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EXPANDED SITE INVESTIGATION REPORT NS MAYPORT FL
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E C JORDAN

U.S. DEPARTMENT OF THE NAVY

NAVAL STATION
MAYPORT, FLORIDA

FINAL REPORT

NIRP
EXPANDED SITE INVESTIGATION

CONTRACT NO. N62467-86-C-0174
E.C. JORDAN PROJECT NO. 5097-06

APRIL 1988

E.C. JORDAN CO.

U.S. DEPARTMENT OF THE NAVY
NAVAL STATION MAYPORT, FLORIDA
JOB NO. 5097-06

FINAL REPORT

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CONTRACT NO. N62467-86-C-0174

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APRIL 1988

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EXECUTIVE SUMMARY

The U.S. Naval Station (NAVSTA) at Mayport, Florida is included in the Navy's Installation Restoration Program for the investigation of past disposal sites. As part of this program, an Initial Assessment Study was conducted by Environmental Science and Engineering in 1986. Based upon this study and the review by the Florida Department of Environmental Regulation, 10 sites were selected to undergo an Expanded Site Investigation (ESI). E.C. Jordan Co. was contracted by the U.S. Navy to complete the ESI at the facility. The purpose of the ESI was to determine if specific toxic and hazardous materials are present at suspected waste disposal sites and to recommend additional studies, if necessary.

The ESI encompassed 10 areas on NAVSTA Mayport where past disposal practices were known or suspected to have occurred. These areas include:

Site 1	Landfill A
Site 2	Landfill B
Site 4	Landfill D
Site 5	Landfill E
Site 6	Landfill F
Site 8	Waste Oil Pit
Site 9	Fuel Spill
Site 13	Old Fire Training Area(s)
Site 14	Mercury/Oily Waste Spill
Site 16	Transformer Storage Yard

The scope of work completed at these sites included: a review of existing data; 7,300 linear feet of terrain conductivity survey; 30 soil borings; 28 monitoring well installations; collection of 4 surface water and sediment samples, 30 groundwater samples and 27 soil samples; analyses of soil and water samples for EPA Method 624 compounds, priority pollutant base/neutral compounds, priority pollutant acid extractable compounds, priority pollutant pesticides, and PCBs, and priority pollutant (water) or EPTOX (soil) metals; and evaluation of hydrogeologic information and laboratory data.

Based on the information derived during this study, it is concluded that an environmental risk assessment is warranted at 7 sites. This recommendation is based on the elevated levels of either pesticides or priority pollutant metals found in groundwater and surface water samples. In addition, Sites 13

and 16 are recommended for a Phase II ESI in order to complete the physical and chemical understanding of these sites and thereby verify the existence of groundwater contamination, should it exist. Site 2 is recommended for remedial action due to the concentration of PCB-1260 in soils exceeding the limit established under the Toxic Substance Control Act.

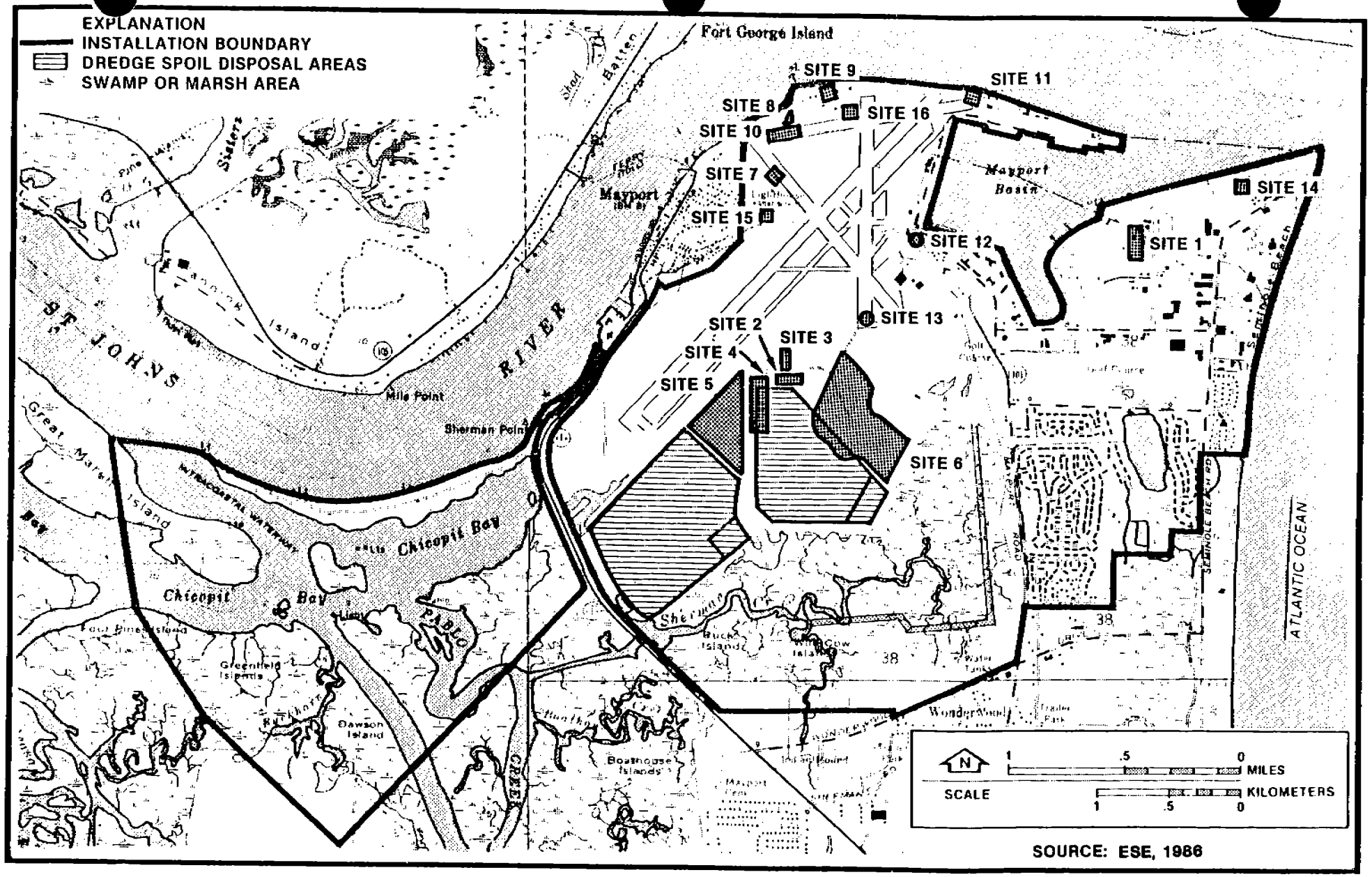
SECTION 1

TABLE 1-1
RESULTS OF CONFIRMATION STUDY RANKING SYSTEM
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

SITE NUMBER	SITE NAME	YEARS OF OPERATION	CSRS SCORE
1	LANDFILL A	1942-1960	15
2	LANDFILL B	1960-1964, 1979-1980	12
3	LANDFILL C	1963	NR
4	LANDFILL D	1963-1965	8
5	LANDFILL E	1963-1966, 1974-1980	10
6	LANDFILL F	1981-1985	10
7	HAZARDOUS WASTE STORAGE AREA	1981-CURRENT	NR
8	WASTE OIL PIT	1973-1978	26
9	FUEL OIL SPILL	1942-CURRENT	22
10	DEFENSE REUTILIZATION AND MARKETING OFFICE STORAGE YARD	1967-1980	NR
11	NEUTRALIZATION BASIN	1970-CURRENT	NR
12	OILY WASTE PIPELINE	1942-CURRENT	NR
13	OLD FIRE FIGHTING TRAINING AREAS	1973-1982	NR
14	MERCURY/OIL WASTE SPILL AREA	1977-CURRENT	21
15	OLD PESTICIDE AREA	1963-1964	NR
16	TRANSFORMER STORAGE YARD	1950?-CURRENT	NR

NOTE: NR - NOT REPORTED
(SITE/WASTE CHARACTERISTICS DID NOT WARRENT RANKING)

SOURCE: ESE (1986)



SOURCE: ESE, 1986

ECJORDANCO ENGINEERS & SCIENTISTS	LOCATION OF POTENTIAL CONTAMINATION SITES
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 1-1

2. **Site Investigation (SI)/Remedial Investigations (RI)**. These studies consist of on-site investigations, including physical and chemical analyses, to confirm or deny the existence of contamination, to quantify the extent of the problem, and to recommend necessary corrective measures if contamination is present.

3. **Feasibility Study (FS)**. This study involves the selection of remedial alternatives based on costs, environmental effects, and engineering responses.

4. **Remedial Action (RA)**. This study identifies and implements corrective actions to control and mitigate contamination.

Under the NIRP a PA has been completed for NAVSTA Mayport by Environmental Science and Engineering, Inc. (ESE) and a report was submitted to the Navy in May of 1986 (ESE, 1986). The report contains background information on chemicals which were used at the Navy facility and on sites were chemical wastes were known or suspected to have been stored or disposed. In addition, a Confirmation Study Ranking System (CSRS) was used to evaluate the severity of the potential problems at each site. Sixteen sites (Figure 1-1) were initially identified in the PA Report as areas where hazardous materials were suspected of having been disposed of or spilled. Based upon the results of the CSRS evaluation (Table 1-1) and on a review of the PA Report by the Florida Department of Environmental Regulation (FDER) and the U.S. Environmental Protection Agency, eight sites were selected by the Navy for an Expanded Site Investigation (ESI) (see Table 1-1).

On 9 September 1986, E.C. Jordan Co. (Jordan) was contracted by the U.S. Department of the Navy, Southern Division, Naval Facilities Engineering Command to develop a work plan and conduct the ESI. Upon review of existing information by Jordan and FDER comments to the PA (ESE, 1986), two additional sites (Site 13 - Old Fire Fighting Training Area and Site 16 - Transformer Storage Area) were included in the ESI by the Navy.

The ESI at NAVSTA Mayport was conducted from 8 September to 8 October 1987. An evaluation of the results of the field and laboratory investigations is presented in Section 3.0.

1.0 INTRODUCTION

In compliance with the Superfund Amendments and Reauthorization Act (SARA) and Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), a Naval Facilities Engineering Command Interim Policy, dated 23 April 1987, stated that all future Navy restoration program methodology and terminology will conform to that used by the U.S. Environmental Protection Agency (USEPA). In addition, to insure consistency among the agencies within the Department of Defense, the Navy has renamed its Navy Assessment and Control of Installation Pollutants (NACIP) program, the Navy Installation Restoration Program (NIRP). The discussion in this report conforms to this directive, and appropriate USEPA/NIRP terms are used. Corresponding NACIP project titles and USEPA/NIRP terms are illustrated as follows:

NACIP Term	USEPA/NIRP Term
Initial Assessment Study	Preliminary Assessment/ Site Inspection
Confirmation Study - Verification Step	Expanded Site Investigation
Confirmation Study - Characterization Step	Remedial Investigation
Feasibility Study	Feasibility Study
Remedial Measures	Remedial Actions

1.1 BACKGROUND

The U.S. Naval Station (NAVSTA) at Mayport, Florida is included in the Navy's Installation Restoration Program. NIRP was established to identify the presence of suspected contamination at Navy and Marine Corps lands resulting from past operations and, if needed, to institute corrective remedial actions. As with the Comprehensive Environmental Response, Compensation and Liability Act program, NIRP is implemented in four parts:

1. **Preliminary Assessment (PA)**. This study consists of a records search and personnel interviews to collect and evaluate evidence supporting the existence of any potential contamination problems.

1.2 PURPOSE

The purpose of the ESI is to:

1. determine whether or not specific hazardous wastes and constituents are present at the suspected waste disposal sites;

2. evaluate the types and concentrations of contaminants found and the potential for adverse impacts on human health and the environment; and

3. recommend whether or not to proceed with additional studies (e.g., remedial investigation, risk assessment, etc).

1.3 SCOPE OF WORK

The scope of work developed by Jordan and the Navy and reviewed by FDER and USEPA was completed as follows:

1. compiled data consisting of a review of the Preliminary Assessment Report (ESE, 1986) and Geraghty and Miller Reports (1983, 1984, 1985);

2. developed a health and safety program for field and laboratory work;

3. developed a detailed work plan;

4. conducted 7,300 linear feet of terrain conductivity survey at Sites 2, 4, 5 and 6;

5. conducted 30 test borings and installed 28 groundwater monitoring wells;

6. conducted in-situ permeability tests at monitoring wells;

7. conducted a level survey to establish vertical and horizontal control of monitoring wells with reference to a NAVSTA datum;

8. collected 4 surface water, 4 sediment, 30 groundwater, and 31 soil samples for laboratory chemical analyses;

9. analyzed soil and water samples for selected parameters which included USEPA Method 624 constituents (volatile organics), priority pollutant pesticides, priority pollutant base/neutral extractable compounds, priority pollutant acid extractable compounds, and EPTOX/total metals;

10. evaluated geologic and hydrogeologic information and laboratory analytical data; and

11. prepared a report to describe the methods, results, and conclusions of the ESI and to recommend the need for further study.

2.0 EXISTING SITE CONDITIONS

2.1 ENVIRONMENTAL SETTING

2.1.1 Geography and Land Use

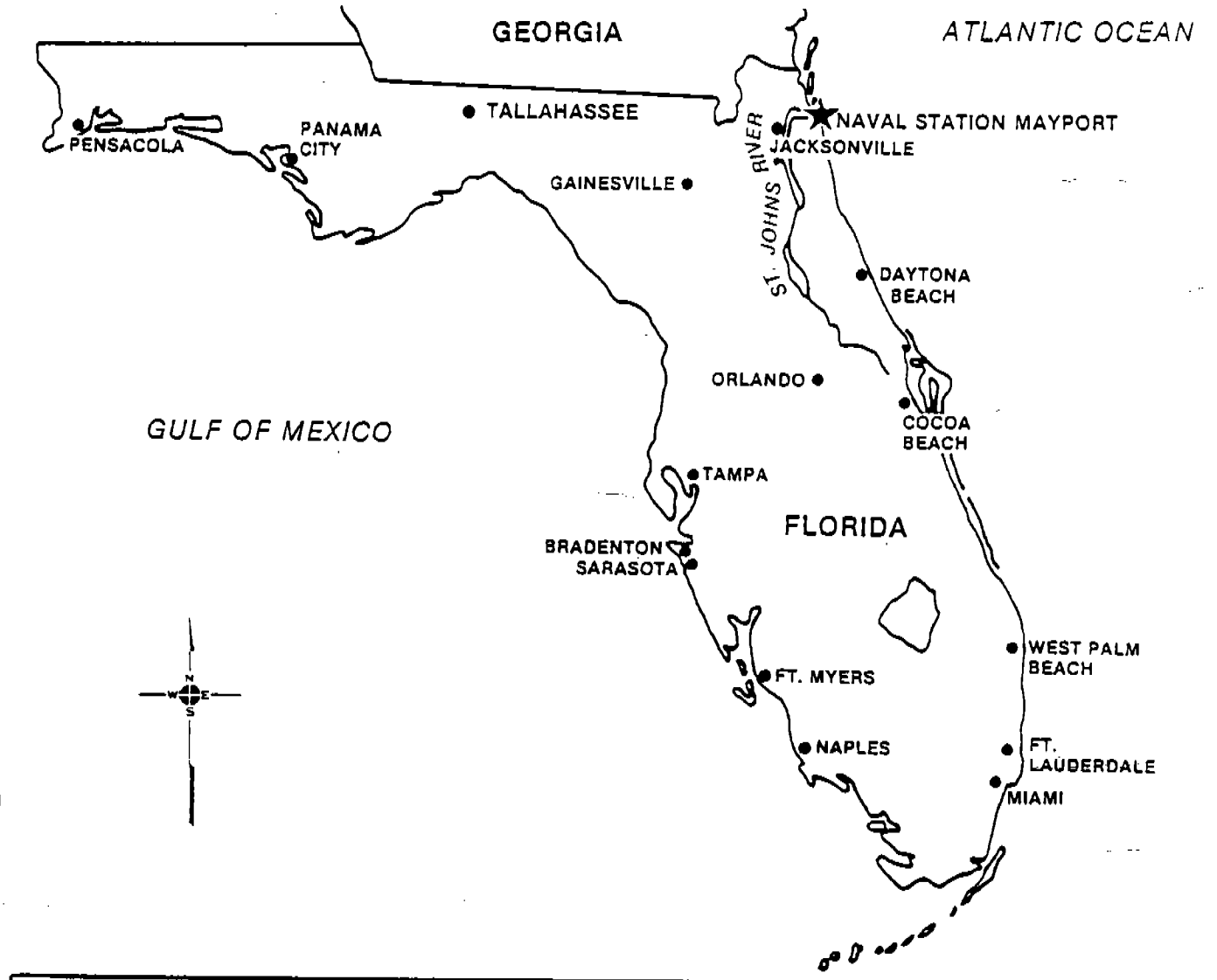
The U.S. Naval Station (NAVSTA) Mayport lies on the south bank of the St. Johns River at its confluence with the Atlantic Ocean (Figure 2-1). The station is approximately 15 miles east of the Jacksonville central business district and 5 miles north of the communities of Atlantic Beach, Neptune Beach and Jacksonville Beach. The station is bounded on the east by the Atlantic Ocean and on the north and northwest by the St. Johns River (with the exception of the area adjacent to the City of Mayport). Most of the station that is located west of Route A1A and the area south of the magazines is comprised of coastal marsh and tidal creeks.

