anne County, to the U.S. Government "to erect fortifications and for other military purposes". On June 14, 1914 the U.S. District Court acquired title for the land by condemnation proceedings against the Cape Henry Syndicate and other landowners in the Cape Henry subdivision. War Department General Order No. 31, dated July 24, 1916 named this newly acquired tract of land Fort Story in honor of Major General John Patton Story.

Construction of powder magazines and projectile rooms got underway during the latter part of 1916 and by February 1917, construction of the 16-inch howitzer fortifications had begun. Also, during February 1917, the 2nd and 5th Coast Artillery Companies established the military garrison at Fort Story. From 1917 through 1925, the installation continued to develop as a small coast artillery garrison consisting of little more than its armament. The only land expansion which occurred during the period was the acquisition of 9.38 acres from the Norfolk and Southern Railway Company in March 1917.

During World War I, Fort Story was integrated into the Coast Defenses of Chesapeake Bay which included Fort Monroe (Headquarters) and Fort Wool (located at the east entrance of the Hampton Roads Bridge Tunnel). On June 9, 1925 Fort Story was designated a Harbor Defense Command by War Department General Order No. 13, but the change in designation added little to the dwindling post-war activity of the garrison.

As World War II approached, Fort Story began an extensive development. Many of the facilities which exist at Fort Story today were constructed then, and the installation increased in size to 1,439 acres. An additional 11.82 acres were acquired in 1963 which increased its size to its present 1,451 acres. In the 1940s, the construction included temporary artillery batteries, theater, chapel, fire station, mess halls, barracks, Officer and NCO clubs, shops, additional powder magazines and projectile rooms, six underground storage bunkers and 19 seacoast searchlights.

In December 1941, the Headquarters of the Harbor Defense Command was moved from Fort Monroe to Fort Story. Two harbor defense installations were added to the network in 1941; Fort John Curtis and a mine base. On March 1, 1944 the Chesapeake Bay sector of the Harbor Defenses was inactivated, and control passed to Headquarters, Southeastern Sector, Eastern Defense Command, Raleigh, North Carolina.

By September 1944, Fort Story began a transition from a heavily fortified coast artillery garrison to a convalescent hospital. At the time of its closing on March 15, 1946 the hospital had accommodated over 13,472 patients.

At the closing of World War II, Fort Story again changed missions. This time it assumed the role which it still has today, to train units and individuals for amphibious operations. Fort Story was officially transferred to the Transportation Corps in July 1948 as a subpost of the Transportation Training Command, Fort Eustis, Virginia.

Fort Story trains army personnel in amphibious and Logistics Over-the-Shore (LOTS) operations. Fort Story is the only available facility which has the necessary natural terrain features and beaches, sand, surf, variable tide conditions (bay and ocean) and hinterlands, all of which are normally experienced by amphibious and LOTS operations. In addition, Fort Story contains beach training areas, tactical training areas and a series of trails throughout the installation. The deep water ship anchorage, off-road driving areas and soil of sufficient bearing strength for the heavy vehicles are indispensable in amphibious training, LOTS training and the testing of new equipment, doctrines and techniques.

### **1.2.1 Landfill No. 2 - Site Description and History**

Site 2 - Landfill No. 2 is located within the wetland area along the southern margin of Fort Story, adjacent to the southern flank of a central sand ridge area near the junction of Coast Artillery Road and U.S. Route 60. Figure 3 shows the site map for Landfill No. 2.

According to the *Update of the Initial Installation Assessment of Ft. Story, Final Report* prepared by Environmental Science and Engineering in 1988, the landfill was in operation from 1956 to 1962. It was reported in the *Final Confirmatory Studies Report* by Montgomery Watson, 1995 that during the 1960s, a group of wooden buildings were reported to have been demolished

and buried at this site, but no documentation was available to confirm this action. Reportedly, surface debris or evidence of buried debris was not evident during field observations for the PA/SI in 1990. Based on geographical and electromagnetic surveying conducted during the 1990 PA/SI the landfill was estimated to cover 3 acres. Five monitoring wells were installed at the site as shown on Figure 3. These wells were sampled to assess whether the landfill may have released contaminants to the environment.

During the PA/SI in 1990, cadmium was detected in groundwater collected from MW109 at a concentration of 87 mg/l. Although MW109 is cross-gradient to the landfill, it is downgradient of a marshy area suspected to have been impacted by the landfill. Additionally, elevated concentrations of copper were detected in soil samples collected from the boring of monitoring well MW107, located downgradient of the landfill.

In 1995, another sampling event was conducted. Five groundwater samples, two surface water samples, and five sediment samples were collected during this effort. Samples were analyzed for volatile organic compounds (VOCs), base-neutral acid extractable compounds (BNAs), pesticides and polychlorinated biphenyls (PCBs), total fuel hydrocarbons, and total metals. Concentrations of total lead in samples at MW107 (16 µg/l) and MW108 (18 µg/l) exceeded Federal MCLs, while zinc was detected in three wells at concentrations exceeding Virginia Groundwater Protection Limits (VPGLs). However, in all groundwater samples that exceeded regulatory levels for total metals, the dissolved metals were below regulatory levels. The surface water samples collected were below the Virginia Water Quality Standards (VWQS) for freshwater except for zinc which was detected in both surface water samples at concentrations greater than the VWQS for the protection of freshwater aquatic life. DDE, arsenic, lead, and mercury were detected above criteria in the sediment samples, however, these contaminants are not believed to be indicative of background concentration and not directly related to conditions at Landfill No. 2.

Water level measurements collected in January 1995 at the five monitoring wells at Landfill No. 2 (MW105 through MW109) indicate that the hydraulic gradient at the site changes in head less than 0.1 feet across the site. Groundwater was interpreted to flow in a southerly direction towards the wetland area.

### **1.3 Purpose and Scope**

The results of the confirmatory studies performed at Landfill No. 2 at Fort Story, Virginia, and reported November 1995 indicated inconsistent analytical results between the 1990 and 1995 groundwater sampling events. Therefore it has been agreed that one additional groundwater and surface water sampling event will be performed to determine whether contaminant levels detected in 1990 and 1995 have changed over time.

The five existing monitoring wells will be purged, sampled, and analyzed for TCL VOCs, priority pollutant metals (total and dissolved), hardness, ammonia, chloride, nitrate-N, orthophosphate-P, total dissolved solids (TDS), and phosphorus. Two surface water samples will also be collected and analyzed for the same parameters.

## **2.0 FIELD SAMPLING PLAN**

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### **2.1 Groundwater Elevation Gauging**

Prior to sampling activities, depth to water measurement from top-of-casing will be obtained using an electric water level indicator calibrated to 0.01 feet. This data will be used to construct a groundwater elevation contour map. Flow directions and gradients will be compared to previously obtained data. The meter will be decontaminated before gauging begins and between each well.

### **2.2 Groundwater Sampling**

Groundwater sampling techniques, as outlined in Enclosure No. 1 of Attachment I in the *Final Work Plan for Groundwater, Surface Water and Gas Monitoring Program - Landfills 1, 7, and 15 Fort Eustis, Virginia* will be used during sampling activities. To obtain comparable results to the 1995 data set, the wells will be purged in a like manner to that of the 1995 sampling activities. MW109, MW105, MW107, and MW108 will be purged using an electric stage pump (centrifugal pump with foot valve) while MW106 will be hand bailed using a teflon bailer. Analytical requirements for surface water samples are summarized in Table 1, including method of analysis for each parameter. Table 2 summarizes specific analytical method requirements for

metals analyses. In accordance with the CDAP, the following procedures will be followed:

- A piece of polyethylene sheeting will be fitted over the monitoring well and laid on the ground. All sampling equipment will be placed on this sheet. Upon removal of the well cap, the concentration of the VOC vapors and explosive gases will be recorded using a PID/FID and explosimeter.
- The depth to water and total depth of the well will be recorded using an electric water level meter. These measurements will be used to calculate the purge volume for each well using the formula and tables provided in Section 4.3.3.2 of the CDAP.
- The monitoring wells will be purged using a centrifugal pump or teflon bailer as outlined above. Purge water will be containerized. Field measurements of pH, dissolved oxygen, specific conductance, temperature and water level will be recorded before purging begins and during purging at 10, 30, 50, and 80 percent of the anticipated purge volume (i.e., three times the calculated well and annulus volume). Purging will be continued until the measured field parameters have stabilized but not before three well volumes have been evacuated.
- Groundwater samples will be collected using a 2-inch teflon bailer with a teflon coated leader and placed in their appropriate sample container. Upon collection, samples containers will be properly labelled and placed in coolers with ice as outlined in Section 5 (Sample Custody Procedures) of the CDAP. Samples will be collected in order of decreasing volatility as follows:
  - VOCs
  - Total Metals
  - Dissolved Metals
  - Water Quality Parameters

### **2.3 Surface Water Sampling**

Standard surface water sampling procedures are detailed in Section 4.3.1 of the CDAP. Analytical requirements for surface water samples are summarized in Table 3, including method of analysis for each parameter. Table 2 summarizes specific analytical method requirements for metals analyses. Proposed sample locations are shown on Figure 3. The proposed locations shown on Figure 3 were chosen to coincide with the previous sample locations.

### **2.4 Daily Quality Control Reports**

Daily Quality Control Reports (DQCR) are required during field work activities. A sample report is shown in Appendix C and is required to record each days activities. The reports contain pertinent information regarding personnel, equipment, progress, procedures, field conditions, problems encountered, quality control methods, and other related information. Reports must be hand carried to the installation Environmental Coordinator on the morning after each reported work day. At the end of each sampling round, the DQCR's must be compiled and submitted to the Engineer Manager.

### **2.5 Control and Disposal of Investigation Derived Waste**

All groundwater purged during the confirmatory sampling event will be collected and stored in the on-site polyethylene container provided by Fort Story. At the completion of the sampling program one sample of the purge water will be collected from the polyethylene container. The sample will be analyzed for full TCLP as listed on Table 4.

**TABLE 1**  
**GROUNDWATER ANALYTICAL SUMMARY**  
**LANDFILL No. 2, FORT STORY**

Parameter	Analytical Method <sup>(1)</sup>	Well ID				
		MW105	MW106	MW107	MW108	MW109
TCL VOC	8260	✓	✓	✓	✓	✓
Priority Pollutant Metals - Total	6010/7470	✓	✓	✓	✓	✓
Priority Pollutant Metals - Dissolved	6010/7470	✓	✓	✓	✓	✓
Hardness	130.2	✓	✓	✓	✓	✓
Ammonia	350.1	✓	✓	✓	✓	✓
Chloride	325.2	✓	✓	✓	✓	✓
Nitrate-N	353.2	✓	✓	✓	✓	✓
Orthophosphate-P	365.1	✓	✓	✓	✓	✓
Sulfate	375.2	✓	✓	✓	✓	✓
TDS	160.1	✓	✓	✓	✓	✓
Phosphorus	365.4	✓	✓	✓	✓	✓
pH <sup>(2)</sup>	--	✓	✓	✓	✓	✓
Dissolved Oxygen <sup>(2)</sup>	--	✓	✓	✓	✓	✓
Temperature <sup>(2)</sup>	--	✓	✓	✓	✓	✓
Specific Conductance <sup>(2)</sup>	--	✓	✓	✓	✓	✓

Notes:

- (1) Analytical methods from SW-846
- (2) Field measurement

**TABLE 2**  
**SUMMARY OF ANALYTICAL METHOD REQUIREMENTS**  
**METAL ANALYSIS**  
**LANDFILL No. 2, FORT STORY**

Parameter	Analytical Method
Antimony	6010
Arsenic	6010
Barium	6010
Beryllium	6010
Cadmium	6010
Chromium	6010
Cobalt	6010
Copper	6010
Lead	6010
Mercury	7470
Nickel	6010
Selenium	6010
Silver	6010
Thallium	7841
Vanadium	6010
Zinc	6010

**TABLE 3**  
**SURFACE WATER ANALYTICAL SUMMARY**  
**LANDFILL No. 2, FORT STORY**

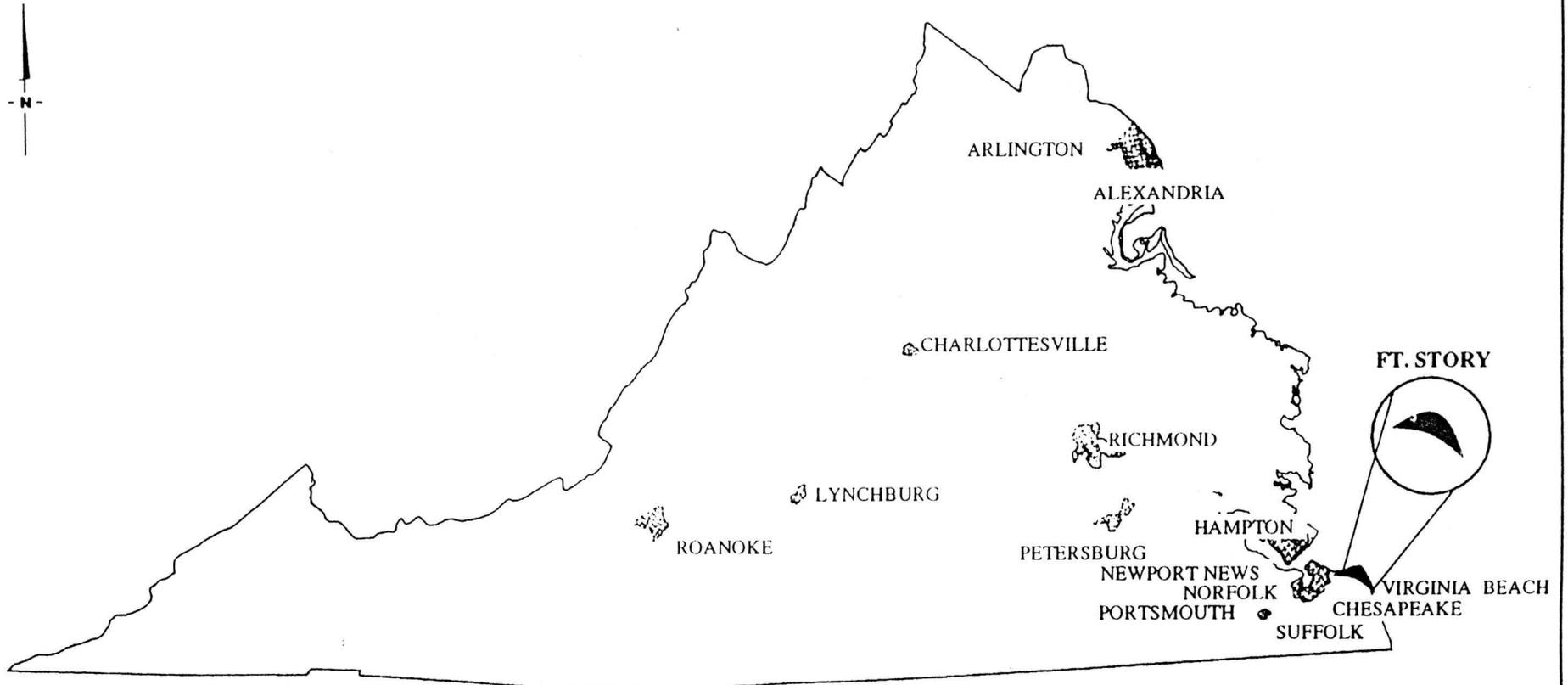
Parameter	Analytical Method	Surface Water Sample ID	
		SW3006	SW3007
TCL VOC	8260	✓	✓
Priority Pollutant Metals - Total	6010/7470	✓	✓
Priority Pollutant Metals - Dissolved	6010/7470	✓	✓
Hardness	130.2	✓	✓
Ammonia	350.1	✓	✓
Chloride	325.2	✓	✓
Nitrate-N	353.2	✓	✓
Orthophosphate-P	365.1	✓	✓
Sulfate	375.2	✓	✓
TDS	160.1	✓	✓
Phosphorus	365.4	✓	✓
pH <sup>(2)</sup>	--	✓	✓
Dissolved Oxygen <sup>(2)</sup>	--	✓	✓
Temperature <sup>(2)</sup>	--	✓	✓
Specific Conductance <sup>(2)</sup>	--	✓	✓

Notes:

- (1) Analytical methods from SW-846
- (2) Field measurement

**TABLE 4**  
**PURGE WATER/IDW ANALYTICAL SUMMARY**  
**LANDFILL No. 2, FORT STORY**

Parameter	Analytical Method	Sample ID
		IDW-1
Full TCLP	1311	✓
	8260	
	8270	
	8080	
	8151	
	6010	
	7470	