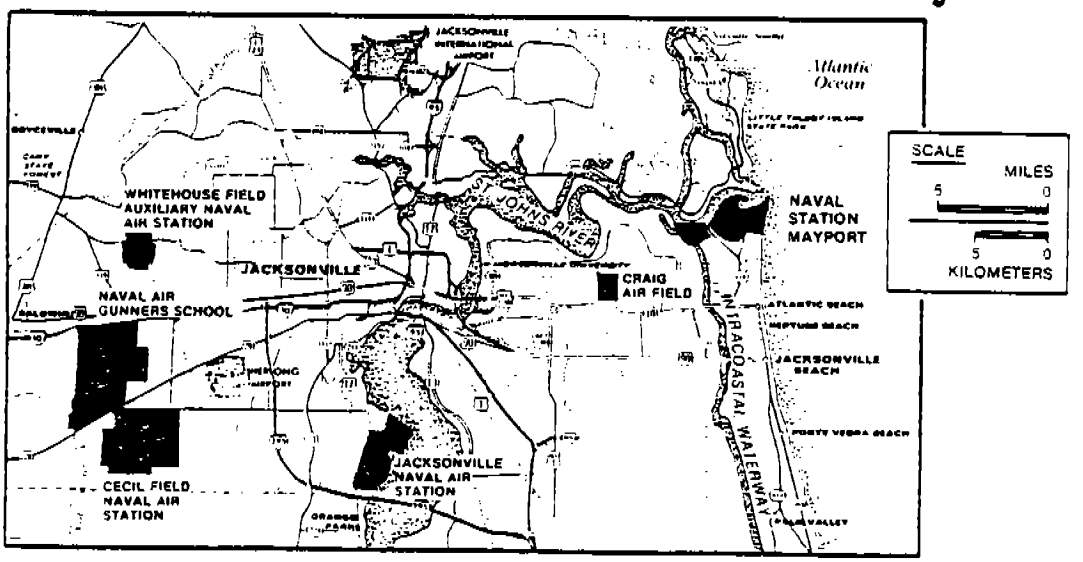
The installation encompasses 3,401 acres, of which approximately half (1,667 acres) is brackish marsh, sand spits, beach (vegetated and nonvegetated), and dredge spoil areas. Other land-use types on NAVSTA Mayport include regularly mowed lawns, roadsides, and a golf course (527 acres); irregularly mowed road and runway shoulders (420 acres); buildings and pavement (387 acres); and managed forest (285 acres). The station also has one 20 acre freshwater lake, Lake Wonderwood.

2.1.2 Physiography and Topography

NAVSTA Mayport is situated in the southeastern Coastal Plain physiographic province. The topography of the Coastal Plain in northeastern Florida is controlled by a series of ancient marine terraces which formed during the Pleistocene when sea level was higher than at present (Leve, 1966). Seven terraces are located in northeast Florida. Moving from west to east and decreasing in elevation these terraces are the Coharie, Sunderland, Wicomico, Penholoway, Talbot, Pamlico and Silver Bluff terraces. NAVSTA Mayport lies upon remnants of the Pamlico and the Silver Bluff terraces which form a low coastal plain throughout most of the central and eastern part of northeast Florida. Elevations of the plain range from slightly above mean sea level to 25 feet above mean sea level (MSL). These original terraces have been modified by sand dune development, stream erosion, and especially by the dredging and filling activities at NAVSTA Mayport.

The land surface exhibits little relief and elevations on station range from about 0 to 30 feet above MSL. Many areas at NAVSTA Mayport have been filled with dredge spoil resulting





FROM: MAYPORT IAS, ESE 1986

E.C. JORDAN CO. ENGINEERS & SCIENTISTS	LOCATION MAP OF NAVAL STATION MAYPORT, FL
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 2-1

from the construction and maintenance of the turning basin. The elevations of the runways are higher than most of the surrounding land to provide drainage, and they serve as a drainage divide between the southeast and northwest areas of the station.

2.1.3 Climate

The climate at NAVSTA Mayport is subtropical, with extensive marine influence. Rainfall in the vicinity of NAVSTA Mayport averages 50.8 inches annually. The months of highest rainfall are June through September, with average monthly precipitation ranging from 5.28 to 7.19 inches. The months with lowest rainfall are November through January, with mean monthly rainfall amounts ranging from 1.95 to 2.99 inches.

Precipitation during the period of April through September usually occurs as thunderstorms, with large amounts of rain falling in a short period of time. Because of the station's proximity to the Atlantic Ocean, tropical storms are not unusual. Tropical storms usually bring high winds and prolonged rainfall and can quickly result in flooding of parts of the station. The mean annual lake evaporation rate in the area of NAVSTA Mayport is in excess of 50 inches.

July and August are the warmest months at NAVSTA Mayport, with an average temperature of 80.8 degrees Fahrenheit. January has the lowest temperature, with a monthly average of 54.7 degrees Fahrenheit. The mean annual temperature is 68.8 degrees Fahrenheit. The temperatures are moderated by the marine influence.

2.1.4 Soils

In the vicinity of NAVSTA Mayport soils consist predominantly of sand, shells, and clay, with organic peats in the salt marsh areas. The western area of the station has been built up by dredge spoil material from the St. Johns River and the Mayport Basin. The dredge spoil materials range from sand to silt and consolidation occurs slowly.

In accordance with the USDA, Soil Conservation Service (SCS) survey (SCS, 1978) for the City of Jacksonville, Duval County, Florida, 11 soil types are recognized in the immediate vicinity of NAVSTA Mayport. These soils can be placed into three groups:

1. soils of the sand ridges;
2. soils of the tidal marsh; and
3. soils of the flatwoods.

Soils of the sand ridges are sandy to a depth of 80 inches or more and are well-drained, occurring on nearly level to moderately steep terrain. At NAVSTA Mayport these soils cover approximately two thirds of the station and have been filled or reworked by dredging and earth moving operations. At the station sand ridge soils are represented by Aquic Quartzipsamments; Arents and sanitary landfill Arents; and several soil series comprised of fine sand including Beach, Mandarin fine sand, Fripp fine sand, and Canaveral fine sand.

Aquic Quartzipsamments are sandy soils which are variable in composition. Thicknesses range from 2 to 12 feet and under natural conditions these soils have very rapid permeabilities. Arents soils are nearly level, poorly drained soils that have been altered by earth-moving operations. These soils are typically 2 to 20 feet thick, variable in permeability, and consist of mixed soil material, fine sand, sandy loam and sandy clay loam. Sanitary landfill Arents soils are similar to Arents but are distinguished by the fact that they overlie sanitary landfill cells.

Beach soils consist of narrow strips of nearly level sand along the Atlantic Ocean. Compositionally they are a mixture of quartz sand, heavy minerals (i.e., rutile and ilmenite), and seashell fragments. The Mandarin fine sand is a nearly level, somewhat poorly drained soil found on narrow to broad ridges slightly higher than the adjacent flatwoods. The soil is composed of fine sand with organic coatings and exhibits moderate to rapid permeabilities (ESE, 1986).

Fripp fine sand is gently sloping to sloping, excessively drained soil on narrow to broad ridges along the Atlantic Coast. Generally the surface 6 inches is fine sand which changes to fine sand containing horizontal bands of black, heavy minerals below 6 inches. Permeability is rapid throughout the soil. Canaveral fine sand is a nearly level to gently sloping, well to poorly drained soil on a broad ridge near the Atlantic Coast. Permeability is very rapid and the soil consists initial of fine sand which grades to a mix of fine sand and shell fragments.

Essentially, soils of the tidal marsh make up the remainder of the soils on NAVSTA Mayport and generally occur in broad expanses of tidal marsh. On NAVSTA these soils are represented by the Tisonia mucky peat which is underlain by clay. Soils are nearly level, poorly drained, and permeability is rapid in the peat and very slow in the clay.

Soils of the flatwoods are sparse at NAVSTA Mayport and are represented by the Wesconnet fine sand found within the tidal marshes. This soil occurs on nearly level to gently sloping

terrain, is very poorly drained and is typically composed of a thin black, fine sand layer underlain by fine sand. Permeabilities are moderate to rapid (ESE, 1986).

2.2 REGIONAL GEOLOGY

In northeastern Florida, the distribution of sediments is controlled by the Peninsular Arch and the Southeast Georgia Embayment. NAVSTA Mayport lies at the boundary of this embayment. More than 1,500 feet of Eocene and younger age sediments were deposited in the region underlying the station.

The underlying geologic sequence consists of flat-lying unconsolidated deposits of sands, silts and clays overlying a thick sequence of marine carbonates (Figure 2-2). Essentially, three discernible geologic units underlie the station:

1. surficial deposits which form a unit approximately 100 feet thick and are of late Miocene to Recent age;
2. Hawthorn Formation which is approximately 300 feet thick and of middle Miocene age; and
3. marine carbonate sequences of the Floridan aquifer which are of Eocene age and comprise a unit greater than 1,000 feet thick.

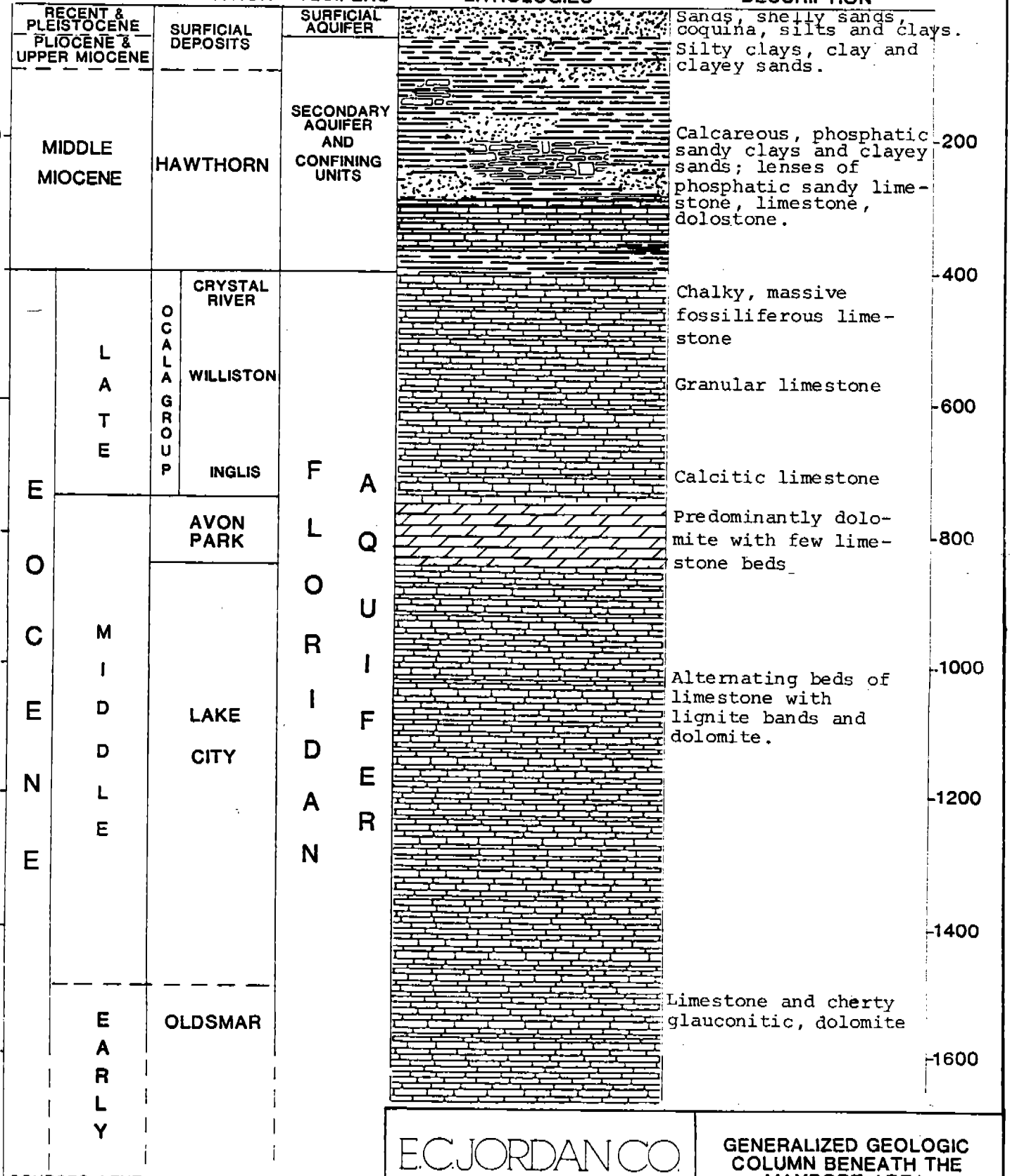
These geologic units are described in more detail in the following sections.

2.2.1 Surficial Deposits

The surficial deposits consist of sediments of upper Miocene age and younger. These deposits can be divided into undifferentiated sediments of Pleistocene and Recent age and sediments of upper Miocene and Pliocene age. These sediments were deposited in lagoon and estuarine environments. The Pleistocene and Recent age sediments extend from the surface to about 40 feet below land surface (BLS) and comprise the shallow aquifer. These highly variable sediments include sands, shelly sands, coquina, silts, clay, and shell beds. The Upper Miocene and Pliocene sediments consist of silty clays, clay, and clayey sands. The contact between the Upper Miocene and Pliocene deposits and the underlying Hawthorn Formation is an unconformity marked by a coarse phosphatic sand and gravel bed (Leve, 1966).

2.2.2 Hawthorn Formation

Lithologically the Hawthorn Formation is quite variable and consists of calcareous, phosphatic sandy clays and clayey sands interbedded with thin discontinuous lenses of phosphatic



SOURCES: LEVE, 1966, GERAGHTY & MILLER, 1983, ESE, 1986.

E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

GENERALIZED GEOLOGIC COLUMN BENEATH THE MAYPORT AREA

U.S. DEPARTMENT OF THE NAVY

NIRP EXPANDED SITE INVESTIGATION

U.S. NAVAL STATION MAYPORT, FLORIDA

5097-06 FIGURE 2-2

sand, phosphatic sandy limestone, limestone, and dolostones. The limestone and dolostone lenses are thicker and more prevalent near the base of the Hawthorn. The permeable sand and limestone layers within the Hawthorn's confining clays form the secondary artesian aquifer. The Hawthorn Formation serves as a confining layer which separates the shallow aquifer from the underlying Floridan aquifer. It lies unconformably above the Ocala Group (Crystal River Formation).

2.2.3 Marine Carbonates (Floridan Aquifer)

The marine carbonate sequence which makes up the Floridan aquifer beneath NAVSTA Mayport consists of the following formations in descending order:

1. the Ocala Group which consists of the Crystal River Formation, the Williston Formation and the Inglis Formation;
2. the Avon Park Limestone;
3. the Lake City Limestone; and
4. the Oldsmar Limestone.

These formations range in age from the late Eocene Crystal River Formation to the early Eocene Oldsmar Limestone.

The Crystal River Formation is a white to cream, chalky, massive fossiliferous limestone and is the youngest Eocene formation underlying NAVSTA Mayport. The Williston Formation, which lies conformably between the overlying Crystal River Formation and the underlying Inglis Formation, is a tan to buff granular limestone. The Inglis Formation, of early late Eocene age, is lithologically a tan to buff calcitic limestone which is very similar to the Williston Formation (Leve, 1966).

The Avon Park Limestone of late middle Eocene unconformably underlies the Ocala Group. It consists of alternating beds of tan, hard, massive dolomite and brown to cream, granular, calcitic limestone. The Lake City Limestone unconformably underlies the Avon Park Limestone and is early middle Eocene in age. Lithologically it consists of alternating beds of white to brown, chalky to granular limestone with lignite bands and gray to tan dolomite. Below the Lake City Limestone is the Oldsmar Limestone of early Eocene age. It consists of a cream to brown, soft, granular limestone and cherty, glauconitic, massive to finely crystalline dolomite (Leve, 1966).

2.3 REGIONAL HYDROLOGY

2.3.1 Surface Water

NAVSTA Mayport is situated at the mouth of the St. Johns River, on the south bank (Figure 2-3). The facility is bordered on the east by the Atlantic Ocean and to the north and northwest by the St. Johns River. To the south and southwest an extensive tract of tidal marsh exists within the boundaries of the facility.

The facility has one man-made, freshwater lake, Lake Wonderwood, located in the on-base housing area. Lake Wonderwood is approximately 20 acres in size and was created to provide fill for the adjacent housing area. The lake has a depth of approximately 20 feet and is used by facility personnel as a recreation source.

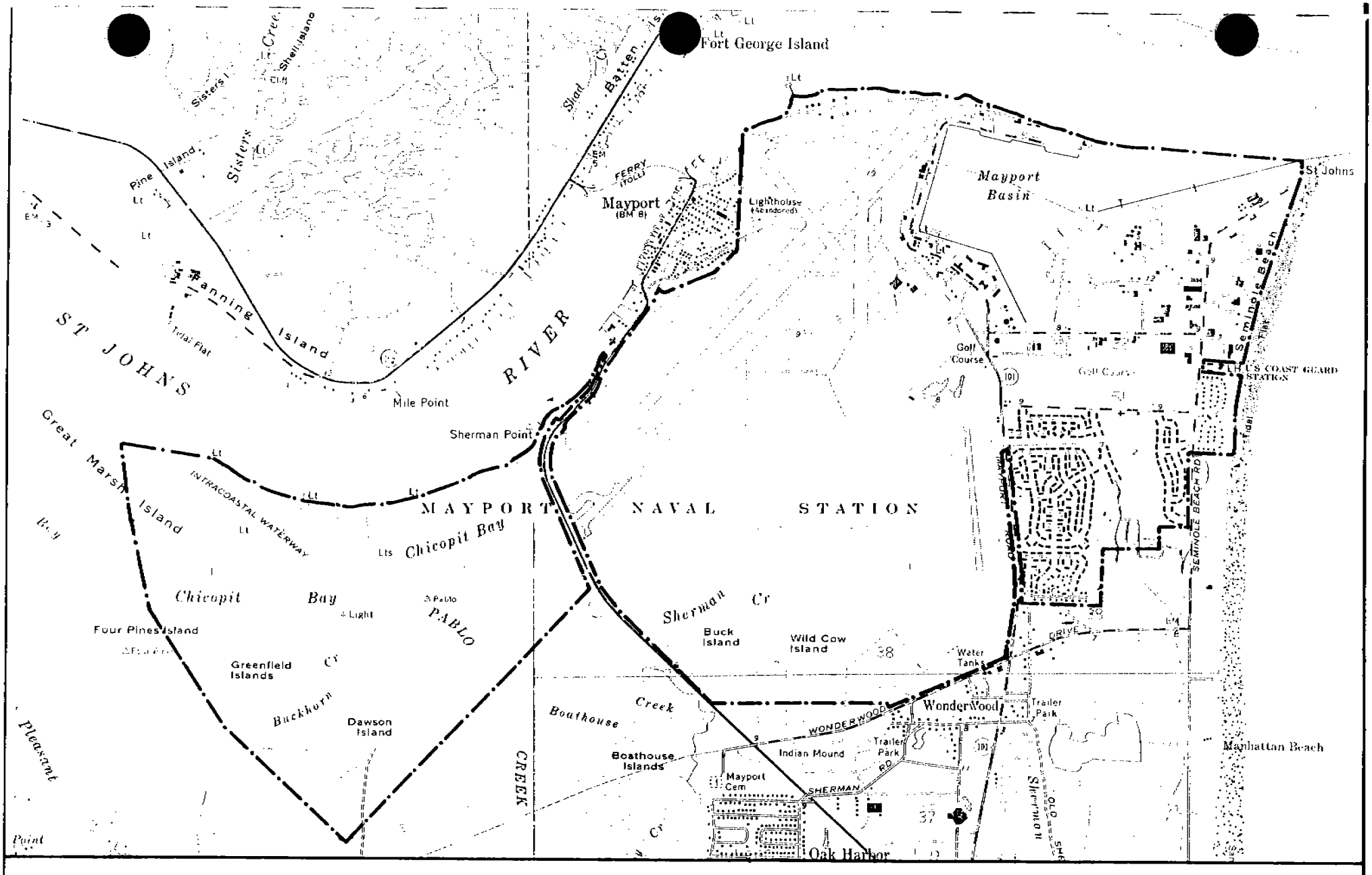
The other dominant surface water feature on base is the turning basin, i.e., Mayport Basin. The turning basin was constructed during the early 1940s through dredging the eastern portion of Ribault Bay. Dredge spoil was pumped behind the west bulkhead to fill the old bay in order to elevate the land surface. Subsequent maintenance dredge spoil has been used to fill in other areas of the facility. Originally Mayport Basin was dredged to a depth of 29 feet. In 1952 the basin was deepened to a depth of 40 feet to provide access to larger ships.