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FORT STORY, VIRGINIA  
LANDFILL 2 CONFIRMATORY SAMPLING

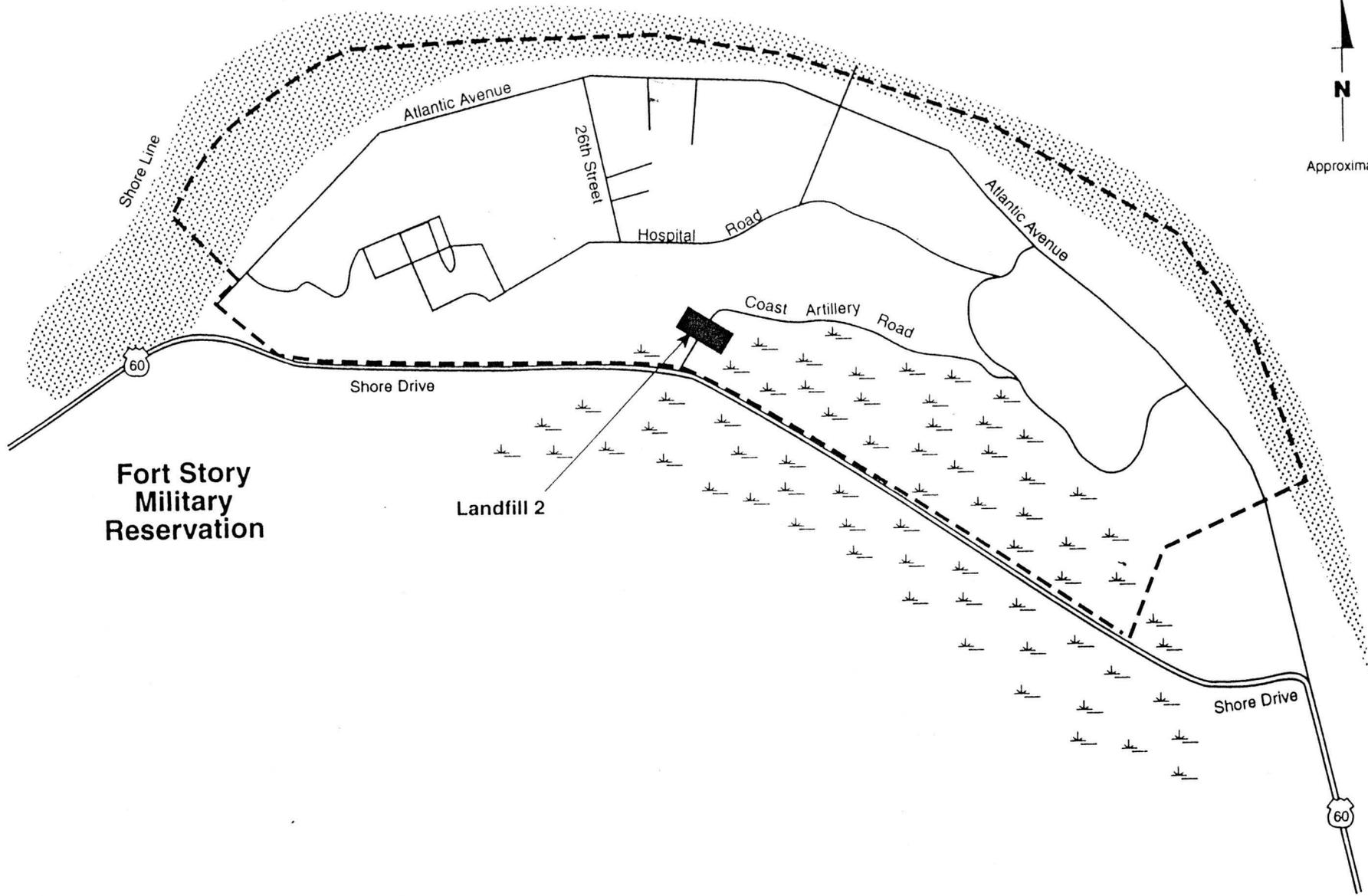
FIGURE 1 - VICINITY MAP

**MALCOLM  
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Chesapeake Bay



Approximate



**Fort Story  
Military  
Reservation**

Landfill 2

Atlantic Ocean

**LEGEND**

-  Swamp land
-  Shore line
-  Fort Story Military Reservation Boundary

SCALE IN FEET

0 1000 2000 3000

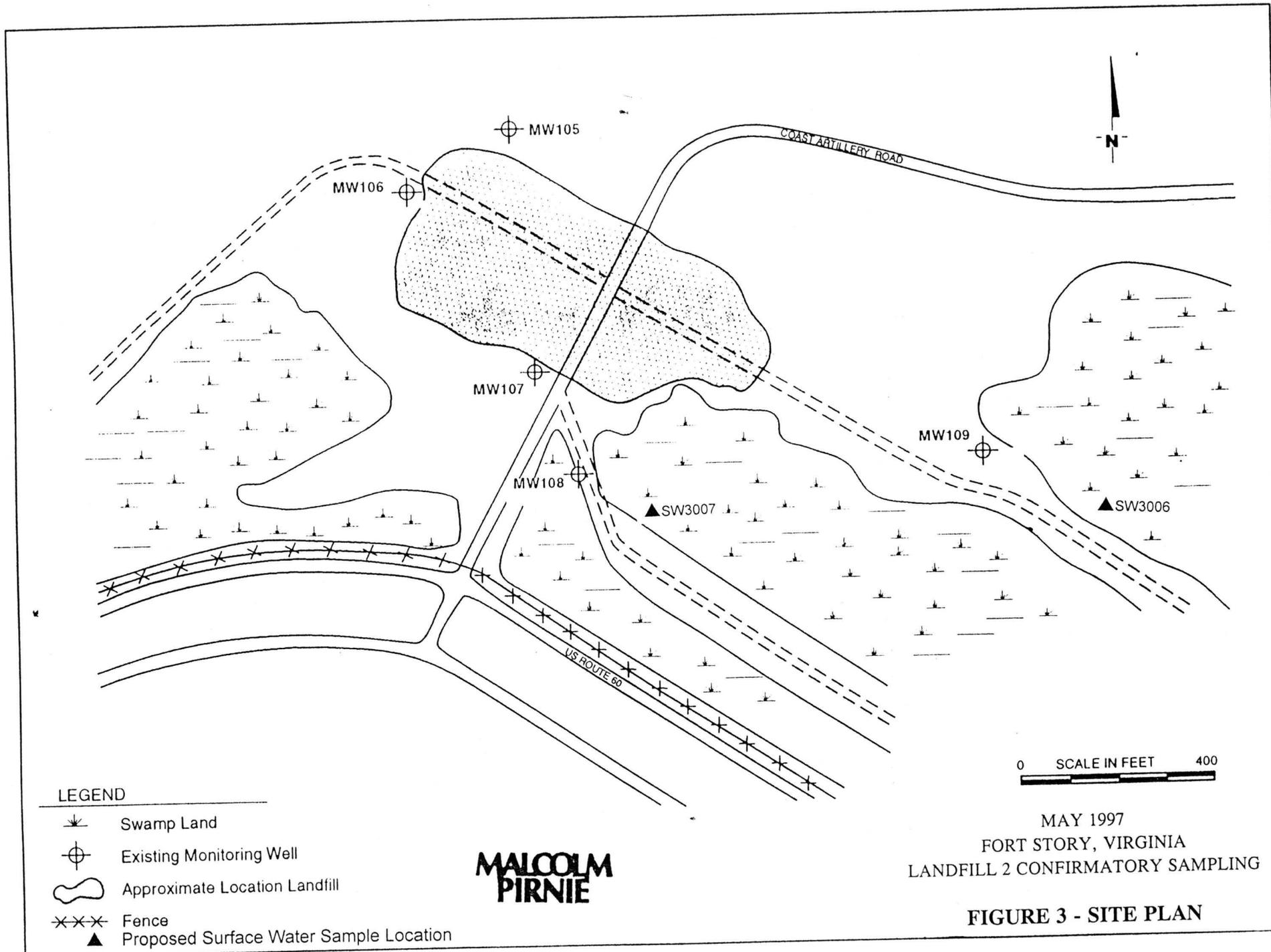


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PIRNIE**

MAY 1997

FORT STORY, VIRGINIA  
LANDFILL 2 CONFIRMATORY SAMPLING

**FIGURE 2 - INSTALLATION MAP**



MAY 1997  
 FORT STORY, VIRGINIA  
 LANDFILL 2 CONFIRMATORY SAMPLING

**FIGURE 3 - SITE PLAN**

**APPENDIX A**

**SITE-SPECIFIC HEALTH AND SAFETY PLAN**

**ATTACHMENT I**  
**SITE-SPECIFIC SAFETY AND HEALTH PLAN**

**LANDFILL No. 2 SAMPLING PROGRAM**  
**FORT STORY, VIRGINIA**

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Figure 2	Fort Story Installation Map
Figure 2	Landfill No. 2 Site Plan

**ATTACHMENT I**  
**SITE-SPECIFIC SAFETY AND HEALTH PLAN**

**LANDFILL No. 2 SAMPLING PROGRAM**  
**FORT STORY, VIRGINIA**

**I-1.0 SITE LOCATION AND DESCRIPTION**

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Landfill No. 2 is located within the wetland area along the southern margin of Ft. Story, and is immediately adjacent to the southern flank of a central sand ridge area near the junction of Coast Artillery Road and U.S. Route 60. Figure 1 shows the location of Fort Story, Figure 2 is the Fort Story installation map, and Figure 3 is a site map of Landfill No. 2.