Surface runoff from NAVSTA Mayport enters Mayport Basin, the St. Johns River, Lake Wonderwood, Sherman Creek, Pablo Creek, Chicopit Bay, and the Atlantic Ocean. The runways provide an artificial drainage divide between the northwest and southeast portions of the facility. To the north, soils along the St. Johns River tend to be very sandy and have high infiltration capacities. In this area there exists little surface runoff and few drainage features are evident.

To the south of the runways, soils are underlain by less permeable deposits and the topography is flatter and lower in elevation. The predominate drainage feature in this area is Sherman Creek.

2.3.2 Surficial Aquifer

The surficial aquifer extends to a depth of approximately 70 feet below land surface (Causey and Phelps, 1978; Franks, 1980). It is comprised of unconsolidated deposits of sand, shells and clay which vary in lithology, thickness, and permeability throughout the facility. Causey and Phelps (1978) report that the surficial aquifer over most of Duval County is



SCALE IN FEET

0 2500 5000

INSTALLATION BOUNDARY

N

SOURCE: U.S.G.S. 7.5 MINUTE QUADRANGLE MAYPORT, FL., PHOTOREVISED 1982, AND U.S.G.S. 7.5 MINUTE QUADRANGLE JACKSONVILLE BEACH, FL., PHOTOREVISED 1981.

E.C JORDAN CO. ENGINEERS & SCIENTISTS	SITE LOCATION MAP
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 2-3

composed of an upper and a lower zone which are separated by deposits of lower permeability at a depth from 25 to 50 feet below land surface. Franks (1980), however, found no evidence of this confining bed in the area east of Jacksonville Shipyard.

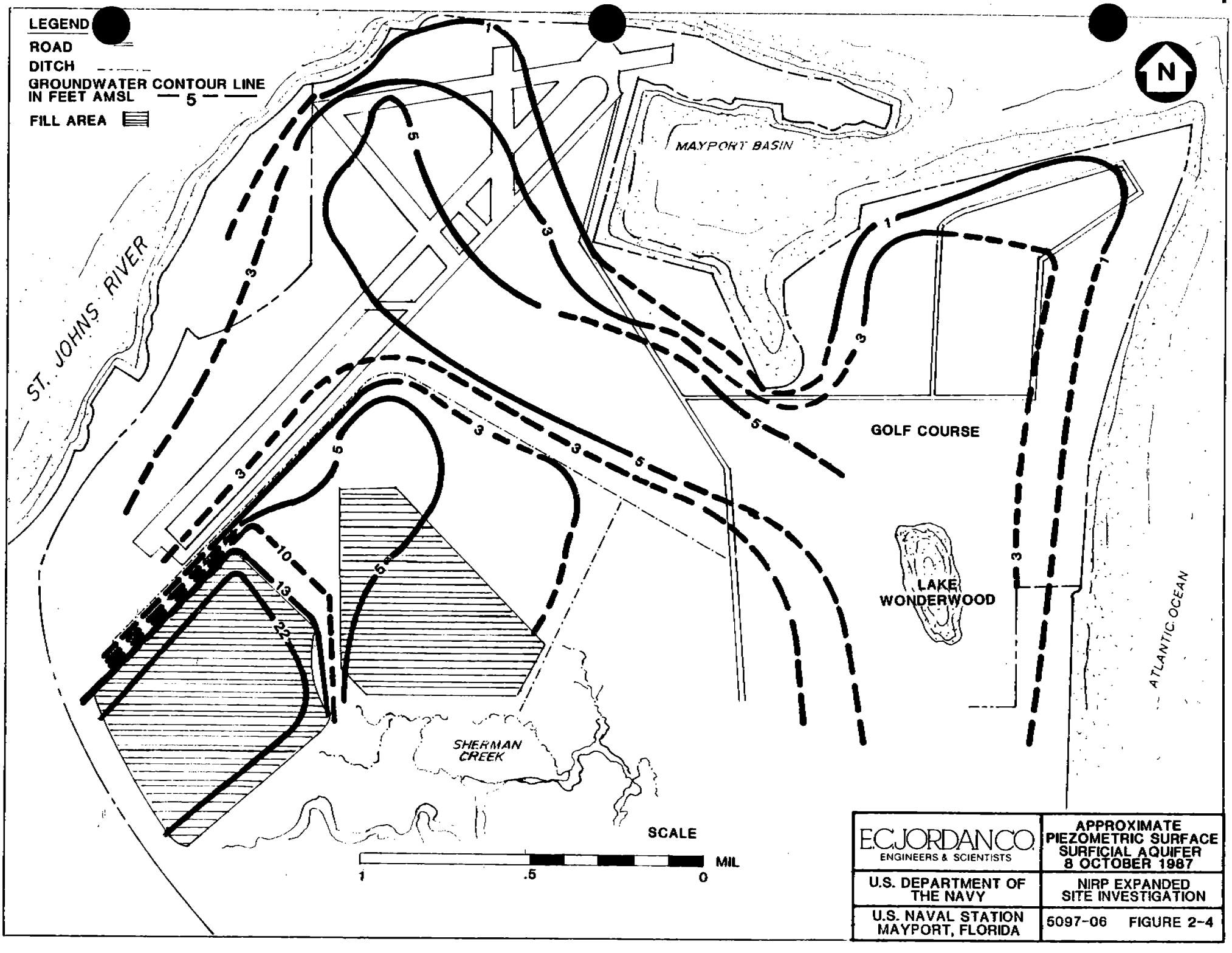
Throughout much of NAVSTA Mayport it is anticipated that groundwater flow is radial towards the major surface water features (Figure 2-4). These water bodies include the Atlantic Ocean to the east, the St. Johns River to the north and west, and Sherman Creek to the south. This general pattern is disrupted in the vicinity of the dredge spoil area. Fill activities in the past have resulted in a topographic high in the northern one-third of the northeastern dredge spoil areas. Groundwater elevations measured during this study indicate groundwater mounding is occurring under this topographic high. During the field studies for the ESI, the southwestern dredge spoil areas was receiving dredge material. This condition also produced a groundwater mound as seen in the water level measurements in monitoring well MPT-2-3 (Appendix A-7). A third complicating factor in this area is the peripheral drainage ditch. It is anticipated that the ditch provides a discharge point and, thus, alters flow patterns.

Franks (1980) estimated the transmissivity of the primary water-bearing sand and shell zone (35 to 55 feet BLS) of the surficial aquifer to be 2,400 ft^2/day (hydraulic conductivity equal to 34 ft/day). Laboratory testing of a near surface Shelby tube sample (8 to 10 feet BLS), obtained from the landfill area, yielded a hydraulic conductivity of 3.8 ft/day (Geraghty and Miller, 1984). Results from single-hole permeability tests conducted during the present study indicate that the hydraulic conductivity throughout much of the facility exceeds 2.8 ft/day (the upper limit of the test procedure).

Geraghty and Miller (1984), citing the work of Causey and Phelps (1978), report that groundwater in the surficial aquifer at NAVSTA Mayport is fresh in the upper part but becomes brackish below a depth of 40 feet (Table 2-1). This was also confirmed by Frazee and McClaugherty (1979) in other areas near NAVSTA Mayport. Frazee & McClaugherty (1979) found chloride concentration to be less than 250 mg/l in samples obtained near the water table. At depths greater than 50 feet, the chloride concentration exceeded 4,000 mg/l. This condition should be more pronounced near the coast and the St. Johns River.

2.3.3 Secondary Artesian Aquifer

The secondary artesian aquifer consists of sand and limestone lenses interbedded in the clayey sands and sandy clays of the Hawthorn Formation and is situated between the surficial



E.C JORDAN CO. ENGINEERS & SCIENTISTS	APPROXIMATE PIEZOMETRIC SURFACE SURFICIAL AQUIFER 8 OCTOBER 1987
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 2-4

TABLE 2-1
WATER QUALITY IN THE SURFICIAL AQUIFER
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

PARAMETER	WELL DS-256	WELL DS-263
WELL DEPTH (FT)	63	14
CASING DEPTH (FT)	51	10
SAMPLING DATE	7/7/76	7/8/76
TEMPERATURE (CELCIUS)	22.5	23
pH	7.3	6.8
SPECIFIC CONDUCTANCE (umhos/cm)	2250	750
CHLORIDE (mg/L)	452	18
HARDNESS, AS CACO3 (mg/L)	290	424
IRON (mg/L)	0.09	0.34
CALCIUM (mg/L)	74	-
MAGNESIUM (mg/L)	21	-
SODIUM (mg/L)	420	-
POTASSIUIM (mg/L)	18	-
SULFATE (mg/L)	16	-
STRONTIUM (mg/L)	0.5	-

SOURCE: CAUSEY AND PHELPS (1978)
NOTE: SEE FIGURE 2-5 FOR WELL LOCATIONS.

aquifer and the underlying Floridan aquifer. Spechler (1982) noted that the most productive zone, a limestone layer in the upper part of the Hawthorn, is notably absent in the Mayport area. Water levels in the secondary artesian aquifer indicate that groundwater flow in the Mayport area is towards the northeast (Fairchild, 1972). Fairchild (1972) presents data on water quality for the secondary artesian aquifer (Table 2-2). In general, water quality is within state and federal standards.

2.3.4 Floridan Aquifer

The Floridan aquifer system is the principal source of fresh water in northeast Florida. It is comprised in part or all of the Oldsmar, Lake City and Avon Park Limestones, the Ocala Group, and a few discontinuous thin water bearing zones in the lower portion of the Hawthorn Formation.

The Ocala Group is a homogeneous sequence of permeable, hydraulically connected, marine limestone beds which contain very few hard dolomite or limestone beds which restrict the vertical movement of water. The Avon Park Limestone consists almost entirely of hard, relatively impermeable, dolomite confining beds and soft, permeable limestone and dolomite water-bearing zones.

The top of the Floridan aquifer occurs at a depth of about 400 feet BLS at NAVSTA Mayport. Published transmissivities of the Floridan aquifer in eastern Duval County range from approximately 85,000 to 160,000 gpd/ft (Leve, 1968).

Geraghty and Miller (1983) report that groundwater in the Floridan aquifer in the vicinity of Mayport is moving southward toward areas of heavy pumpage along the coast. Floridan wells, in the vicinity of NAVSTA Mayport, are under sufficient artesian pressure to flow at the surface. This results in upward hydraulic gradient between the Floridan and surficial aquifer.

Water quality in the Floridan aquifer is potable in the Mayport area, as shown in Table 2-3. The concentration of total dissolved solids is approximately 400 mg/l and the concentration of chlorides is around 25 mg/l.

2.4 POTENTIAL RECEPTORS

2.4.1 Water Supply Wells

The shallow groundwater and the surface water emanating downgradient from NAVSTA Mayport are both potential pathways

TABLE 2-2
WATER QUALITY IN THE SECONDARY ARTESIAN AQUIFER
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

PARAMETER	WELL DS-119A
WELL DEPTH (FT)	162
CASING DEPTH (FT)	?
SAMPLING DATE	9/26/68
pH	8.1
SPECIFIC CONDUCTANCE (umhos/cm)	442
CHLORIDE (mg/L)	25
HARDNESS, AS CACO3 (mg/L)	182
CALCIUM (mg/L)	46
MAGNESIUM (mg/L)	16
SODIUM (mg/L)	25
POTASSIUIM (mg/L)	4.7
SULFATE (mg/L)	14
SILICA (mg/L)	55
BICARBONATE (mg/L)	228
FLUORIDE (mg/L)	0.9
NITRATE (mg/L)	0.3
PHOSPHATE (mg/L)	0
DISSOLVED SOLIDS (mg/L)	299

SOURCE: FAIRCHILD (1972)
NOTE: SEE FIGURE 2-5 FOR WELL LOCATIONS.

TABLE 2-3
WATER QUALITY IN THE FLORIDAN AQUIFER
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

PARAMETER	WELL N-2	WELL N-4
WELL DEPTH (FT)	1000	1000
CASING DEPTH (FT)	435	419
SAMPLING DATE	10/12/61	5/31/79
pH	7	7.6
ALKALINITY AS CaCO3 (mg/L)	152	138
BICARBONATE (mg/L)	-	138
TOTAL HARDNESS as CaCO3 (mg/L)	196	280
CALCIUM HARDNESS (mg/L)	-	182
MAGNESIUM HARDNESS (mg/L)	-	98
NON-CARBONATE HARDNESS (mg/L)	48	142
TOTAL SOLIDS (mg/L)	444	-
DISSOLVED SOLIDS (mg/L)	-	394
SUSPENDED SOLIDS (mg/L)	-	11
CALCIUM (mg/L)	35.3	72.83
CHLORIDE (mg/L)	21.3	22.2
IRON (mg/L)	0.2	0.4
MAGNESIUM (mg/L)	26.2	23.71
NITRATE (mg/L)	-	0.04
POTASSIUIM (mg/L)	-	2.53
SODIUM (mg/L)	-	15.14
SODIUM & POTASSIUM AS Na (mg/L)	33.5	-
SILICA (mg/L)	1	22.2
SULFATE (mg/L)	74.2	129

SOURCE: GERAGHTY & MILLER (1984)
NOTE: SEE FIGURE 2-5 FOR WELL LOCATIONS.

for contaminant migration. However, neither of these are utilized as sources of potable water because of undesirable water quality.

The deeper Floridan aquifer is overlain by approximately 300 feet of the Hawthorn Formation which acts as a confining layer and offers considerable protection from contamination. Protection is further enhanced by an upward hydraulic gradient from the Floridan to the surficial aquifer.

There are several Floridan aquifer wells located on and downgradient of NAVSTA Mayport (Figure 2-5) which are used as sources of potable water. Although the potential for contamination of the Floridan aquifer is minimal, three things should be considered:

1. Improper well construction could allow contaminated surface and/or groundwater to travel down into the Floridan aquifer.

2. Pumping for a long period of time, particularly excessive pumping, could reverse the present gradient and allow downward migration of contaminated water into the Floridan.

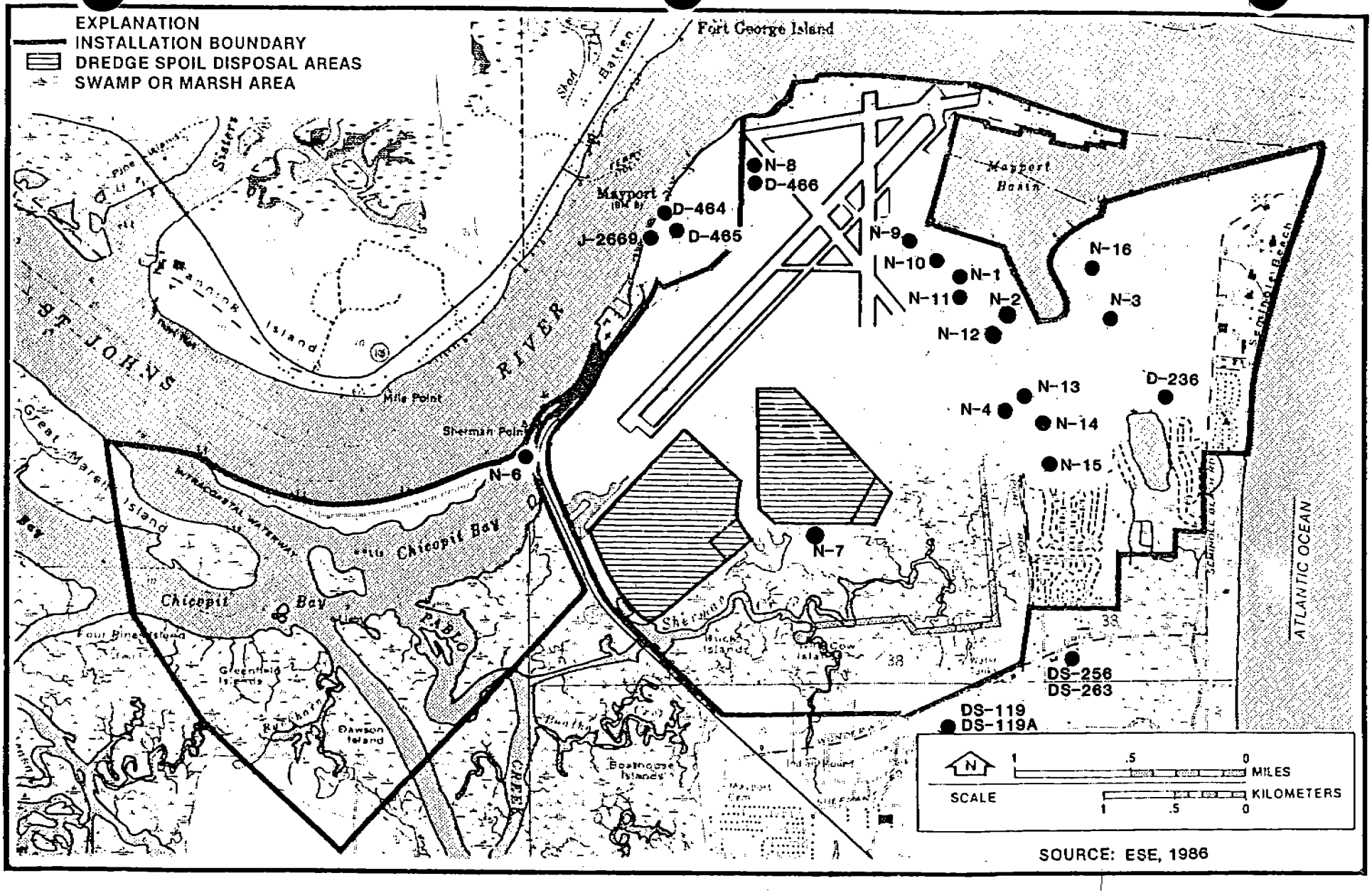
3. Some downward migration does occur over very long periods of time even through confining layers.