According to the *Update of the Initial Installation Assessment of Ft. Story, Final Report* prepared by Environmental Science and Engineering in 1988, the landfill was in operation from 1956 to 1962. It was reported in the *Final Confirmatory Studies Report* by Montgomery Watson, 1995 that during the 1960s, a group of wooden buildings were reported to have been demolished and buried at this site, but no documentation was available to confirm this action. Reportedly, surface debris or evidence of buried debris was not evident during field observations for the PA/SI in 1990. Based on geographical and electromagnetic surveying conducted during the 1990 PA/SI the landfill was estimated to cover 3 acres. Five monitoring wells were installed at the site as shown on Figure 3. These wells were sampled to assess whether the landfill may have released contaminants to the environment.

During the PA/SI in 1990, cadmium was detected in groundwater collected from MW109 at a concentration of 87 µg/l. Although MW109 is cross-gradient to the landfill, it is downgradient of a marshy area suspected to have been impacted by the landfill. Additionally, elevated concentrations of copper were detected in soil samples collected from the boring of monitoring well MW107, located downgradient of the landfill.

In 1995, another groundwater sampling event was conducted. Each of the five wells were sampled for Volatile Organic Compounds, Base-Neutral Acid Extractable Compounds, Pesticides

and Polychlorinated Biphenyls, Total Fuel Hydrocarbons, and Total Metals. Only Total Lead for samples at MW107 and MW108 exceeded Federal MCLs, while zinc was detected in three wells at concentrations exceeding Virginia Groundwater Protection Limits (VPGLs). However, in all groundwater samples that exceeded regulatory levels for Total Metals, the dissolved metals were below regulatory levels. The surface water samples collected were below the Virginia Water Quality Standards (VWQS) for freshwater except for zinc which was detected in both surface water samples at concentrations greater than the VWQS for the protection of freshwater aquatic life.

Water level measurements collected in January 1995 at the five monitoring wells at Landfill No. 2 (MW105 through MW109) indicate that the hydraulic gradient at the site changes in head less than 0.1 feet across the site. Groundwater was interpreted to flow in a southerly direction towards the wetland area.

## **I-2.0 HAZARD ASSESSMENT**

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### **I-2.1 Description of Field Activities**

Samples will be collected to physically and chemically characterize groundwater and surface water. The sampling locations are included on the site plan.

**Groundwater** - Five (5) groundwater samples will be collected from the existing monitoring wells. One groundwater sample will be collected from each of the five monitoring wells at the site. Refer to the Field Investigation Plan for more detailed sampling information.

**Surface Water** - Two (2) surface water samples will be collected from the swampy area downgradient (south) of the landfill.

### **I-2.2 Summary of Project Risks**

Personnel must be aware of all hazards associated with the field activities to be performed and the physical environment in which the activities will be conducted. It should be noted that risks presented here are only speculated risks based on limited information from previous activities and investigations conducted at the site. Since unidentified risks may exist, all field personnel

shall exercise extreme care during all field activities. As more specific information is obtained about the chemical contaminants, additional precautions may be implemented by the Site Safety and Health Officer (SSHO) and the Project Industrial Hygienist. A hazards analysis of each task is provided in Table I-1. These hazards are discussed below.

### **I-2.2.1 Chemical Hazards**

While conducting site investigations, a potential exists for exposure to chemical contaminants through ingestion/inhalation and skin contact. Chemical contaminants previously detected at the site which are regulated by the Occupational Safety and Health Administration (OSHA) are listed in Table I-2.

Dermal contact and inhalation of these contaminants can be avoided through the use of proper personal protective equipment as described in Section I-4.0, Personal Protective Equipment.

In addition to the monitoring requirements stated in the GSSHP, a combustible gas indicator will be used to monitor for explosive or dangerous conditions during all site subsurface sampling activities. Action levels are described in Section 10.0 of the GSSHP.

General chemical, physical, and toxicological data, protective exposure standards, and first aid procedures for each contaminant of concern is given in Table I-2.

### **I-2.2.2 Physical Hazards**

The primary physical hazard which may be encountered during site investigation is injury due to slips, trips, and falls. The surface water sampling is of particular concern because of the need to walk in wet, marshy areas to collect the samples. To address these hazards particular attention shall be paid to good housekeeping practices. All walkways shall be kept free of obstacles and care shall be taken while travelling in areas of uneven or slippery terrain. Personnel shall always work in pairs during field investigation activities. In the marshy areas, personnel shall wear slush boots to protect their feet from surface water in addition to the PPE requirements, if any, specified in Section I-4.0 for protection from chemical hazards.

### **I-3.0 SITE CONTROL**

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The following work zones for sampling activities will be established and communicated to all employees by the SSHO:

- Exclusion Zone ("Hot Zone"): The exclusion zone will be considered to be a 20-foot radius around the monitoring well being sampled.
- Contamination Reduction Zone (CRZ) and Support Zone ("Clean Zone"): The CRZ is the designated area where personnel and equipment decontamination will take place. The CRZ will be located between the Exclusion Zone and the Support Zone. The CRZ will be of sufficient size to permit decontamination activities to be conducted efficiently. the location of the Support Zone will be chosen by the SSHO, preferably upwind of and adjacent to the CRZ.

Figure 3 shows the general layout of the site. Specific boundary locations will be determined by the SSHO based on the sampling locations. Prior to the sampling activities, the work zones will be clearly marked using traffic cones and safety tape. If operations at the base or proximity to the road conflict with the zone requirements, zones will be established at the discretion of the SSHO.

### **I-4.0 PERSONAL PROTECTIVE EQUIPMENT**

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Personal protective equipment (PPE) usage will be in accordance with Section 9.0 of the GSSHHP.

Groundwater and surface water sampling activities will be conducted in Level D protection. To minimize dermal contact and spread of contamination from contact with groundwater and surface water, the following equipment will be required:

- Tyvek (poly coated if desired)
- Latex inner gloves
- Nitrile outer gloves
- Disposable booties or slush boots

Upgrading to higher levels of PPE will be based upon criteria outlined in Section 9.0 of the GSSHP.

## **I-5.0 DECONTAMINATION**

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### **I-5.1 Personnel Decontamination**

Personnel decontamination will be conducted in accordance with Section 11.0 of the GSSHP. The CRZ shall be equipped with wash/rinse/disposal stations in accordance with the GSSHP. Stations shall be set up as appropriate for the required level of PPE being employed.

### **I-5.2 Equipment Decontamination**

The Field Investigation Plan specifies the sequential decontamination procedures to be used in the preparation of the sampling equipment. Rinsewater generated by the decontamination process will be containerized for treatment and disposal if it contains decontamination solvents.