2.4.2 Flora/Fauna

The primary potential receptors near NAVSTA Mayport are plants and animals utilizing surface waters. Although these plants and animals are the primary contaminant receptors, humans who consume these organisms as a food source are also susceptible.

The coastal marsh vegetation is composed primarily of glasswort, cordgrass, and needlerush, with false willow, wax myrtle, and bluestem grass in the transitional and spoil bank areas. Common fauna are marsh rabbit, raccoon, laughing gull, ring-billed gull, herring gull, boat-tailed grackle, red-winged blackbird, tree swallow, and the killdeer. Several types of marine invertebrates are also present.

The dune and beach communities commonly have numerous live oaks and other coastal hammock species, as well as the early successional species, including railroad vine, ragweed, sea oats, groundsel-tree, wax myrtle, greenbriar, and various native grasses. Common fauna are the semipalmated plover, killdeer, ruddy turnstone, herring gull, ring-billed gull, laughing gull, royal tern, and the Caspian tern.



SOURCE: ESE, 1986

E.C JORDAN CO. ENGINEERS & SCIENTISTS	LOCATION OF PRODUCTION WELLS NEAR NAVSTA MAYPORT
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 2-5

The most common trees in the disturbed lands on station are live oak, cabbage palm, and slash pine. Various shrubs, grasses, and trees have been planted for landscaping purposes. Wildlife species commonly present are mourning dove, rock dove, cattle egret, meadowlark, blue jay, fish crow, northern mockingbird, American robin, European starling, house sparrow, and gray squirrel.

Coastal hammock areas have a more diversified tree population which includes cabbage palm, live oak, hickory, American holly, sweet bay magnolia, red maple, and red cedar. Other flora include the wax myrtle, dahoon, pokeweed, devils-walkingstick, saw palmetto, greenbriar, muscadive, poison ivy, pennywort, sedges, and cinnamon fern. These areas are important to wildlife species throughout the year, but are even more so during migration periods. Birds commonly present are the red-billed woodpecker, common flicker, Carolina wren, blue jay, gray catbird, and northern mockingbird.

There are several endangered, threatened, and rare species of animals present on and around NAVSTA Mayport. These are the shortnose sturgeon, the eastern indigo snake, the Atlantic loggerhead turtle, the Arctic peregrine falcon, the bald eagle, the wood stork, the least tern, the southeastern kestrel, and the West Indian manatee. The American alligator is also commonly found and is classified as a species of special concern. Numerous fish, crabs, and shrimp also occur in the surface waters. These are food sources for humans and thus are of particular concern with regard to contaminant levels.

SECTION 3

3.0 EXPANDED SITE INVESTIGATION

The Expanded Site Investigation (ESI) for NAVSTA Mayport included the collection and evaluation of hydrogeologic and chemical data obtained at 10 sites. The methods of investigation and results are presented in this section of the report.

3.1 EXISTING DATA COMPILATION

Previous studies conducted by Environmental Science and Engineering, Inc. (1986) and Geraghty and Miller, Inc. (1983, 1984, 1985) were reviewed prior to the preparation of the ESI work plan. Existing water quality data are presented in Appendix A-1. Additional sources of regional geologic and hydrogeology information also were reviewed. These sources included publications by the U.S. Geologic Survey, Florida Bureau of Geology, and St. Johns River Water Management District.

3.2 SUMMARY OF FIELD EXPLORATION AND SAMPLING PROGRAMS

The exploration and sampling program at NAVSTA Mayport consisted of a terrain conductivity survey, soil borings, installation of monitoring wells, collection of soil and water samples, laboratory chemical analyses, permeability testing, and a level survey of monitoring wells. Borings, sampling, and testing procedures were conducted in accordance with the protocols outlined in the approved Work Plan. Field sampling techniques and sample tracking records are presented in Appendix A-2 and A-3, respectively. Summaries of the exploration and analytical programs completed during the ESI for Sites 1, 2, 4, 5, 6, 8, 9, 13, 14, and 16 are presented in Tables 3-1 and 3-2, respectively. A more detailed discussion of these programs is presented for each site in the following discussion.

3.2.1 Terrain Conductivity Survey

E.C. Jordan Co. conducted a terrain conductivity survey at the Naval Station Mayport on 9 September 1987. The purpose of this survey was to detect any high conductivity leachate plumes which might be migrating from the landfills and to determine whether the shallow aquifer is being intercepted by the drainage ditch located between the landfills and outlying areas (Figure 3-1).

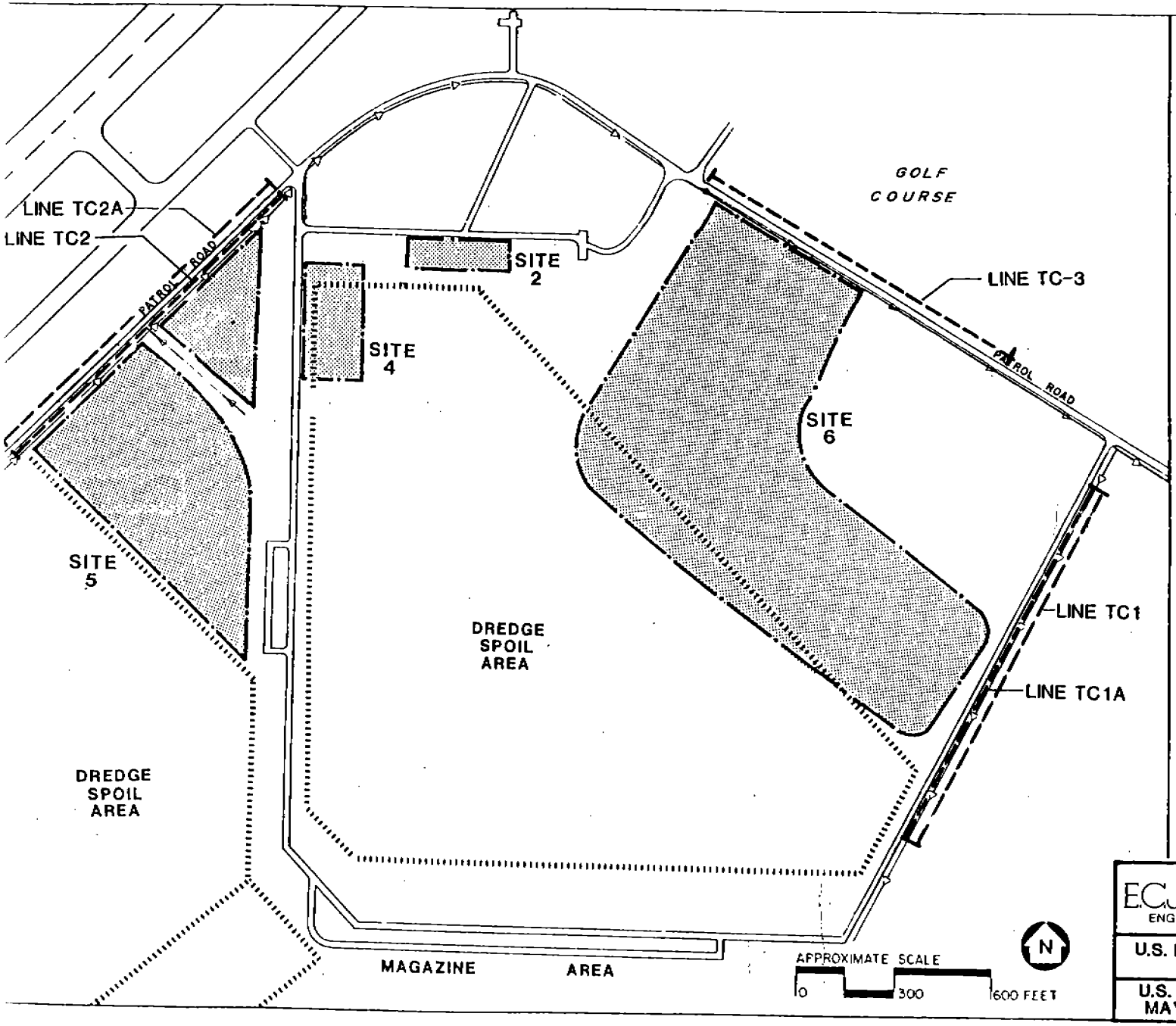
TABLE 3-1
SUMMARY OF EXPLORATION PROGRAMS
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

METHOD OF INVESTIGATION	SITE 1	SITE 2,4,5 & 6	SITE 8	SITE 9	SITE 13	SITE 14	SITE 16	TOTAL
TERRAIN CONDUCTIVITY	NO	YES	NO	NO	NO	NO	NO	
SOIL BORINGS	3	14	3	3	3	2	2	30
MONITORING WELLS	3	14	3	3	3	2	0	28
SOIL SAMPLES	3	11	3	3	3	2	2	27
GROUND WATER SAMPLES	3	16	3	3	3	2	0	30
SURFACE WATER/SEDIMENT SAMPLES	0	4	0	0	0	0	0	4

TABLE 3-2
SUMMARY OF ANALYTICAL PROGRAM
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

LOCATION	MEDIA	PP B/N	PP A	PP PEST	624	EPTOX METALS	TOTAL CADMIUM	TOTAL CHROMIUM	TOTAL LEAD	TOTAL MERCURY
SITE 1	SOIL	3	3	3	3	3				
	GROUNDWATER	3	3	3	3		3	3	3	3
SITES 2,4,5 AND 6	SOIL	12	12	12	12	12				
	GROUNDWATER	16	16	16	16		16	16	16	16
	SEDIMENT/ SURFACE WATER	4	4	4	4	4	4	4	4	4
SITE 8	SOIL	3	3	3	3	3				
	GROUNDWATER	3	3	3	3		3	3	3	3
SITE 9	SOIL	3	3	3	3	3				
	GROUNDWATER	3	3	3	3		3	3	3	3
SITE 13	SOIL	3	3	3	3	3				
	GROUNDWATER	3	3	3	3		3	3	3	3
SITE 14	SOIL	2	2	2	2	2				
	GROUNDWATER	2	2	2	2		2	2	2	2
SITE 16	SOIL	2	2	2	2	2				
SUBTOTAL:		62	62	62	62	32	34	34	34	34
DUPLICATES	SOIL	3	3	3	3	3				
	GROUNDWATER	3	3	3	3		3	3	3	3
	SEDIMENT/SW	1	1	1	1	1	1	1	1	1
TRIP BLANKS										
FIELD BLANKS		2	2	2	2	2	2	2	2	2
TOTAL:		71	71	71	71	38	40	40	40	40

NOTES:
- PP B/N — PRIORITY POLLUTANT BASE/NEUTRAL EXTRACTABLE COMPOUNDS
- PP A — PRIORITY POLLUTANT ACID EXTRACTABLE COMPOUNDS
- PP PEST — PRIORITY POLLUTANT PESTICIDES AND PCBs
- 624 — EPA METHOD 624 COMPOUNDS
- METAL — SOILS EPTOX METALS; WATER - TOTAL METALS

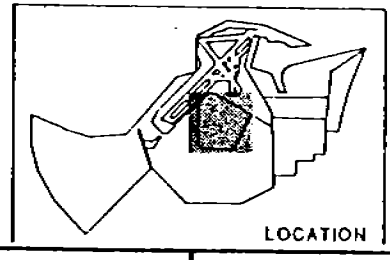


LEGEND

- TERRAIN CONDUCTIVITY SURVEY LINE LOCATION
- STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW
- BERMED SOIL 25' ABOVE GROUND SURFACE CONTAINING DREDGE SOIL
- SITE LOCATION AREA

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,66 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



E.C JORDAN CO. ENGINEERS & SCIENTISTS	LOCATION OF TERRAIN CONDUCTIVITY TRANSECTS
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-1

The survey was conducted in three areas (see Figure 3-1) and consisted of five traverses on which measurements were taken every 20 feet. The instrument used for this work was a Geonics EM 31 Terrain Conductivity Meter. The instrument measures the conductivity of underlying soil materials to a depth of approximately 6 meters (20 feet). A total of 7,300 feet of conductivity profiling was completed during this study. A discussion of the results and individual profiles as well as the conclusions and recommendations are given in Section 3.4.2. Additional information on the principles and applications of the terrain conductivity technique is contained in Appendix A-4.

3.2.2 Boring and Monitoring Well Installations

Soil borings and monitoring well installations were completed by Monitor Testing Corporation of Lakeland, Florida. Twenty-eight monitoring wells were completed during the period 8 September through 25 September 1987. The purpose of the borings was to obtain geologic information and analytical soil samples. Borings were advanced using hollow stem-auger techniques. Continuous split-spoon samples were taken from ground surface to the water table, at which point, samples were taken at 5-foot intervals to the bottom of the borings.

Auger flights and all down-hole tools were steam cleaned after each boring to prevent cross contamination. In addition, split spoons were decontaminated between samples using a soap and potable water wash, potable water rinse, isopropanol rinse, and a final deionized water rinse.

Groundwater monitoring wells were installed and sealed in the completed boreholes. Monitoring wells were constructed with 2-inch ID PVC riser pipe and well screen having flush-threaded, screw-type joints. Glue or other adhesive compounds were not used to join pipe sections. The well screens range from 5 feet to 10 feet in length and have 0.010-inch slots. The annulus around each screen was backfilled with 6/20 silica sand and sealed a minimum of 0.5 foot above the slotted screen sections with a 0.5 to 2-foot thick layer of bentonite. The remaining portion of the annular space was tremie grouted with cement to the ground surface.

Wells are equipped with a locking protective steel casing cemented in the ground over the PVC riser pipe. The wells were pumped to remove fine sediment and to develop a good hydraulic connection between the wells and the geologic formation. The drilling and installation procedures were monitored throughout the duration of the subsurface exploration program. Logs of the soil borings and monitoring well installation details were

recorded by Jordan and are included in Appendices A-5 and A-6, respectively.

Water levels measured at the monitoring wells during the drilling and sampling activities are included in Appendix A-7. Elevations were surveyed at the monitoring well locations by L.D. Bradley Land Surveyors between the period 16 September and 7 October 1987. The survey benchmark locations and elevations are presented on Table 3-3 and are referenced to NAVSTA Mayport datum.

3.2.3 Surface Water Sampling

Surface water samples were collected at four locations during the week of 10 October 1987. The approximate locations of the sampling stations are shown in Figure 3-2. The sampling was conducted along the drainage ditch located at Sites 2, 4, 5 and 6. The samples were collected and analyzed for the compounds specified in Table 3-2.

3.2.4 Groundwater Sampling

Groundwater samples were collected from 30 monitoring well locations during the period 28 September through 8 October 1987. The samples were subsequently analyzed for the presence of suspected chemical wastes which, based on the PA, potentially may be dissolved and moving in groundwater (see Table 3-2).

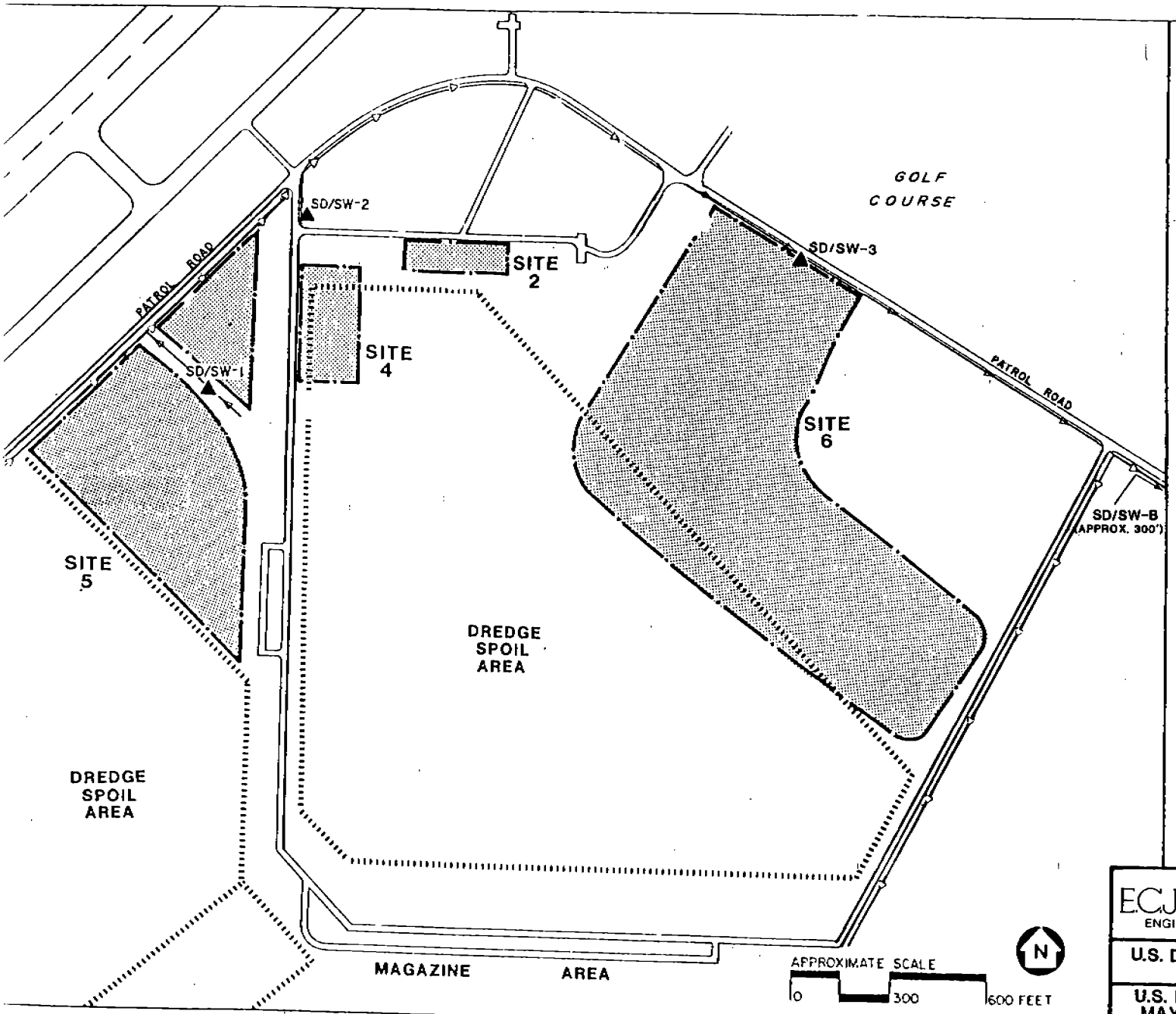
In-situ (rising-head) permeability tests and water level measurements were completed at each monitoring well location during the same period. Calculated hydraulic conductivities for most wells exceeded the maximum value for single hole aquifer tests (i.e., 10^{-3} cm/sec). Therefore, seepage velocities could not be accurately calculated in this study. The results of permeability tests are presented in Appendix A-8.

3.2.5 Data Interpretation

Although the surficial aquifer at NAVSTA Mayport is classified as a Class G-II water by the State of Florida, it is not now, nor is it anticipated to be used as a potable water supply. In fact, Franks (1980) determined that after only a short pumping interval (i.e., 30 minutes) brackish water in the lower zone of the surficial aquifer would rise in response to a reduction in hydraulic head. With continued withdrawal this would seriously degrade water quality in the upper zone of the surficial aquifer.

TABLE 3-3
SUMMARY OF SURVEY DATA
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

WELL NUMBER	COORDINATES X	Y	ELEVATION (FEET MSL) PVC	PROTECTIVE CASING
MPT-1-1	372829.29N	2202286.79E	17.03	17.01
MPT-1-2	372520.30N	2202618.15E	16.95	16.93
MPT-1-3	372946.43N	2202888.96E	14.93	14.92
MPT-2-1	365498.53N	2199297.33E	10.8	11.25
MPT-2-2	368573.62N	2199854.83E	7.61	7.57
MPT-2-3	364604.59N	2199038.59E	17.34	17.34
MPT-2-4	365010.89N	2199894.16E	11.36	11.33
MPT-2-5	365958.23N	2200114.76E	9.89	9.81
MPT-2-6	365492.42N	2199779.50E	9.96	9.84
MPT-2-7S	365926.52N	2197405.08E	10.59	10.56
MPT-2-7D	365934.16N	2197403.09E	10.11	10.06
MPT-2-8	365838.59N	2200144.79E	10.58	10.50
MPT-2-9S	366127.37N	2200345.64E	10.56	10.53
MPT-2-9D	366127.69N	2200338.72E	10.51	10.53
MPT-2-10	366392.03N	2200333.83E	10.06	10.03
MPT-2-15S	367580.43N	2200453.11E	10.66	10.62
MPT-2-15D	367583.65N	2200446.63E	9.33	9.52
S-4	364658.22N	2199526.42E	9.64	9.54
S-5	365274.10N	2200179.02E	8.14	8.04
MPT-8-1	366277.63N	2204731.05E	15.80	15.74
MPT-8-2	366254.39N	2204968.65E	13.90	13.90
MPT-8-3	366355.75N	2205070.17E	13.66	13.61
MPT-9-1	367073.58N	2205228.88E	14.42	14.39
MPT-9-2	367004.19N	2205467.55E	13.36	13.38
MPT-9-3	367174.75N	2205510.14E	11.57	11.49
MPT-13-1	368004.28N	2202051.76E	13.09	13.03
MPT-13-2	367476.28N	2201306.64E	10.46	10.45
MPT-13-3	367740.75N	2200862.00E	10.46	10.45
MPT-14-1	374861.04N	2203770.89E	7.43	7.41
MPT-14-2	374681.41N	2203726.03E	8.45	8.47



LEGEND

SD/SW-1▲ — SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS SD/SW-1 THROUGH SD/SW-3

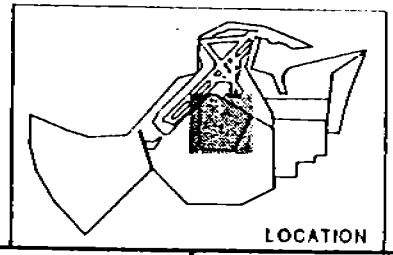
STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW

BERMED SOIL 25' ABOVE GROUND SURFACE CONTAINING DREDGE SOIL

SITE LOCATION AREA

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



E.C JORDAN CO. ENGINEERS & SCIENTISTS	LOCATIONS OF SURFACE WATER/ SEDIMENT SAMPLING STATIONS
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-2

For the reason stated, drinking water standards are not applied in this study. Instead, USEPA ambient water quality criteria for the protection of aquatic life in saltwater environments are used. In that marine flora and fauna are the primary receptors, the use of this saltwater criteria is applicable in this analysis.

3.3 STUDY OF SITE 1 - LANDFILL A

Site 1 encompasses a former landfill which was operated from 1942 to 1960. The site is located east of the Mayport Basin under an area currently occupied by Jacksonville Shipyards - a tenant on NAVSTA Mayport (Figure 3-3). Site 1 occupied approximately 4 acres and consisted of a series of trenches approximately 15 feet wide, 400 feet long, and 8 feet deep. The site received industrial and sanitary wastes during the years of operation. These wastes included waste oils and solvents, mercury lamps, asbestos, sulfuric acid, pesticide cans, general garbage, and construction rubble.

3.3.1 Field Exploration and Sampling Plan

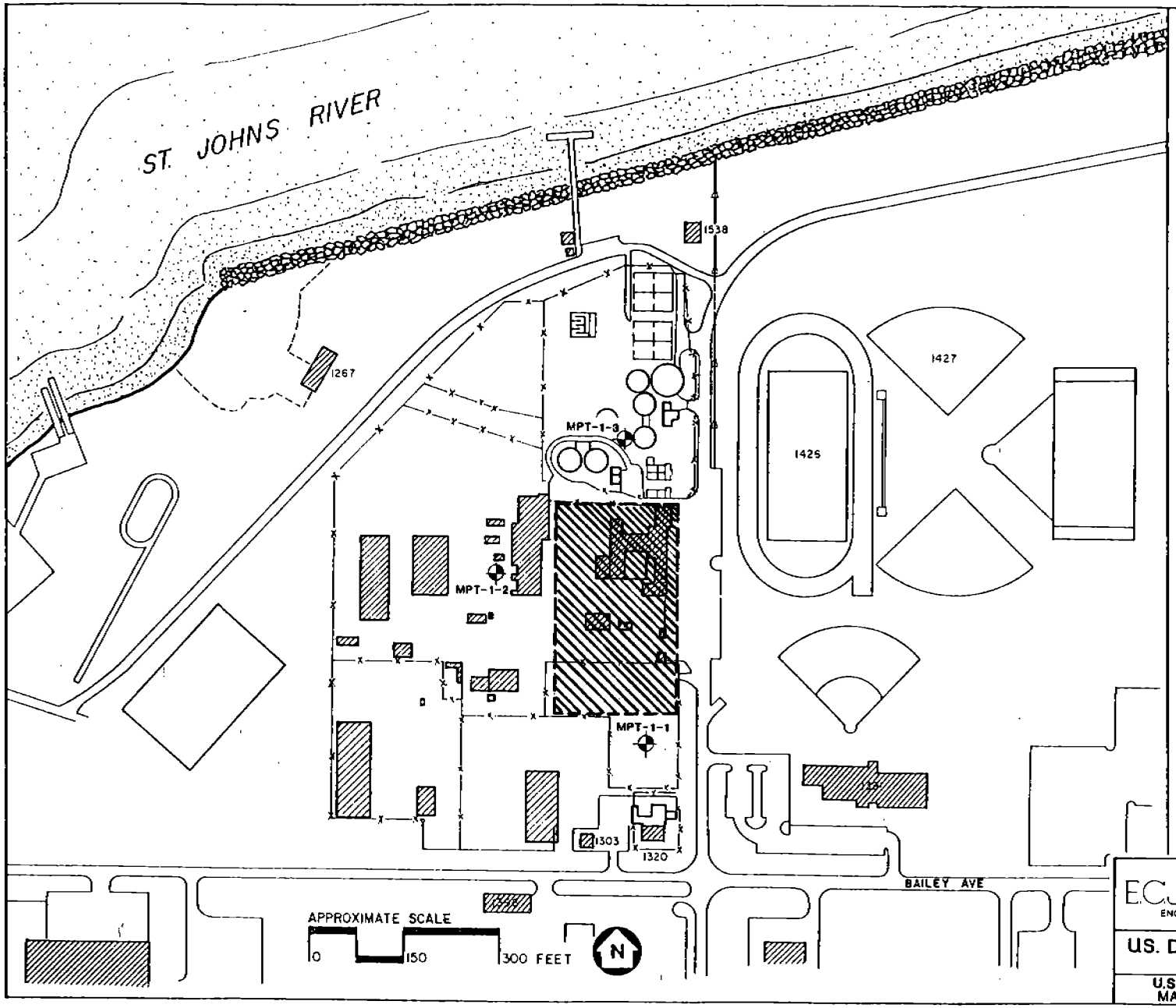
The exploration program at Site 1 consisted of the installation of three monitoring wells and the collection of three soil samples and three groundwater samples. A summary of the laboratory program for Site 1 is presented in Table 3-2. The location of the explorations is presented in Figure 3-3 and the specific rationale for each monitoring well location is as follows:

- MPT-1-1 is a shallow monitoring well located south of Site 1 and is upgradient of Site 1.
- MPT-1-2 is a shallow monitoring well located west of Site 1 and is downgradient of the landfill.
- MPT-1-3 is a shallow monitoring well located north of Site 1 and is downgradient of the landfill.

3.3.2 Hydrogeology

The shallow surface soils at Site 1 consist mainly of fine quartz sands. A thin clay layer (less than 1 foot thick) was noted in each of the borings at a depth of 7 to 10 feet below land surface (2 to 7 feet MSL). This thin clay layer slopes downward towards the St. Johns River. Below this clay layer lies a fine quartz sand to a depth of at least 17 feet BLS.

Water level measurements were obtained on four separate occasions at Site 1 (see Appendix A-7). Data from 8 October

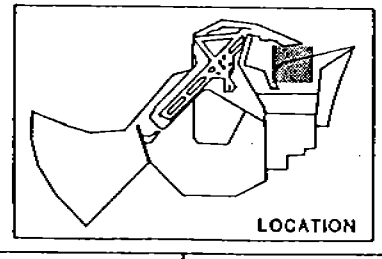


LEGEND

- MPT-1-1 — LOCATION OF MONITORING WELLS
- x—x—x — FENCE
- — — — — APPROXIMATE EXTENT OF SITE
- → STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW

NOTES:

1. THE LOCATION AND BOUNDARIES OF SITE 1 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD. DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'



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ENGINEERS & SCIENTISTS

LOCATIONS OF EXPLORATIONS SITE 1

U.S. DEPARTMENT OF THE NAVY

NIRP EXPANDED SITE INVESTIGATION

U.S. NAVAL STATION MAYPORT, FLORIDA

5097-06 FIGURE 3-3

1987 indicate an average hydraulic gradient across the site of 0.004 feet per foot (Figure 3-4). Groundwater flows north directly towards the St. Johns River which is located 600 feet north of the site.

Based on the observed gradient on 8 October 1987, the lower bound of the seepage velocity beneath the site was estimated using:

$$v = K(dH/dl)/n$$

where,

v = seepage velocity (ft/day);
K = hydraulic conductivity (ft/day);
dH/dl = hydraulic gradient (ft/ft); and
n = effective porosity (dimensionless).

Assuming a conservative estimate of 0.25 for the effective porosity and a value of the hydraulic conductivity of 2.8 ft/day (upper limit of test procedure), the seepage velocity within the surficial aquifer is calculated to be something greater than 0.04 ft/day. Due to the hydraulic conductivity exceeding the aquifer test procedure upper limit, a more accurate calculation of the seepage velocity can not be obtained.

3.3.3 Chemical Distribution

The results of analyses of soil and groundwater samples obtained at Site 1 are presented in Table 3-4. Chemicals at concentrations equal to or greater than the reported detection limit are shown in Figure 3-5.

Soils - The pesticide 4,4'-DDE was detected at a concentration of 58 ug/kg in the soil sample obtained from boring MPT-1-3. This sample was collected at a depth of 5 to 7 feet below land surface. No other compounds were detected in any of soil samples collected from this site.

Groundwater - The pesticide 4,4'-DDE was detected in groundwater samples collected from both monitoring well MPT-1-2 (0.01 ug/l) and monitoring well MPT-1-3 (0.14 ug/l). The duplicate sample collected from well MPT-1-3 also contained 4,4'-DDE at a concentration 0.07 ug/l.

The groundwater sample obtained from monitoring well MPT-1-3, contained total cadmium at 2.0 ug/l, while the duplicate sample contained 1.0 ug/l total cadmium. Total lead was present in the groundwater sample obtained from MPT-1-3 at a concentration of 122 ug/l, while the duplicate sample contained 26 ug/l. Specific conductance increased in the downgradient direction

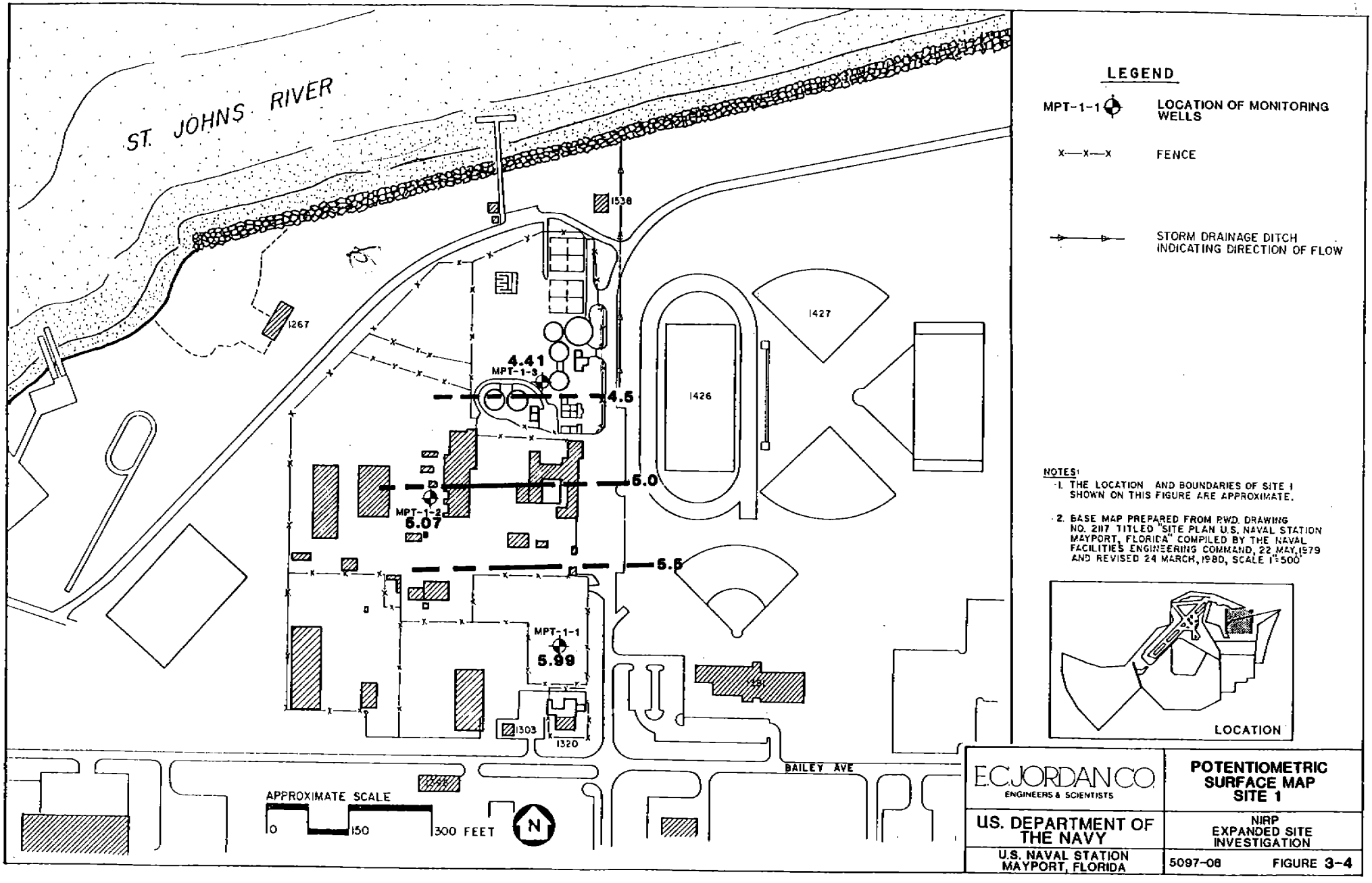
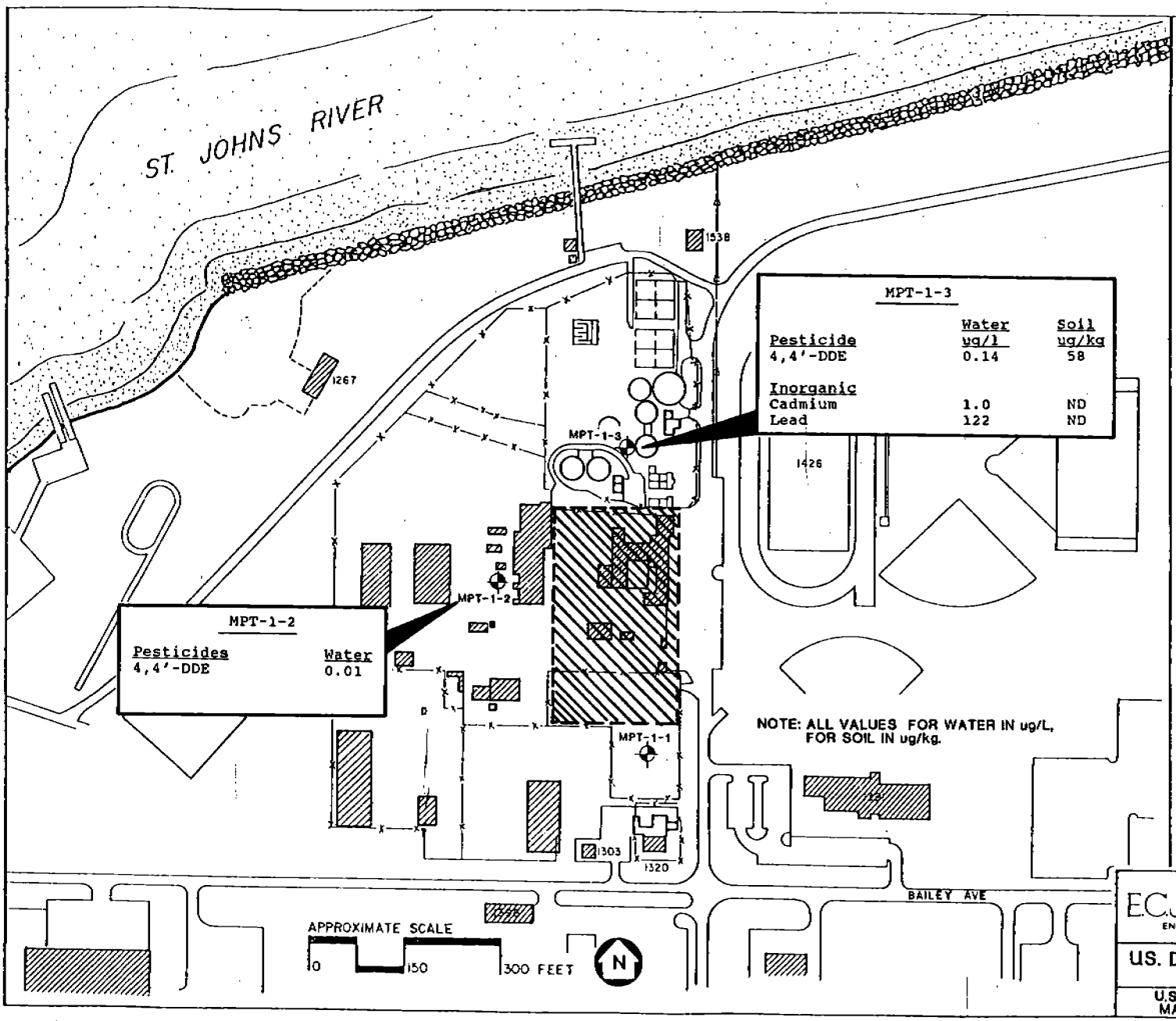