**TABLE I-1**  
**HAZARDS ANALYSIS**

<b>Work Task</b>	<b>Slip/Trip/Fall</b>	<b>Vapor/Gas Inhalation</b>	<b>Noise Exposure</b>	<b>Insects/ Bio Hazards</b>	<b>Exposure to Contaminated Media</b>
<b>Groundwater Sampling</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Surface Water Sampling</b>	<b>X</b>	<b>X</b>		<b>X</b>	<b>X</b>

**TABLE I-2  
TOXICOLOGICAL SUMMARY**

Compound	Vapor Pressure (mm HG)	Ionization Potential (eV)	PEL STEL IDLH	Action Level	Odor Threshold	Target Organs	Route of Entry	Symptoms and Toxicological Effects	First Aid
<b>Inorganics</b>									
Cadmium	0	N/A	0.005 mg/m <sup>3</sup> (PEL) 9 mg/m <sup>3</sup> (IDLH)	N/A	N/A	Respiratory system, kidneys, prostate, blood [prostatic and lung cancer]	Inhalation, Skin/eye contact, Ingestion	Pulmonary edema, dysplasia, coughing, chest tightness, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, anosmia, emphysema, proteinuria, mild anemia, [carcinogen]	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Copper	0	N/A	1 mg/m <sup>3</sup> (PEL)	N/A	N/A	Respiratory System, skin, liver, kidneys	Inhalation, Skin/eye contact, Ingestion	Eye, skin, mucous membrane irritation, metallic taste; In animals: lung, liver & kidney damage, anemia	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Lead	0	N/A	0.05 mg/m <sup>3</sup> (PEL) 700 mg/m <sup>3</sup> (IDLH)	N/A	N/A	GI tract, CNS, blood, kidneys, gingival tissue	Inhalation, Skin/eye contact, Ingestion	Weakness, insomnia, facial palor, tremor, abdominal pain, eye irritation, colic, anemia, constipation, low weight	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
Zinc	1	N/A	N/A	N/A	N/A	GI tract, blood, immune system	Inhalation, Skin/eye contact, Ingestion	Digestive difficulties, anemia, altered immune system	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention
<b>Organics</b>									
Toluene	21	8.82	200 ppm (PEL) 300 ppm (Ceiling) 500 ppm (IDLH)	100 ppm	----	Eyes, skin, respiratory system, CNS, liver, kidneys	Inhalation, Skin/eye contact, Ingestion	Eyes and nose irritation, fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, necrosis, muscle fatigue, insomnia, paresthesia, dermatitis; liver and kidney damage	Eye: Irrigate immediately Skin: Wash with soap Breath: Respiratory support Swallow: Immediate medical attention

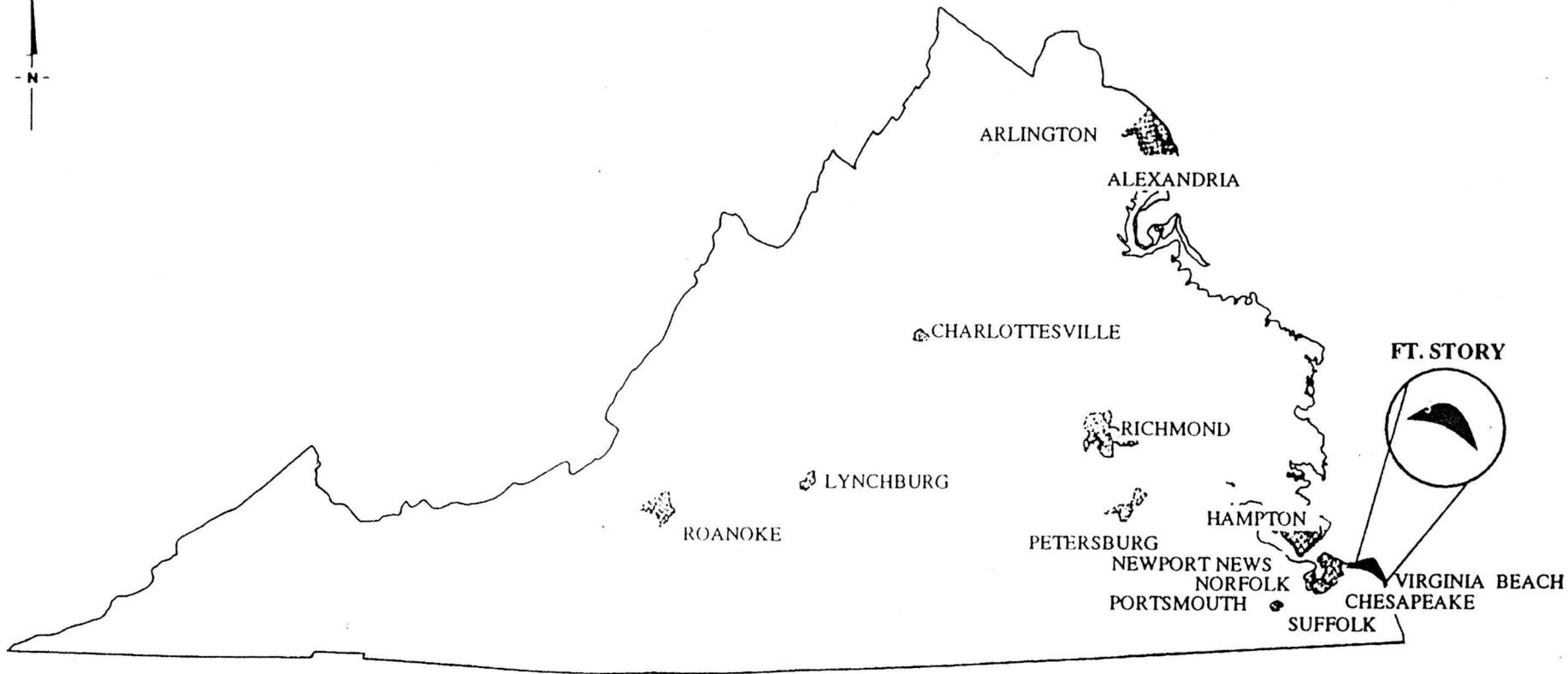
N/A - Not Available

PEL - OSHA Permissible Exposure Limit

STEL - OSHA Short Term Exposure Limit

IDLH - Immediately Dangerous to Life and Health

CNS - Central Nervous System

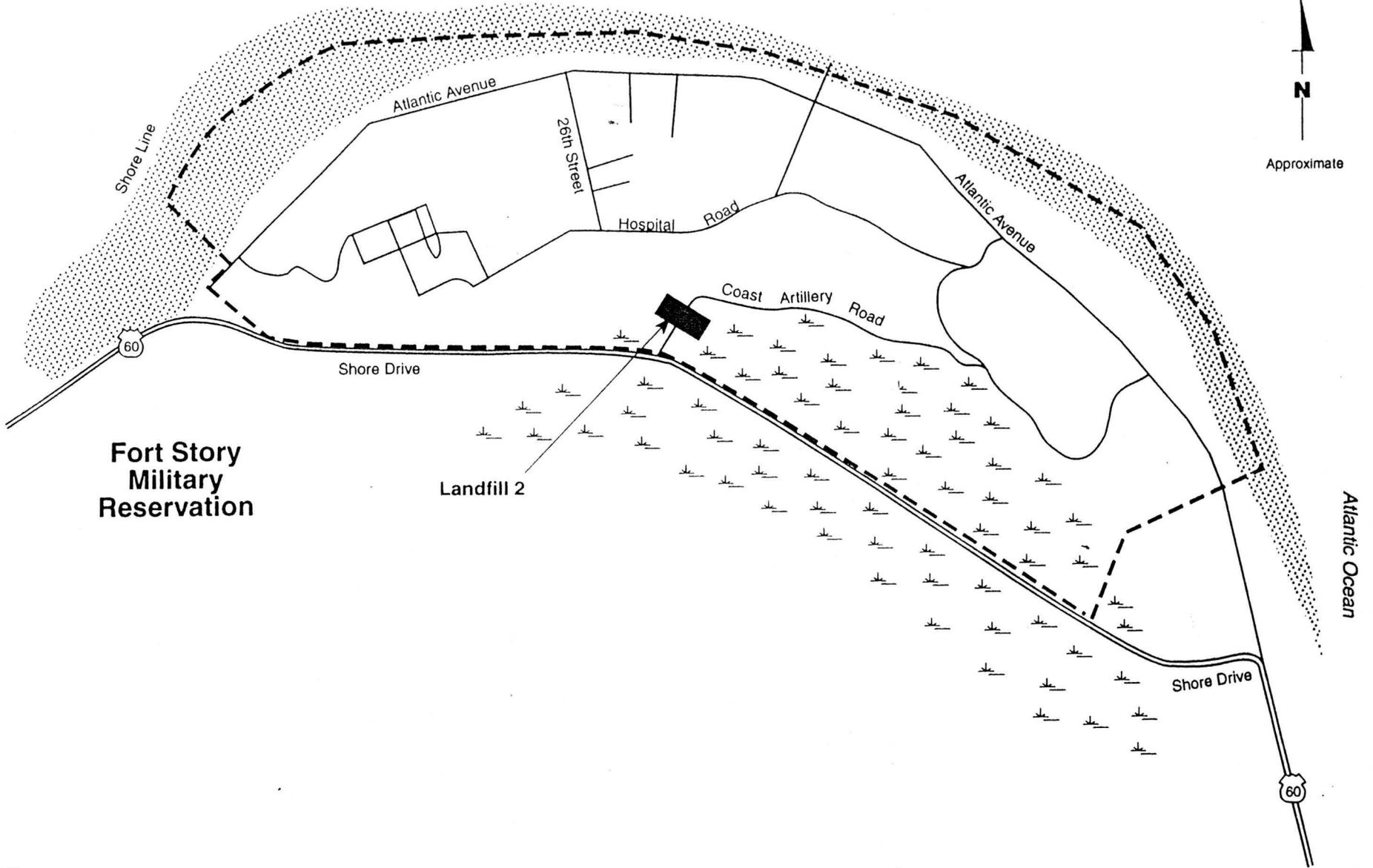
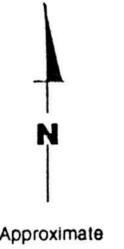


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FORT STORY, VIRGINIA  
LANDFILL 2 CONFIRMATORY SAMPLING

**FIGURE 1 - VICINITY MAP**

Chesapeake Bay



**Fort Story  
Military  
Reservation**

Landfill 2

**LEGEND**

-  Swamp land
-  Shore line
-  Fort Story Military Reservation Boundary

SCALE IN FEET

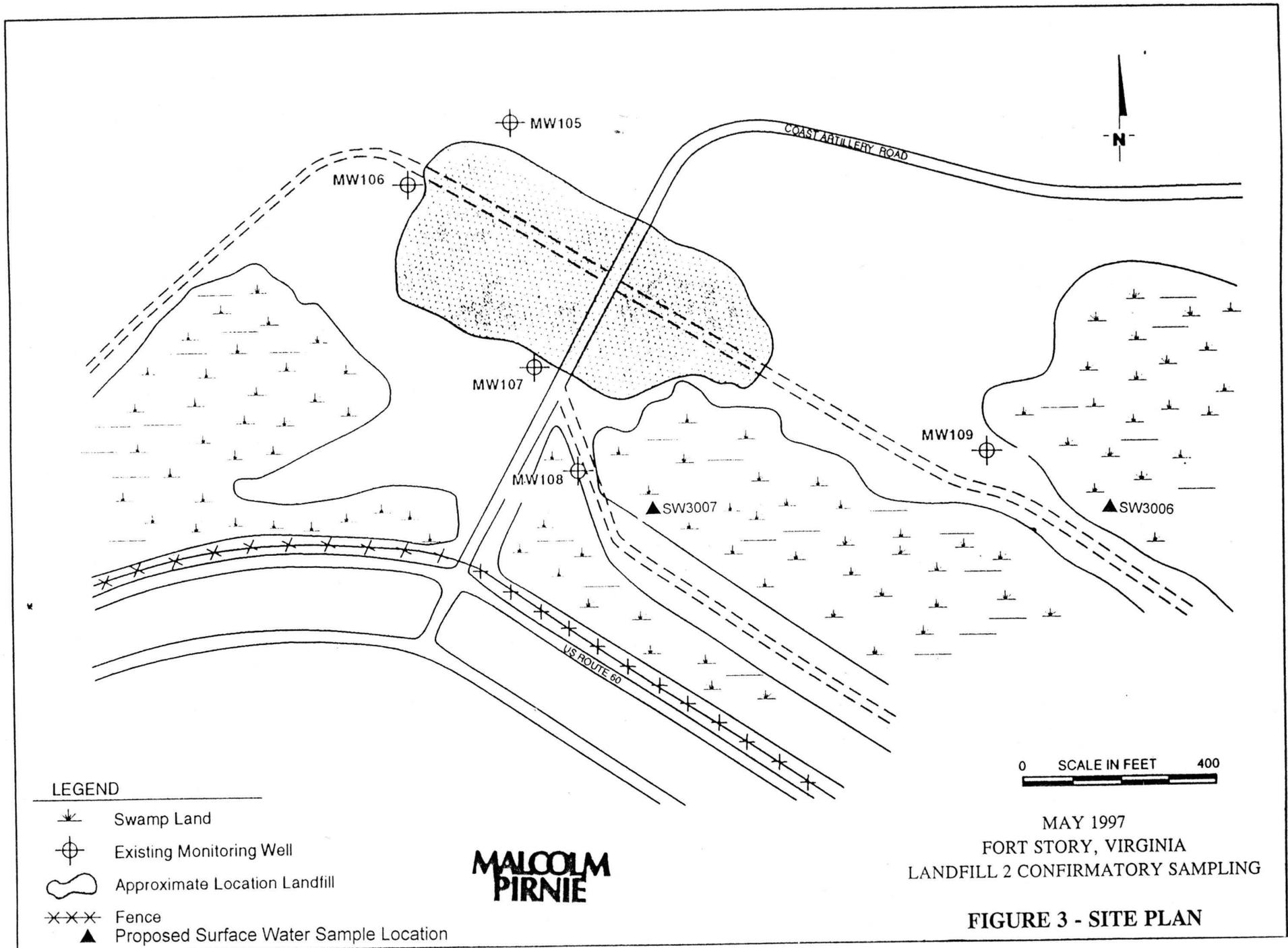
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**FIGURE 2 - INSTALLATION MAP**



**ATTACHMENT II**

**SITE-SPECIFIC**

**CHEMICAL DATA ACQUISITION PLAN**

**ATTACHMENT II**  
**SITE-SPECIFIC CHEMICAL DATA ACQUISITION PLAN**

**LANDFILL No. 2 SAMPLING PROGRAM**  
**FORT STORY, VIRGINIA**

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Figure 2	Landfill No. 2 Site Plan

**ATTACHMENT II**  
**SITE-SPECIFIC CHEMICAL DATA ACQUISITION PLAN**

**LANDFILL No. 2 SAMPLING PROGRAM**  
**FORT STORY, VIRGINIA**

This Site-Specific Chemical Data Acquisition Plan is an attachment to the Fort Eustis Installation Chemical Data Acquisition Plan (CDAP) prepared by Malcolm Pirnie, Inc., as part of the Final Work Plan for the Remedial Investigation for Building 1607 Storage Yard Site, dated July 1995.

**II-1.0 SITE LOCATION AND DESCRIPTION**

---

Fort Story is located in southeastern Virginia within the city of Virginia Beach, Virginia. Fort Story occupies an area of approximately 1,450 acres and is situated on Cape Henry which divides the waters of the Chesapeake Bay to the north and the Atlantic Ocean to the east. Figure 1 shows the location of Fort Story and Figure 2 shows the installation map.

**II-1.1 Landfill No. 2**

Landfill No. 2 is located within the wetland area along the southern margin of Fort Story, adjacent to the southern flank of a central sand ridge area near the junction of Coast Artillery road and U.S. Route 60. Figure 3 shows the site map for Landfill No. 2.

According to the *Update of the Initial Installation Assessment of Ft. Story, Final Report* prepared by Environmental Science and Engineering in 1988, the landfill was in operation from 1956 to 1962. It was reported in the *Final Confirmatory Studies Report* by Montgomery Watson, 1995 that during the 1960s, a group of wooden buildings were reported to have been demolished and buried at this site, but no documentation was available to confirm this action. Reportedly, surface debris or evidence of buried debris was not evident during field observations for the PA/SI in 1990. Based on geographical and electromagnetic surveying conducted during the 1990 PA/SI

the landfill was estimated to cover 3 acres. Five monitoring wells were installed at the site as shown on Figure 3. These wells were sampled to assess whether the landfill may have released contaminants to the environment.

During the PA/SI in 1990, groundwater and soil were sampled and analyzed. Cadmium was detected in groundwater at elevated concentrations and copper was detected in soil samples collected from the monitoring well borings. In 1995, another sampling event was conducted. Five groundwater samples, two surface water samples, and five sediment samples were collected during this effort. Samples were analyzed for volatile organic compounds (VOCs), base-neutral acid extractable compounds (BNAs), pesticides and polychlorinated biphenyls (PCBs), total fuel hydrocarbons, and total metals. Elevated concentrations of total lead and zinc was detected in three wells at concentrations exceeding Virginia Groundwater Protection Limits (VPGLs). However, in all groundwater samples that exceeded regulatory levels for total metals, the dissolved metals were below regulatory levels. The surface water samples collected were below the Virginia Water Quality Standards (VWQS) for freshwater except for zinc which was detected in both surface water samples at concentrations greater than the VWQS for the protection of freshwater aquatic life. DDE, arsenic, lead, and mercury were detected above criteria in the sediment samples, however, these contaminants are not believed to be indicative of background concentration and not directly related to conditions at Landfill No. 2.