ST. JOHNS RIVER
1538
1267
1427
1426
4.41
MPT-1-3
4.5
5.0
MPT-1-2
5.07
5.5
MPT-1-1
5.99
1303
1320
BAILEY AVE
APPROXIMATE SCALE
0
150
300 FEET
N
LEGEND
MPT-1-1
LOCATION OF MONITORING WELLS
FENCE
STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW
NOTES:
1. THE LOCATION AND BOUNDARIES OF SITE 1 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD. DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'
LOCATION
E.C JORDAN CO.
ENGINEERS & SCIENTISTS
POTENTIOMETRIC SURFACE MAP SITE 1
U.S. DEPARTMENT OF THE NAVY
NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA
5097-08
FIGURE 3-4

TABLE 3-4
SUMMARY OF CHEMICAL ANALYSIS SITE 1
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

MEDIA	PARAMETER	MPT-1-1	MPT-1-2	MPT-1-3	MPT-1-3DUP
SOIL	VOLATILE ORGANICS	BDL	BDL	BDL	
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL	
	PESTICIDES & PCB's				
	4,4'-DDE	BDL	BDL	58 ug/kg	
	TOTAL METALS	BDL	BDL	BDL	
GROUNDWATER	VOLATILE ORGANICS	BDL	BDL	BDL	BDL
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL	BDL
	PESTICIDES & PCBs				
	4,4'-DDE	BDL	0.01 ug/l	0.14 ug/l	0.07 ug/l
	TOTAL METALS				
	Cadmium	BDL	BDL	2.0 ug/l	1.0 ug/l
	Lead	BDL	BDL	122 ug/l	26 ug/l

NOTE: BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)

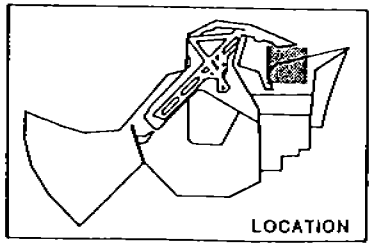


LEGEND

- MPT-1-1 — LOCATION OF MONITORING WELLS
- x—x—x — FENCE
- — — — APPROXIMATE EXTENT OF SITE 1
- STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW

NOTES:

1. THE LOCATION AND BOUNDARIES OF SITE 1 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'



E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

CHEMICAL DISTRIBUTION SITE 1

U.S. DEPARTMENT OF THE NAVY

NIRP EXPANDED SITE INVESTIGATION

U.S. NAVAL STATION MAYPORT, FLORIDA

5097-06 FIGURE 3-5

(421 umhos/cm to 1,140 umhos/cm), while the pH decreased in the downgradient direction (7.09 to 6.41).

Surface Water - No surface water samples were collected around Site 1.

3.3.4 Evaluation of Chemical Distribution

Pesticides - The pesticide 4,4'-DDE was found in the groundwater samples collected from monitoring wells MPT-1-2 and MPT-1-3. It was also found in the soil sample collected at boring MPT-1-3. The concentrations in groundwater, 0.01 and 0.14 ug/l, exceed the USEPA ambient water quality criteria of 0.001 ug/l for chronic exposure in saltwater environments.

Inorganics - Total cadmium, detected at 2.0 ug/l in the groundwater sample obtained from monitoring well MPT-1-3, is below the USEPA ambient water quality criteria of 9.3 ug/l for chronic exposure in saltwater. Total lead, detected at 122 ug/l in MPT-1-3, exceeds the USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments. The concentration of lead in the duplicate sample (26 ug/l) collected from monitoring well MPT-1-3 also exceeds the marine ambient water quality criteria of 5.6 ug/l for chronic exposure.

3.3.5 Conclusions

Based on a review of available information from previous studies and the findings from the Expanded Site Investigation conducted by Jordan, the following conclusions are made for Site 1:

1. The shallow subsurface geology at Site 1 consists of fine sands with a thin clay layer located between 7 to 10 feet below land surface.

2. The shallow groundwater at Site 1 flows north, towards the St. Johns River.

3. The pesticide 4,4'-DDE was detected in low concentrations in both soil and groundwater at Site 1.

4. The concentrations of 4,4'-DDE in groundwater (0.01 ug/l and 0.14 ug/l) exceeded the USEPA ambient water quality criteria of 0.001 ug/l for chronic exposure in saltwater environments.

5. Lead was found in the groundwater at a concentration (122 ug/l and 26 ug/l) above the USEPA ambient water

quality criteria of 5.6 ug/l for chronic exposure in marine environments.

3.3.6 Recommendations

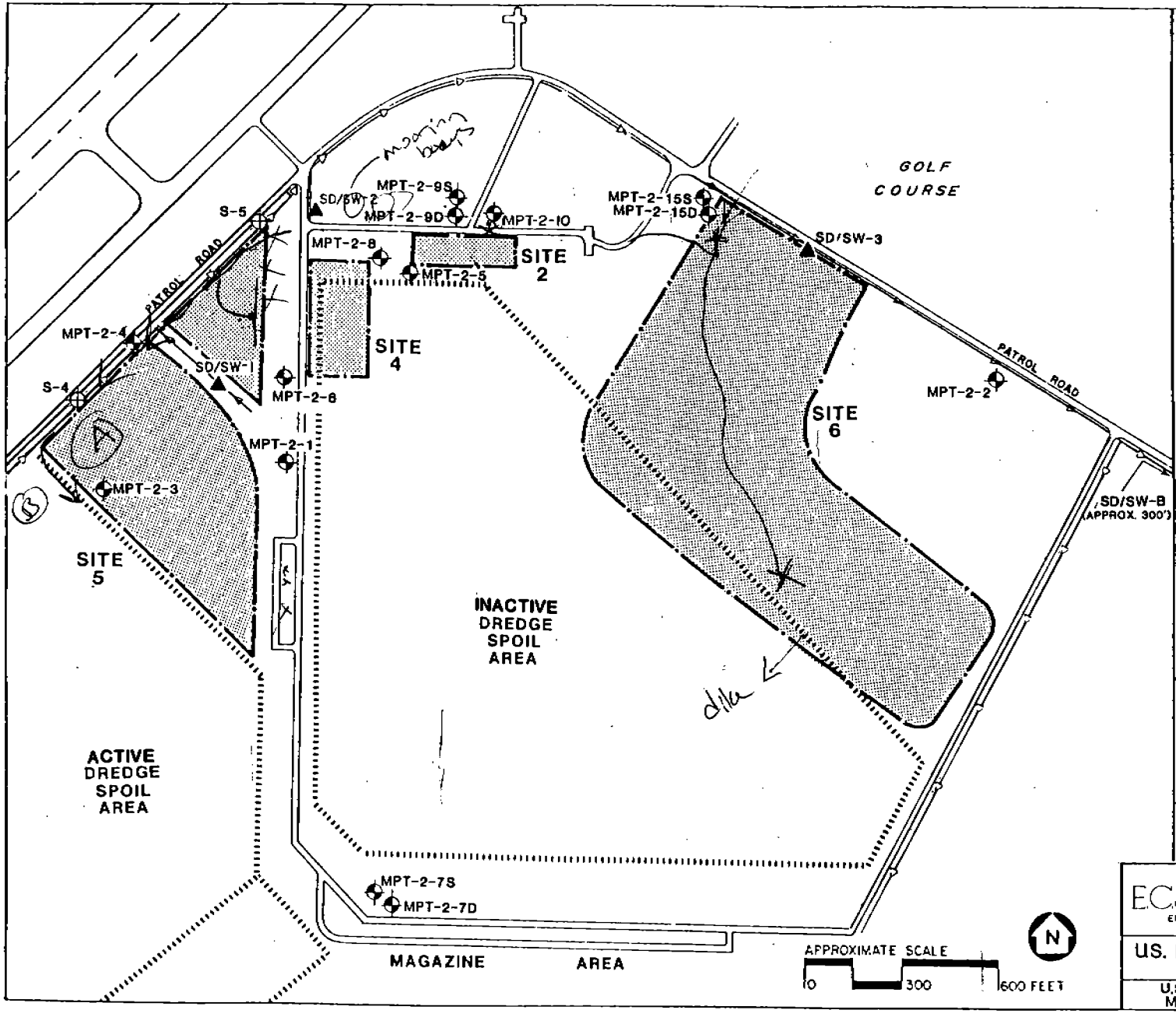
Site 1 is recommended to undergo an environmental risk assessment due to the presence of 4,4'-DDE and lead in groundwater. This study will focus on the risks to the primary receptors in the marine environment that are associated with the levels of contamination found in groundwater.

3.4 STUDY OF SITES 2, 4, 5, AND 6 - LANDFILL B, D, E, AND F

Site 2 is a former landfill that was operated as a trench and fill landfill from 1960 to 1980. The site is located north of the northeastern dredge spoil area (Figure 3-6). The area has subsequently been covered with soil, paved and an ordnance storage yard now occupies the site. The former landfill was approximately 2 acres in size and consisted of a series of trenches which were approximately 15 feet wide, 300 feet long and 8 feet deep. The trenches are known to have intersected the water table and combustible items floating on the water in the trenches were burned daily. Items disposed of in the landfill included waste oils, other petroleum products, mercury lamps, asbestos, sulfuric acid, pesticide cans, paints, toluene, solvents, batteries, transformer oil, penetrants, and general refuse.

Site 4 is the location of a former landfill that was operated from 1963 to 1965. The site is located southwest of Site 2 (see Figure 3-6) and extends under the northwestern corner of the northeastern dredge spoil area. Site 4 occupied approximately 3 acres and consisted of several pits (eight are estimated). Each pit was approximately 40 feet by 40 feet and 8 feet deep and intersected the water table. Items were dumped into standing water contained in the pits. Waste disposal included oil, mercury, solvents, asbestos, acids, pesticide containers, paints, toluene, batteries, penetrants, sanitary wastes, and construction rubble.

Site 5 is a landfill area that was operated as a trench and fill landfill from 1974 to 1980. The site is located west of Site 4 and north of NAVSTA Mayport's southwestern dredge spoil area (see Figure 3-6). The site consists of two adjacent areas divided by a drainage ditch and encompasses approximately 11 acres. The trenches on this site were constructed with a dragline and were approximately 15 feet wide, 750 feet long, and 8 feet deep. These trenches intersected the water table and wastes were disposed of into standing water. Wastes disposed of at Site 5 are essentially identical to those

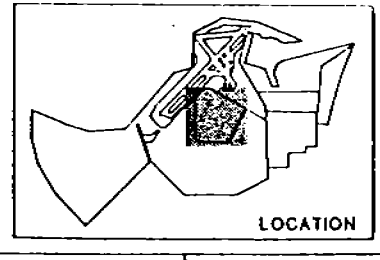


LEGEND

- MPT-2-1 — LOCATION OF MONITORING WELL
- S-4 — EXISTING MONITORING WELL LOCATIONS S-4 AND S-5
- SD/SW-1 — SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS SD/SW-1 THROUGH SD/SW-3
- STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW
- BERMED SOIL 25' ABOVE GROUND SURFACE CONTAINING DREDGE SOIL
- SITE LOCATION AREA

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



E.C JORDAN CO. ENGINEERS & SCIENTISTS	**LOCATIONS OF EXPLORATIONS SITES 2,4,5 & 6**
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE **3-6**

disposed of at Site 2 and 4. In addition, Sites 2, 4, and 5 received an estimated 54,000 gallons of liquid industrial wastes per year.

Site 6 is located south of Patrol Road and north of the northeastern dredge spoil area (see Figure 3-6). The Site 6 landfill was operational from 1966 to 1985. Originally the site was a trench-fill operation, which after completion of the fill and addition of soil cover a second on-surface disposal operation occurred. The site encompasses approximately 24 acres and originally consisted of trenches that were 8 feet deep, 15 feet wide and hundreds of feet long. Trenches intersected the shallow aquifer and wastes were disposed of into standing water. Items disposed of in the landfill were the same as those from Sites 2, 4, and 5.

3.4.1 Field Exploration and Sampling Plan

Both groundwater and soil samples were collected at these sites. Because of the shallow nature of the aquifer and the potential for groundwater migration from Sites 2, 4, 5 and 6 into the drainage ditch which borders these sites, a surface water sampling program was also established. Surface water and sediment sampling stations are shown on Figure 3-2. In addition, a terrain conductivity survey was conducted in an effort to determine if a leachate plume was migrating beyond the ditches. The results of this survey are discussed in Section 3.4.2.

The soil boring and monitoring well installation program for Sites 2, 4, 5, and 6 consisted of 11 shallow soil borings and three deep soil borings completed with monitoring well installation. The location of the monitoring wells are presented in Figure 3-6. Because of the unknown groundwater flow direction, monitoring wells were installed in two phases. This allowed for an initial estimate of the groundwater flow direction to be made in order to optimize the locations of the remaining wells.

Initially, five monitoring wells were installed around the perimeter of the sites. After installation and development the wells were allowed to stabilize. Water levels in the five new wells and two existing wells were then surveyed and plotted to determine groundwater flow direction.

After the groundwater flow direction was determined the drill rig returned to the landfills to complete the monitoring well installation program. An additional nine monitoring wells were installed, six shallow and three deep. These additional wells were installed so that each site would have one upgradient well and two downgradient wells. Three well clusters (MPT-2-7,

MPT-2-9, and MPT-2-15) were installed so that groundwater characteristics below a shallow clay layer could be examined.

The specific rational for each monitoring well location is as follows:

Site 2

- MPT-2-5 is a shallow monitoring well located southwest of Site 2 and is upgradient of Site 2.
- MPT-2-9S is a shallow monitoring well (10 ft deep) located north of Site 2 and is downgradient of Site 2.
- MPT-2-9D is a deep monitoring well (25 ft deep) located north of Site 2 and is nested with MPT-2-9S. It is located downgradient of Site 2.
- MPT-2-10 is a shallow monitoring well located north-northeast of Site 2 and is downgradient of Site 2.

Site 4

- MPT-2-6 is a shallow monitoring well located southwest of Site 4 and because of mounding in the adjacent inactive (northeast) dredge spoil area the well is downgradient of Site 4.
- MPT-2-8 is a shallow monitoring well located northeast of Site 4 and because of mounding in the adjacent inactive dredge spoil area the well is downgradient of Site 4.

Site 5

- MPT-2-3 is a shallow monitoring well located southwest of Site 5 and upgradient of Site 5.
- MPT-2-4 is a shallow monitoring well located northwest of Site 5 and is downgradient of Site 5.
- MPT-2-1 is a shallow monitoring well located northeast of Site 5 and is downgradient of Site 5.