Water level measurements collected in January 1995 at the five monitoring wells at Landfill No. 2 (MW105 through MW109) indicate that the hydraulic gradient at the site changes in head less than 0.1 feet across the site. Groundwater was interpreted to flow in a southerly direction towards the wetland area.

## **II-2.0 FIELD ACTIVITIES**

---

### **II-2.1 Field Equipment**

Equipment required to implement the groundwater and surface water sampling include:

- Photoionization detector (PID)
- Combustible gas indicator for methane monitoring

- Temperature, specific conductance, dissolved oxygen, pH meter
- Electronic water level indicator
- Teflon bailers
- Portable filtering kit including vacuum pump, 0.45 micron filters, plastic tubing and disposable flask
- Centrifugal pump
- Sample containers
- Decontamination solutions (methanol and 0.1N nitric acid)
- Personal protective equipment including latex gloves, nitrile gloves, steel toed boots, and work gloves.
- Portable generator with extension cords

### **II-2.2 Sampling Locations**

One additional round of confirmatory groundwater and surface water samples will be collected at Landfill No. 2. Groundwater gauging will be conducted prior to sampling activities. Figure 1-2 shows the five monitoring well locations and the two proposed surface water sampling locations.

### **II-2.3 Sampling and Preservation Procedures**

Surface water samples will be collected at two (2) locations at Landfill No. 2. Standard surface water sampling procedures are detailed in Section 4.3.1 of the Fort Eustis CDAP.

Groundwater samples will be collected from five (5) existing monitoring wells at Landfill No. 2. All groundwater sampling and analyses will be performed in accordance with the Virginia Solid Waste Management Regulations (VR572-20-10). Monitoring well sampling procedures are not outlined in the general CDAP. Standard groundwater sampling procedures are detailed in Enclosure No. 1 of Attachment I in the *Final Work Plan for Groundwater, Surface Water and Gas Monitoring Program - Landfills 1, 7, and 15 Fort Eustis, Virginia*. Sample containers, preservation, and holding times for each sample parameter is provided in Table II-1

## **II-2.4 Field Documentation**

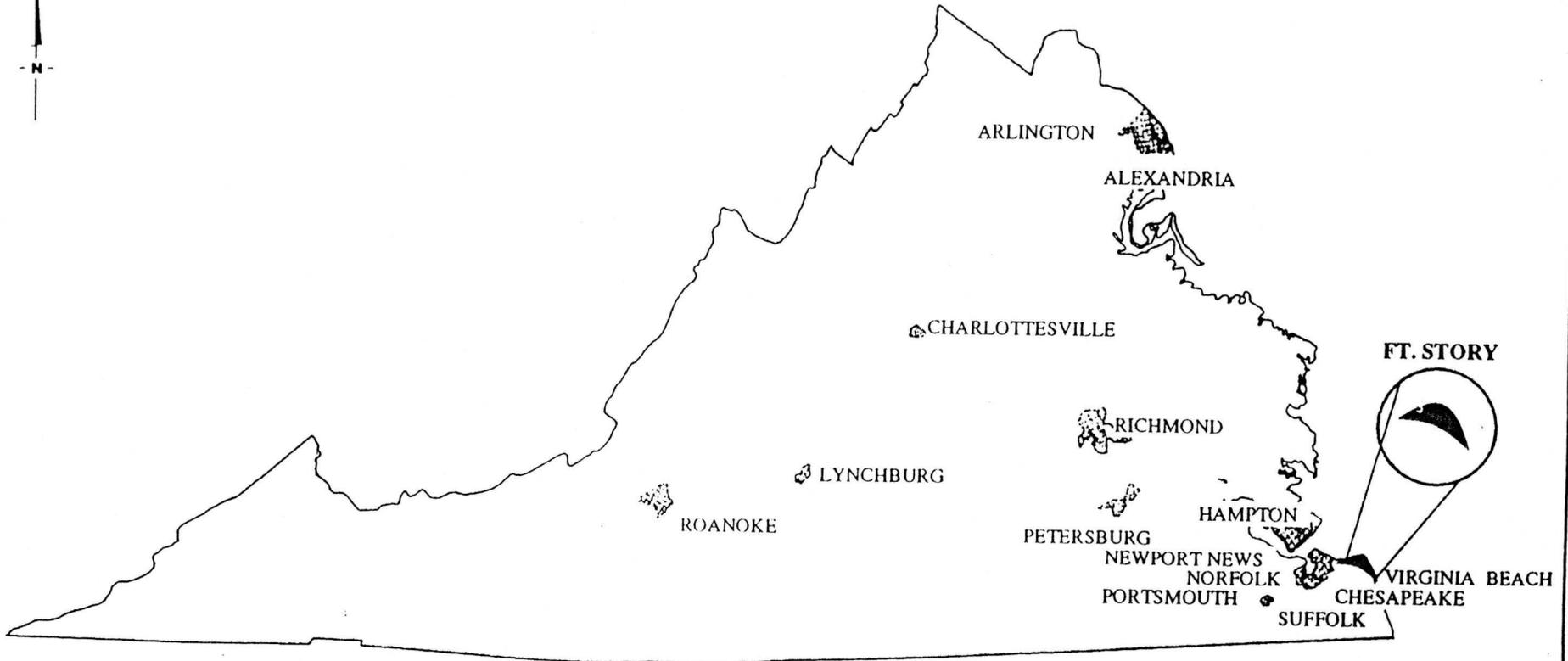
For the confirmatory sampling round, entries shall be made in a field notebook and logbook as specified in Section 4.4 of the CDAP. Sample labels shall contain the information and be numbered as specified in Section 5.4 and Section 4.7 of the CDAP, respectively.

**TABLE II-1**  
**SAMPLE CONTAINER, PRESERVATIVE AND HOLDING TIME REQUIREMENTS**  
**GROUNDWATER, SURFACE WATER, AND IDW SAMPLES**  
**LANDFILL No. 2 FORT STORY, VIRGINIA**

Analysis	Analytical Method	Container	Preservation	Holding Time
TCL VOC	8260	3-40 ml Glass	Cool 4 <sup>0</sup> C, HCL	14 days
Priority Pollutant Metals - Total	6010/7470	1-500 ml 1-250 ml Plastic	Cool 4 <sup>0</sup> C, Nitric	6 months <sup>(2)</sup>
Priority Pollutant Metals - Dissolved	6010/7470	1-500 ml 1-250 ml Plastic	Cool 4 <sup>0</sup> C, Nitric <sup>(1)</sup>	6 months <sup>(2)</sup>
Hardness	130.2	Included in metals	--	6 months
Ammonia	350.1	1-100 ml plastic	Cool 4 <sup>0</sup> C, Sulfuric	28 days
Chloride	325.2	1-250 ml plastic	Cool 4 <sup>0</sup> C	28 days
Nitrate-N	353.2	1-250 ml plastic	Cool 4 <sup>0</sup> C	48 hours
Orthophosphate-P	365.1	1-250 ml plastic	Cool 4 <sup>0</sup> C	48 hours
Sulfate	375.4	1-250 ml plastic	Cool 4 <sup>0</sup> C	28 days
TDS	160.1	1-500 ml plastic	Cool 4 <sup>0</sup> C	7 days
Phosphorus	365.4	1-250 ml plastic	Cool 4 <sup>0</sup> C, Sulfuric	28 days
Full TCLP	1311/8260/ 8270	3-40 ml glass 2-1L glass	Cool 4 <sup>0</sup> C, HCL Cool 4 <sup>0</sup> C	7 days

Notes:

- (1) Field filtered metals will be preserved with nitric/Lab filtered metals are unpreserved.
- (2) Mercury has a holding time of 28 days.