Site 6

- MPT-2-7S is a shallow monitoring well (10 ft deep) located southwest of Site 6 and is located upgradient of Site 6 as well as upgradient to all sites.

- MPT-2-7D is a deep monitoring well (25 ft deep) located southwest of Site 6 and is nested with MPT-2-7S. It is located upgradient of all sites and was used with MPT-2-7S as a background well.

- MPT-2-2 is a shallow monitoring well located east of Site 6 and is downgradient of Site 6.

- MPT-2-15S is a shallow monitoring well (14 ft deep) located north of Site 6 and is downgradient of Site 6.

- MPT-2-15D is a deep monitoring well (25 ft deep) located north of Site 6 and is nested with MPT-2-15S and is downgradient of Site 6.

The depth of borings below ground surface ranged from 10 to 25 feet. Most of the shallow monitoring wells were 10 feet deep while the deep wells were 25 feet deep. Well screens ranged from 5 to 10 feet in length. Shallow well screens were set in a predominately fine to medium grained sand with occasional thin layers of coarse sand and shell fragments. The deep monitoring wells were screened in a fine sand. Specific information on monitoring well construction is presented in Appendix A-6.

One soil sample was collected from each shallow boring for laboratory chemical analysis (see Table 3-2). The soil samples were collected from the unsaturated soils just above the water table.

After final monitoring well installation, each monitoring well was developed by pumping to provide a good hydraulic connection between the well and surrounding aquifer. A groundwater sample was collected from each new monitoring well and from the two existing Geraghty and Miller monitoring wells (S4 and S5) for submittal to a laboratory for chemical analysis (see Table 3-2).

The sediment and surface water sampling locations are presented on Figure 3-6. The purpose of these samples was to assess the possible impact the landfills may have on surface water in the drainage ditches resulting from groundwater discharge.

3.4.2 Terrain Conductivity Survey

A terrain conductivity survey was conducted at NAVSTA Mayport on 9 September 1987. The purpose of this survey was to determine whether or not a leachate plume from Sites 5 and 6 extended beyond the surface water drainage ditch which borders the sites.

The survey was conducted in three areas (see Figure 3-1) and consisted of five traverses with measurements taken every 20 feet. The instrument used for this work was a Geonics EM 31 Terrain Conductivity Meter, which measures the conductivity of underlying soil materials to a depth of approximately 6 meters (20 feet). A total of 7,300 feet of conductivity profiling was completed during this survey.

As a consequence of the near surface elevation of brackish groundwater, most conductivity readings were abnormally high. It was therefore impossible to distinguish between any plume which might be emanating from the sites and background readings. A detailed discussion of the terrain conductivity survey results is presented in Appendix A-4.

3.4.3 Hydrogeology

During drilling operations a relatively uniform clay layer was encountered at a depth of -1 to -4 feet Mean Sea Level (MSL). It can generally be described as a stiff, dark olive clay approximately 2 feet to as much as 6 feet thick. As indicated by boring logs (see Appendix A-5), the clay layer is relatively continuous across Sites 2, 4, 5, and 6 even though it was not encountered in boring MPT-2-1. This is probably due to an insufficient drilling depth.

As a result of encountering the clay layer, three additional monitoring wells were installed to obtain information on the hydrogeology and the presence of contamination in groundwater below the clay. The general geology below the clay is a fine grained, gray to green sand with a thin clay to sandy clay layer (approximately 2 feet thick) found at a depth of 25 feet BLS.

From the ground surface to the top of the clay layer the sediments are fine to coarse grain sands with shells and shell fragments. These sands are generally 9 to 12 feet thick. Occasional thin (1 to 2 feet) sandy clay layers were also encountered in some borings (see Appendix A-5).

It is apparent that the clay layer, throughout much of the area, is acting as confining layer (see water level data in Appendix A-7). However, in monitoring wells MPT-2-7S and MPT-2-7D the potentiometric surfaces are within 0.12 feet of one another which suggests that the clay layer is a semi-confining bed in this area.

Groundwater flow at Sites 2, 4, 5, and 6 is complex and is heavily influenced by the elevated dredge spoil areas and the surface water drainage ditch bordering the sites. Eleven shallow groundwater monitoring wells were installed to

determine the hydrogeologic picture of the surficial aquifer beneath these sites. Water level data collected from these wells indicate that groundwater mounding occurs in the vicinity of both dredge spoil areas.

In the vicinity of the inactive dredge spoil area, groundwater mounding is believed to be caused by the elevated ground surface in the northern third of this spoil area. Differences in elevations between the fill material within the dike and the average surface elevation outside the dike is approximately 23 feet. This is sufficient to delay groundwater recharge and produce mounding under the spoil area.

During the field program of this investigation, the southwestern dredge spoil area was receiving dredge material from the turning basin. This resulted in an artificial groundwater mound under this spoil area, as shown in the elevated water level measurements in monitoring well MPT-2-3. It is anticipated that this condition will dissipate once dredging ceases.

Because of the mounding of groundwater within the two dredge spoil areas and the limited number of wells installed during this phase of the project, a precise groundwater flow direction is difficult to determine (see Figure 2-4). Groundwater appears to be moving radially outward from the northern third of the inactive dredge spoil area towards the perimeter surface ditches. Also, groundwater under the active dredge spoil area appears to be moving radially outward. Because of the mounding of groundwater and the close proximity of surface water ditches, groundwater flow is probable towards the ditch from the mounded areas within the dredge spoil area. This surface water drainage ditch flanks the sites on the northwest, north, northeast, east and southeast (see Figure 3-6) and experiences tidal influences of several feet.

3.4.4 Site 2

3.4.4.1 Chemical Distribution. The results of the analytical program for soils and groundwater at Site 2 are presented in Tables 3-5 and 3-6, respectively. Chemicals present in concentrations above detection limits are presented on Figure 3-7.

Soils - Soil samples taken from around Site 2 had no detectable levels of semivolatile organic compounds or priority pollutant metals. Volatile organic compounds detected at Site 2 include chlorobenzene at 44 ug/kg and toluene at 553 ug/kg, in sample MPT-2-5DUP (0 to 2 feet BLS). Toluene was also present in the soil sample obtained from boring MPT-2-5 at 72 ug/kg. PCB-1260

TABLE 3-5
SUMMARY OF CHEMICAL ANALYSES OF SOIL SAMPLES FOR SITES 2, 4, 5 & 6
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

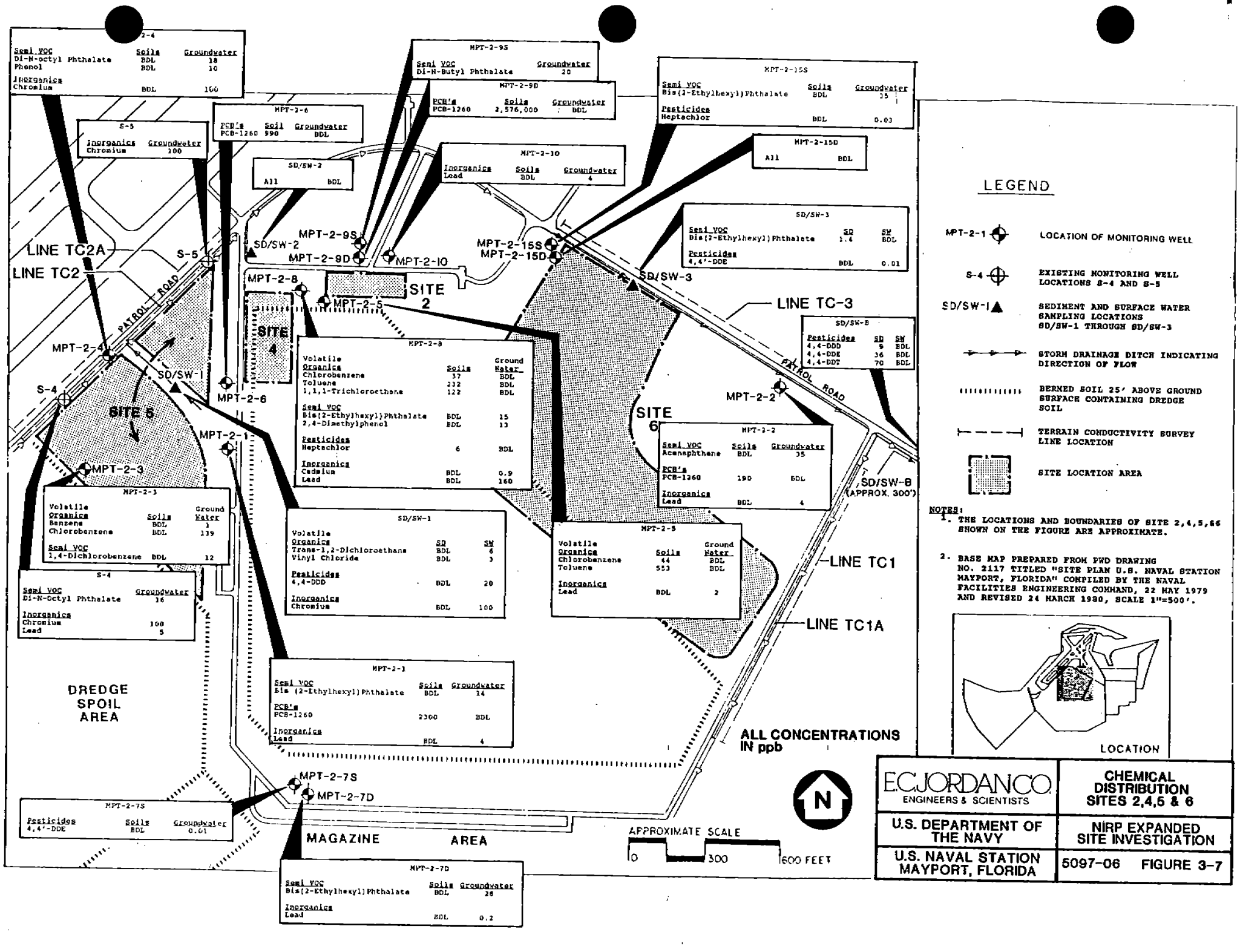
PARAMETER	MPT-2-1	MPT-2-2	MPT-2-3	MPT-2-4	MPT-2-5	MPT-2-5 DUP	MPT-2-6	MPT-2-7	MPT-2-8	MPT-2-8 DUP	MPT-2-9	MPT-2-10	MPT-2-15
VOLATILE ORGANICS													
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	44	BDL	BDL	37	BDL	BDL	BDL	BDL
Toluene	BDL	BDL	BDL	BDL	72	553	BDL	BDL	232	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	122	BDL	BDL	BDL	BDL
SEMIVOLATILE ORGANICS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PESTICIDES & PCB's													
Heptachlor	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6	BDL	BDL	BDL
PCB - 1260	2300	190	BDL	BDL	BDL	BDL	990	BDL	BDL	BDL	2576000	BDL	BDL
TOTAL METALS	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Notes: 1. All concentrations in parts per billion (ppb).
2. BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)

TABLE 3-6
SUMMARY OF CHEMICAL ANALYSES OF GROUNDWATER FOR SITES 2, 4, 5 & 6
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

PARAMETER	MPT-2-1	MPT-2-2	MPT-2-3	MPT-2-4	MPT-2-5	MPT-2-6	MPT-2-7S	MPT-2-7D	MPT-2-8	MPT-2-9S	MPT-2-9D	MPT-2-10	MPT-2-15S	MPT-2-15D	S-4	S-5
VOLATILE ORGANICS																
Benzene	BDL	BDL	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	BDL	BDL	139	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SEMIVOLATILE ORGANICS																
Acenaphthene	BDL	35	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	20	BDL	BDL	BDL	BDL	BDL	BDL
Di-N-Octyl Phthalate	BDL	BDL	BDL	18	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	16	BDL
Phenol	BDL	BDL	BDL	10	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) phthalate	14	BDL	BDL	BDL	BDL	BDL	BDL	28	15	BDL	BDL	BDL	35	BDL	BDL	BDL
1,4-Dichlorobenzene	BDL	BDL	12	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	13	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PESTICIDES & PCB's																
Heptachlor	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	BDL
4,4'-DDE	BDL	BDL	BDL	BDL	BDL	BDL	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOTAL METALS																
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.9	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium	BDL	BDL	BDL	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100	100
Lead	4	4	BDL	BDL	2	BDL	BDL	0.2	160	BDL	BDL	4	BDL	BDL	5	BDL

Notes: 1. All concentrations in parts per billion (ppb).
2. Wells S-4 and S-5 are wells installed previously by Geraghty and Miller.
3. BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)


S-4
Semi VOC | Soils | Groundwater
Di-N-octyl Phthalate | BDL | 18
Phenol | BDL | 10
Inorganics
Chromium | BDL | 100
MPT-2-9S
Semi VOC | Groundwater
Di-N-Butyl Phthalate | 20
MPT-2-9D
PCB's | Soils | Groundwater
PCB-1260 | 2,576,000 | BDL
MPT-2-15S
Semi VOC | Soils | Groundwater
Bis(2-Ethylhexyl)Phthalate | BDL | 35
Pesticides
Heptachlor | BDL | 0.03
MPT-2-15D
All | BDL
S-5
Inorganics | Groundwater
Chromium | 100
MPT-2-6
PCB's | Soil | Groundwater
PCB-1260 | 990 | BDL
SD/SW-2
All | BDL
MPT-2-10
Inorganics | Soils | Groundwater
Lead | BDL | 4
SD/SW-3
Semi VOC | SD | SW
Bis(2-Ethylhexyl)Phthalate | 1.4 | BDL
Pesticides
4,4'-DDE | BDL | 0.01
SD/SW-8
Pesticides | SD | SW
4,4-DDD | 9 | BDL
4,4-DDE | 36 | BDL
4,4-DDT | 70 | BDL
MPT-2-8
Volatile Organics | Soils | Ground Water
Chlorobenzene | 37 | BDL
Toluene | 232 | BDL
1,1,1-Trichloroethane | 122 | BDL
Semi VOC
Bis(2-Ethylhexyl)Phthalate | BDL | 15
2,4-Dimethylphenol | BDL | 13
Pesticides
Heptachlor | 6 | BDL
Inorganics
Cadmium | BDL | 0.9
Lead | BDL | 160
MPT-2-2
Semi VOC | Soils | Groundwater
Acenaphthene | BDL | 35
PCB's
PCB-1260 | 190 | BDL
Inorganics
Lead | BDL | 4
MPT-2-3
Volatile Organics | Soils | Ground Water
Benzene | BDL | 1
Chlorobenzene | BDL | 139
Semi VOC
1,4-Dichlorobenzene | BDL | 12
SD/SW-1
Volatile Organics | SD | SW
Trans-1,2-Dichloroethane | BDL | 6
Vinyl Chloride | BDL | 3
Pesticides
4,4-DDD | BDL | 20
Inorganics
Chromium | BDL | 100
MPT-2-5
Volatile Organics | Soils | Ground Water
Chlorobenzene | 44 | BDL
Toluene | 553 | BDL
Inorganics
Lead | BDL | 2
S-4
Semi VOC | Groundwater
Di-N-Octyl Phthalate | 16
Inorganics
Chromium | 100
Lead | 5
MPT-2-1
Semi VOC | Soils | Groundwater
Bis (2-Ethylhexyl) Phthalate | BDL | 14
PCB's
PCB-1260 | 2300 | BDL
Inorganics
Lead | BDL | 4
MPT-2-7S
Pesticides | Soils | Groundwater
4,4'-DDE | BDL | 0.01
MPT-2-7D
Semi VOC | Soils | Groundwater
Bis(2-Ethylhexyl)Phthalate | BDL | 28
Inorganics
Lead | BDL | 0.2
LINE TC2A
LINE TC2
PATROL ROAD
S-5
MPT-2-9S
MPT-2-9D
MPT-2-10
SD/SW-2
MPT-2-8
MPT-2-5
SITE 2
MPT-2-15S
MPT-2-15D
SD/SW-3
LINE TC-3
PATROL ROAD
MPT-2-4
SITE 4
SD/SW-1
S-4
SITE 5
MPT-2-6
MPT-2-1
MPT-2-3
SITE 6
MPT-2-2
SD/SW-8
(APPROX. 300')
LINE TC1
LINE TC1A
DREDGE SPOIL AREA
MPT-2-7S
MPT-2-7D
MAGAZINE AREA
ALL CONCENTRATIONS IN ppb
N
APPROXIMATE SCALE
0
300
600 FEET
LEGEND
MPT-2-1 LOCATION OF MONITORING WELL
S-4 EXISTING MONITORING WELL LOCATIONS S-4 AND S-5
SD/SW-1 SEDIMENT AND SURFACE WATER SAMPLING LOCATIONS SD/SW-1 THROUGH SD/SW-3
STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW
BERMED SOIL 25' ABOVE GROUND SURFACE CONTAINING DREDGE SOIL
TERRAIN CONDUCTIVITY SURVEY LINE LOCATION
SITE LOCATION AREA
NOTES:
1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.
LOCATION
E.C.JORDAN CO. ENGINEERS & SCIENTISTS
CHEMICAL DISTRIBUTION SITES 2,4,5 & 6
U.S. DEPARTMENT OF THE NAVY
NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA
5097-06 FIGURE 3-7

was found in the soil sample collected from boring MPT-2-9 (0 to 2 feet BLS) at a concentration of 2,576,000 ug/kg.

Groundwater - Groundwater samples collected from Site 2 contained no detectable levels of volatile organics, organochlorine pesticides, or PCBs. Di-n-butyl phthalate was found at 20 ug/l in the sample collected from monitoring well MPT-2-9S. The only priority pollutant metal detected in groundwater at Site 2 consisted of total lead at 2 ug/l and 4 ug/l in samples collected from monitoring wells MPT-2-5 and MPT-2-10, respectively.

3.4.4.2 Evaluation of Chemical Distribution.

Volatile Organics - Chlorobenzene (44 ug/kg) and toluene (553 ug/kg) were detected in the soil at Site 2 but not in groundwater. No criteria for these compounds in soils currently exist.