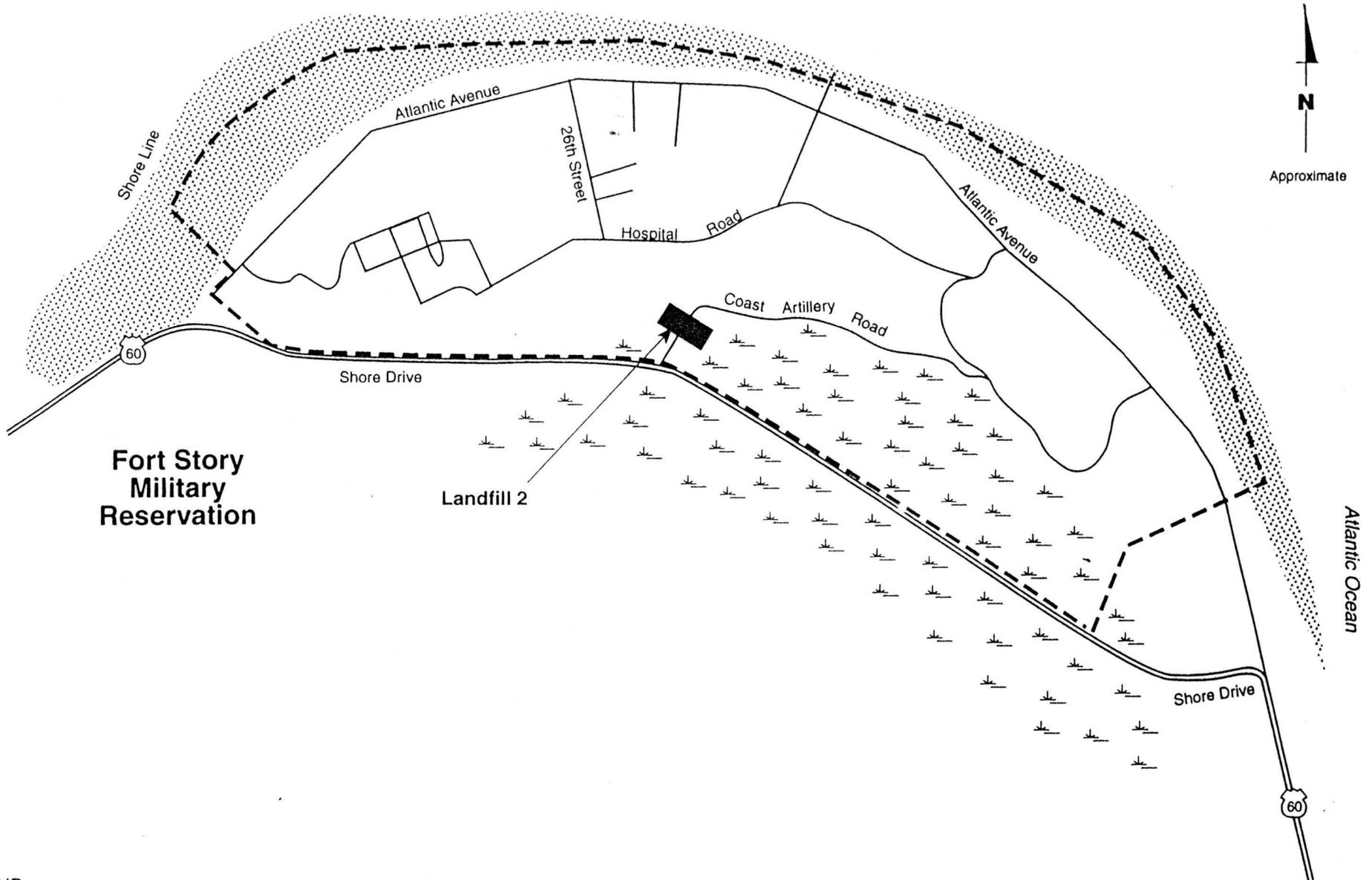
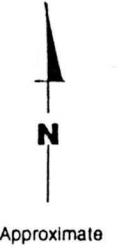


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**FIGURE 1 - VICINITY MAP**

Chesapeake Bay



**Fort Story  
Military  
Reservation**

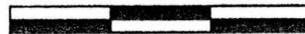
Landfill 2

**LEGEND**

-  Swamp land
-  Shore line
-  Fort Story Military Reservation Boundary

SCALE IN FEET

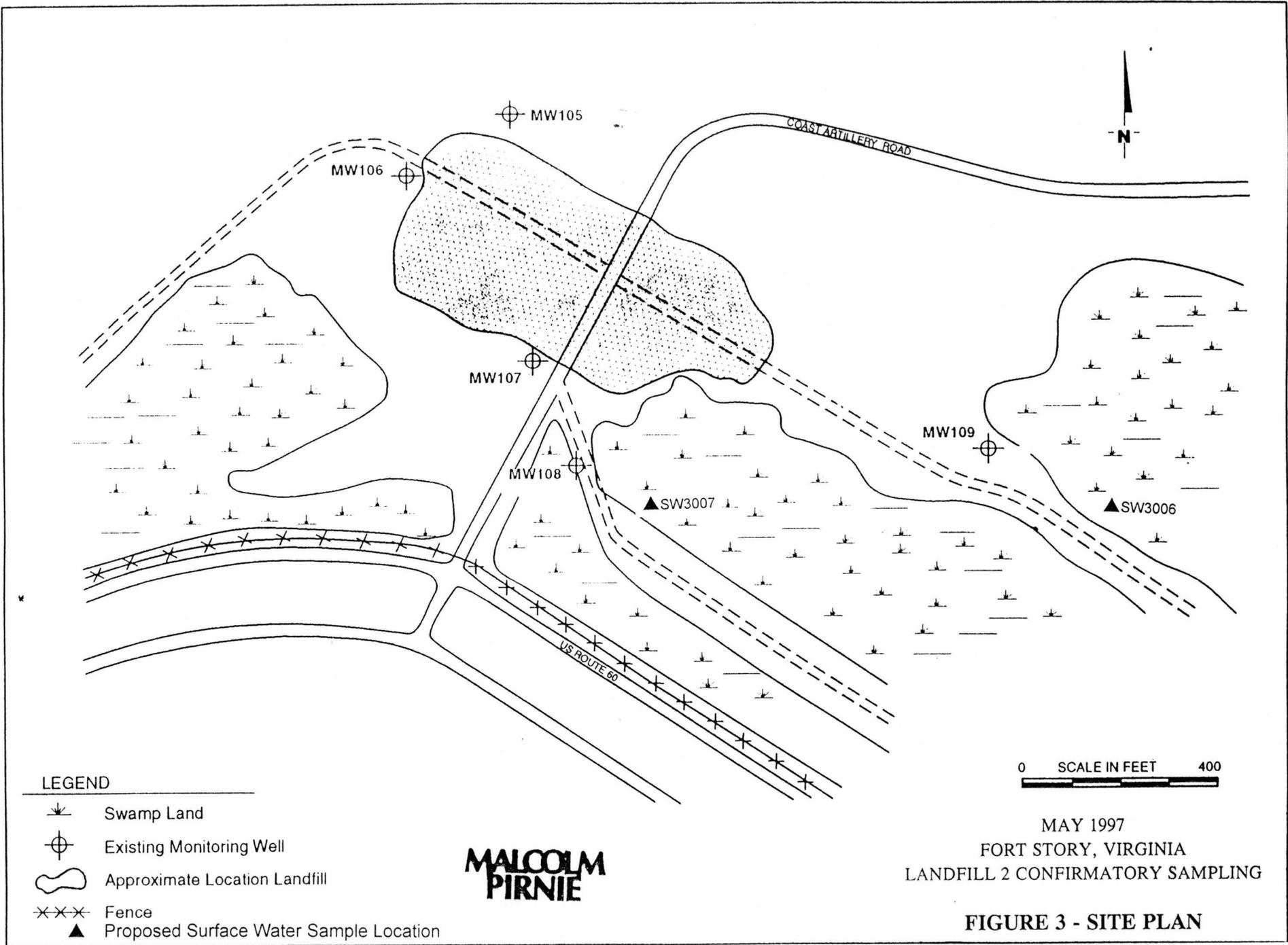
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LANDFILL 2 CONFIRMATORY SAMPLING

**FIGURE 2 - INSTALLATION MAP**



**APPENDIX C**

**DAILY QUALITY CONTROL REPORT**



PROJECT \_\_\_\_\_

REPORT NO. \_\_\_\_\_

JOB NO. \_\_\_\_\_

DATE \_\_\_\_\_

**QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):**


**HEALTH AND SAFETY LEVELS AND ACTIVITIES:**


**PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:**


**SPECIAL NOTES:**


**TOMORROW'S EXPECTATIONS:**


BY \_\_\_\_\_ TITLE \_\_\_\_\_