Other Organics - The only semivolatile organic detected at Site 2 was di-n-butyl phthalate. This compound was found in the groundwater sample collected from monitoring well MPT-2-9S at a concentration of 20 ug/l. No criteria for this compound has been established. PCB-1260 was detected in the soil sample obtained from boring MPT-2-9 at 2,576,000 ug/kg. This concentration exceeds the Toxic Substances Control Act (TSCA) standard for removal of PCB contaminated soil of 50,000 ug/kg. Priority pollutant pesticides were not detected in either soil or groundwater samples collected at Site 2.

Inorganics - Priority pollutant metals detected at Site 2 consist of total lead in groundwater samples obtained from monitoring wells MPT-2-5 (2 ug/l) and MPT-2-10 (4 ug/l). These levels do not exceed the ambient water quality criteria of 5.6 ug/l for protection of aquatic life in marine environments as set by the USEPA.

3.4.4.3 Conclusions. Based upon the review of existing information and the findings of the Expanded Site Investigation, the following conclusions are made for Site 2:

1. The surficial geology at Site 2 is comprised of a fine to coarse sand containing traces of shells and shell fragments. This deposit overlies a 2 to 3-foot thick clay layer located approximately 11 feet BLS.

2. It is anticipated that the groundwater flow direction in the surficial aquifer is north towards the peripheral drainage ditch and is influenced by a groundwater mound which has developed under the northeastern dredge spoil area.

3. Chlorobenzene (44 ug/kg) and toluene (553 ug/kg) were detected in soils at Site 2. No criteria for these compounds in soils currently exist.

4. Groundwater samples collected at Site 2 contained no detectable levels of volatile organic compounds, priority pollutant pesticides, or PCBs.

5. Di-n-butyl phthalate was detected at a concentration of 20 ug/l in the groundwater sample collected from MPT-2-95. No criteria for this compound has been established.

6. The concentration of PCB-1260 in the soil sample obtained from boring MPT-2-9 (2,576,000 ug/kg) exceeds the TSCA standard for removal (50,000 ug/kg).

3.4.4.4 Recommendations. Although unrelated to operations at Site 2, the elevated level of PCB-1260 in the soil sample collected at MPT-2-9 warrants additional work under a remedial action program. The intent of this program will be to assess the extent of PCB contamination in the vicinity of monitoring well MPT-2-9 and remove or treat the contaminated soil. It is proposed that a radial grid be established and centered over monitoring well MPT-2-9D. Samples will be collected at 50-foot intervals along transects established in the four cardinal directions and their half-points (i.e., north, northeast, east, southeast, etc.). Soil samples will be collected in the 0.5 to 1.5 foot interval below land surface and analyzed for PCBs using a field PCB test kit. Upon establishing the extent of contamination, subsequent samples, collected at the boundary points, will be submitted to the laboratory for analysis of PCBs to verify field results.

3.4.5 Site 4

3.4.5.1 Chemical Distribution. The results of the analytical program for soil, groundwater, surface water, and sediment are presented in Tables 3-5, 3-6, and 3-7 respectively. Chemicals found in concentrations above their detection limit are shown in Figure 3-7.

Soil - Soil samples obtained from Site 4 contained no detectable levels of either semivolatile organics or priority pollutant metals. Volatile organics detected include chlorobenzene (37 ug/kg), toluene (232 ug/kg), and 1,1,1-trichloroethane (122 ug/kg). These compounds were detected in soil sample MPT-2-8 (0 to 2 feet BLS). However, none of these compounds were detected in the duplicate sample, MPT-2-8DUP. Soil sample MPT-2-6 contained PCB-1260 at 990 ug/kg.

TABLE 3-7
SUMMARY OF CHEMICAL ANALYSES OF SURFACE WATER (SW)/SEDIMENT (SD) FOR SITES 2, 4, 5 AND 6
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

PARAMETER	SW-1	SW-2	SW-3	SW-B	SW-B DUP	SD-1	SD-2	SD-3	SD-B	SD-B DUP
VOLATILE ORGANICS										
Trans-1,2-Dichloroethene	6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vinyl chloride	3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SEMIVOLATILE ORGANICS										
Bis (2-Ethylhexyl) phthalate	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.4	BDL	BDL
PESTICIDES & PCB's										
4,4' - DDD	20	BDL	BDL	BDL	BDL	BDL	BDL	BDL	9	BDL
4,4' - DDE	BDL	BDL	0.01	BDL	BDL	BDL	BDL	BDL	15	36
4,4' - DDT	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	70
INORGANICS										
Chromium	100	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Notes: 1. All concentrations in parts per billion (ppb).
2. BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)

Groundwater - No volatile organics, organochlorine pesticides or PCBs were detected in groundwater from Site 4. Semivolatile organics detected consisted of bis (2-ethylhexyl) phthalate (15 ug/l) and 2,4-dimethylphenol (13 ug/l) in sample MPT-2-8.

Priority pollutant metals found in groundwater included total cadmium (0.9 ug/l) and total lead (160 ug/l). Both metals were observed in the sample obtained from monitoring well MPT-2-8.

Surface Water/Sediment. No volatile organics, semivolatile organics, pesticides, PCBs or priority pollutant metals were detected in either the sediment or surface water sample collected at sampling station SD/SW-2.

3.4.5.2 Evaluation of Chemical Distribution.

Volatile Organics - Volatile organic compounds were not detected in groundwater samples obtained from Site 4 but were present in soil samples. Chlorobenzene (37 ug/kg), toluene (232 ug/kg) and 1,1,1-trichlorethane (122 ug/kg) were detected in the soil sample obtained from boring MPT-2-8 but not in a field duplicate of that sample. No criteria or standard exist for either of these three compounds in soils.

Other Organics - The semivolatile organic compounds bis (2-ethylhexyl) phthalate (15 ug/l) and 2,4-dimethylphenol (13 ug/l) were detected in groundwater at Site 4. No PCBs or pesticides were detected in groundwater but PCB-1260 and heptachlor were detected in soils. PCB-1260 was detected in the sample obtained from boring MPT-2-6 at 990 ug/kg which does not exceed the TSCA standard of 50,000 ug/kg for removal. Heptachlor was detected in the soil sample obtained from the field duplicate MPT-2-8 DUP at 6 ug/kg. No criteria or standard exists for heptachlor in soils.

Inorganics - Soil samples collected from Site 4 contained no detectable levels of priority pollutant metals. However, groundwater contained both cadmium and lead. Groundwater sample MPT-2-8 contained total cadmium at 0.9 ug/l which is below the 9.3 ug/l USEPA ambient saltwater quality criteria for chronic exposure established by the USEPA. The same sample also contained total lead at 160 ug/l which exceeds the USEPA ambient saltwater quality criteria of 5.6 ug/l for chronic exposure in marine environments. Groundwater sample MPT-2-5 also contained lead but the concentration of 2 ug/l is below the USEPA ambient water quality criteria for chronic exposure in marine environments.

3.4.5.3 Conclusions. Based upon the review of existing information and the findings of the Expanded Site Investigation, the following conclusions are made for Site 4.

1. The surficial deposits at Site 4 consist of fine to coarse sand with traces of shell fragments overlying a dark olive clay layer starting at 10 feet BLS.

2. The groundwater flow direction in the surficial aquifer at Site 4 is anticipated to be radial towards the peripheral drainage ditch due to mounding of groundwater under the northeastern dredge spoil area.

3. Volatile organics, semivolatile organics, pesticides and PCBs detected in groundwater at Site 4 do not exceed USEPA ambient water quality criteria for chronic exposure in a marine environment.

4. Total lead detected in groundwater from sample MPT-2-8 (160 ug/l) at Site 4 exceeds the USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments.

3.4.5.4 Recommendations. Due to the elevated concentration of total lead (160 ug/l) in groundwater which exceeds USEPA ambient water quality criteria for chronic exposure in marine environments, Site 4 is recommended to undergo an environmental risk assessment.

3.4.6 Site 5

3.4.6.1 Chemical Distribution. The results of the analytical program for soil, groundwater, surface water, and sediment samples collected at Site 5 are presented in Tables 3-5, 3-6, and 3-7, respectively. Chemicals found in concentrations greater than their laboratory detection limits are shown in Figure 3-7.

Soil - Soil samples obtained from Site 5 contained no detectable levels of volatile organics, semivolatile organics, organochlorine pesticides, or priority pollutant metals. The only contamination detected in the soil at Site 5 was PCB-1260. PCB-1260 was found at a concentration of 2,300 ug/kg in the sample collected from boring MPT-2-1 (2-4 feet BLS).

Groundwater - Groundwater at Site 5 contained no detectable levels of either organochlorine pesticides or PCBs. Volatile organics detected in groundwater included benzene (1 ug/l) and chlorobenzene (139 ug/l) in sample MPT-2-3. Semivolatile organics detected in groundwater included di-n-octyl phthalate, phenol, bis (2-ethylhexyl) phthalate, and 1,4-dichlorobenzene.

Sample MPT-2-1 contained bis (2-ethylhexyl) phthalate at 14 ug/l. Sample MPT-2-3 contained 1,4-dichlorobenzene at 12 ug/l. Di-n-octyl phthalate was detected in sampled MPT-2-4 and S-4 at 18 ug/l and 16 ug/l, respectively. Sample MPT-2-4 contained phenol at 10 ug/l.

Priority pollutant metals detected in the groundwater samples obtained from Site 5 include chromium and lead. Total chromium (hexavalent) was detected at 100 ug/l in samples obtained from monitoring wells MPT-2-4, S-4, and S-5. Total lead was detected at 4 ug/l in sample MPT-2-1 and at 5 ug/l in sample S-4.

Surface Water/Sediment. The sediment sample collected at station SD/SW-1 had no detectable level of any of the compounds analyzed for. However, the corresponding surface water sample contained trans-1,2-dichloroethene (6 ug/l), vinyl chloride (3 ug/l), 4,4'-DDD 20 ug/l), and total chromium (100 ug/l).

3.4.6.2 Evaluation of Chemical Distribution

Volatile Organics - No volatile organics were detected in soils at Site 5 but groundwater contained both benzene (1 ug/l) and chloroebenzene (139 ug/l) in sample MPT-2-3. Criteria for chronic exposure limits in marine environment for these compounds have not been established by the USEPA.

Volatile organics were also detected in a surface water sample (SW-1) obtained from a ditch which crosses Site 5. This sample contained both trans-1,2-dichloroethene (6 ug/l) and vinyl chloride (3 ug/l). A criteria for chronic exposure in marine environments for trans-1,2-dichloroethene and vinyl chloride has not been established by the USEPA.

Other Organics. The pesticide 4,4'-DDD was detected in a surface water sample collected from the drainage ditch which crosses Site 5. Surface water sample SW-1 contained 4,4'-DDD at 20 ug/l. This exceeds the USEPA ambient water quality criteria of 0.001 ug/l for chronic exposure in a marine environment.

Inorganics. Both chromium and lead were detected in groundwater at Site 5. Total lead was detected in Sample S-4 at a concentration of 5 ug/l. This concentration does not exceed the USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments. However, the concentration of total chromium (hexavalent) found in samples MPT-2-4, S-4, and S-5 was 100 ug/l which exceeds the USEPA ambient water quality criteria of 50 ug/l for chronic exposure in marine environments. Chromium was also detected in surface water sample SW-1 at 100 ug/l which exceeds the USEPA ambient

water quality criteria of 50 ug/l for chronic exposure in marine environments.

3.4.6.3 Conclusions. Based upon the review of existing information and the findings of the Expanded Site Investigation, the following conclusions are made for Site 5.

1. The surficial deposit at Site 5 is comprised of a fine to medium sand containing traces of shell fragments. This deposit overlies a clay layer located at approximately 10 feet BLS.

2. Groundwater flow in the surficial aquifer is anticipated to be directed towards the drainage ditch system located around the site. Flow is anticipated to be influenced by mounding of groundwater which is occurring under both spoil areas.

3. Because of brackish groundwater and extensive dredge and fill activity at NAVSTA, the terrain conductivity survey produced no anomalous results which could be interpreted as a leachate plume.

4. Volatile organics, semivolatile organics, pesticides and metals in soils around Site 5 were not detected. The concentration of PCB-1260 found in the soil sample collected from boring MPT-2-1 does not exceed the TSCA criteria for removal.

5. Benzene (1 ug/l) and chlorobenzene (139 ug/l) were detected in the groundwater sample obtained from monitoring well MPT-2-3. No ambient water quality criteria for chronic exposure in marine environments has been developed by the USEPA for these two compounds.

6. Pesticides and PCBs were not detected in groundwater at Site 5.

7. Total hexavalent chromium was reported at 100 ug/l in three separate groundwater samples from Site 5. This level exceeds USEPA ambient water quality criteria (50 ug/l) for chronic exposure in marine environments.

8. Surface water sample SW-1 contained vinyl chloride (3 ug/l), trans-1,2-dicloroethene (6 ug/l), hexavalent chromium (100 ug/l) and 4,4'-DDD (20 ug/l). The concentrations of hexavalent chromium and 4,4'-DDD exceed their corresponding USEPA ambient water quality criteria of 50 ug/l and 0.001 ug/l,

respectively, for chronic exposure in marine environments. No criteria for chronic exposure in marine environments has been established for vinyl chloride or trans-1,2-dichloroethene by USEPA.

3.4.6.4 Recommendations. Due to the elevated concentrations of hexavalent chromium in groundwater and in surface water, Site 5 is recommended to undergo an environmental risk assessment.

3.4.7 Site 6

3.4.7.1 Chemical Distribution. The results of the analytical program for soil, groundwater, surface water, and sediment samples collected at Site 6 are presented in Tables 3-5, 3-6, and 3-7, respectively. Chemicals found in concentrations greater than their laboratory detection limits are presented on Figure 3-7.

Soils - The only contaminant detected in soils at Site 6 was PCB-1260 (190 ug/kg) in the sample obtained at 0 to 2 ft BLS from boring MPT-2-2.

Groundwater - Groundwater samples collected from Site 6 contained no detectable levels of volatile organic compounds. Semivolatile organic compounds detected at Site 6 include acenaphthene (35 ug/l) in the sample obtained from monitoring well MPT-2-2 and bis (2-ethylhexyl) phthalate (20 and 35 ug/l) in samples MPT-2-15S and MPT-2-15S DUP. Heptachlor was detected in the sample obtained from monitoring well MPT-2-15S at 0.03 ug/l. In addition, total lead was found in the sample obtained from monitoring well MPT-2-2 at 4 ug/l.

Surface Water/Sediment - The sediment sample collected at station SD/SW-3 contained bis (2-ethylhexyl) phthalate at a concentration of 1.4 ug/kg. The corresponding surface water sample was found to contain 4,4'-DDE at 0.01 ug/l. No other compound was detected in either the surface water or sediment sample collected at this station.

3.4.7.2 Evaluation of Chemical Distribution.

Volatile Organics - No volatile organics were detected in soil, groundwater, surface water, or sediment samples collected at Site 6.

Other Organics - Semivolatile organics detected in groundwater at Site 6 include acenaphthene (35 ug/l) and bis (2-ethylhexyl) phthalate (20 to 35 ug/l). Groundwater sample MPT-2-15S contained heptachlor at 0.03 ug/l. This concentration exceeds

the USEPA ambient water quality criteria of 0.0036 ug/l for heptachlor for chronic exposure in marine environments. Surface water sample SW-3 contained 4,4'-DDE at 0.01 ug/l. This exceeds the USEPA ambient water quality criteria of 0.001 ug/l for chronic exposure in marine environments. Soils from boring MPT-2-2 contained PCB-1260 at 190 ug/kg. As aforementioned, this concentration is below the TSCA standard of 50,000 ug/l set as a clean-up level by the USEPA.

Inorganics - Total lead was detected at 4 ug/l in the groundwater sample obtained from monitoring well MPT-2-2. This concentration is below the USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments.

3.4.7.3 Conclusions. Based on a review of available information from previous studies and the findings from the Expanded Site Investigation conducted by Jordan, the following conclusions are made for Site 6.

1. The surficial geology at Site 6 is comprised of a fine to medium sand with few shell fragments. This deposit overlies a dark olive clay layer found at a depth of approximately 10 feet BLS.

2. The groundwater flow direction in the surficial aquifer under Site 6 is north towards the peripheral drainage ditch.

3. Concentrations of volatile organics, semivolatile organics and total metals in groundwater at Site 6 are below USEPA ambient water quality criteria for chronic exposure in marine environment, when applicable.

4. Heptachlor was detected at 0.03 ug/l in the groundwater sample collected from MPT-2-15S and exceeds the USEPA ambient water quality criteria (0.0036 ug/l) for chronic exposure in a marine environment.

5. PCB-1260 (190 ug/kg) detected in soil sample MPT-2-2 is below the TCSA criteria of 50,000 ug/kg.

6. Surface water sample SW-3, collected adjacent to Site 6, contained 4,4'-DDE at 0.01 ug/l. This concentration exceeds ambient water quality criteria of 0.001 ug/l for chronic exposure in marine environments.

3.4.7.4 Recommendations. As a result of elevated concentrations of heptachlor and 4,4'-DDE in water samples

collected around Site 6, this site is recommended to undergo an environmental risk assessment to determine if the site poses a threat to the marine environment.

3.4.8 Background Samples

Monitoring wells MPT-2-7S and MPT-2-7D were used to obtain background samples for Sites 2, 4, 5, and 6. No contamination was detected in the soil sample obtained from boring MPT-2-7S. Groundwater from the deep well, MPT-2-7D, contained bis (2-ethylhexyl) phthalate at 28 ug/l and total lead at 0.2 ug/l. The shallow well, MPT-2-7S, contained 4,4'-DDE at a concentration of 0.01 ug/l.

The sediment sample collected from sampling station SD/SW-B contained no detectable levels of volatile organics or priority pollutant metals.

The pesticides 4,4'-DDD, 4,4'-DDE and 4,4'-DDT were detected in the sediment sample collected at station SD/SW-B. Sediment sample SD-B contained 4,4'-DDD and 4,4'-DDE at 9 ug/kg and 15 ug/kg, respectively. Sample SD-B DUP contained 4,4'-DDE and 4,4'-DDT at 36 ug/kg and 70 ug/kg, respectively.

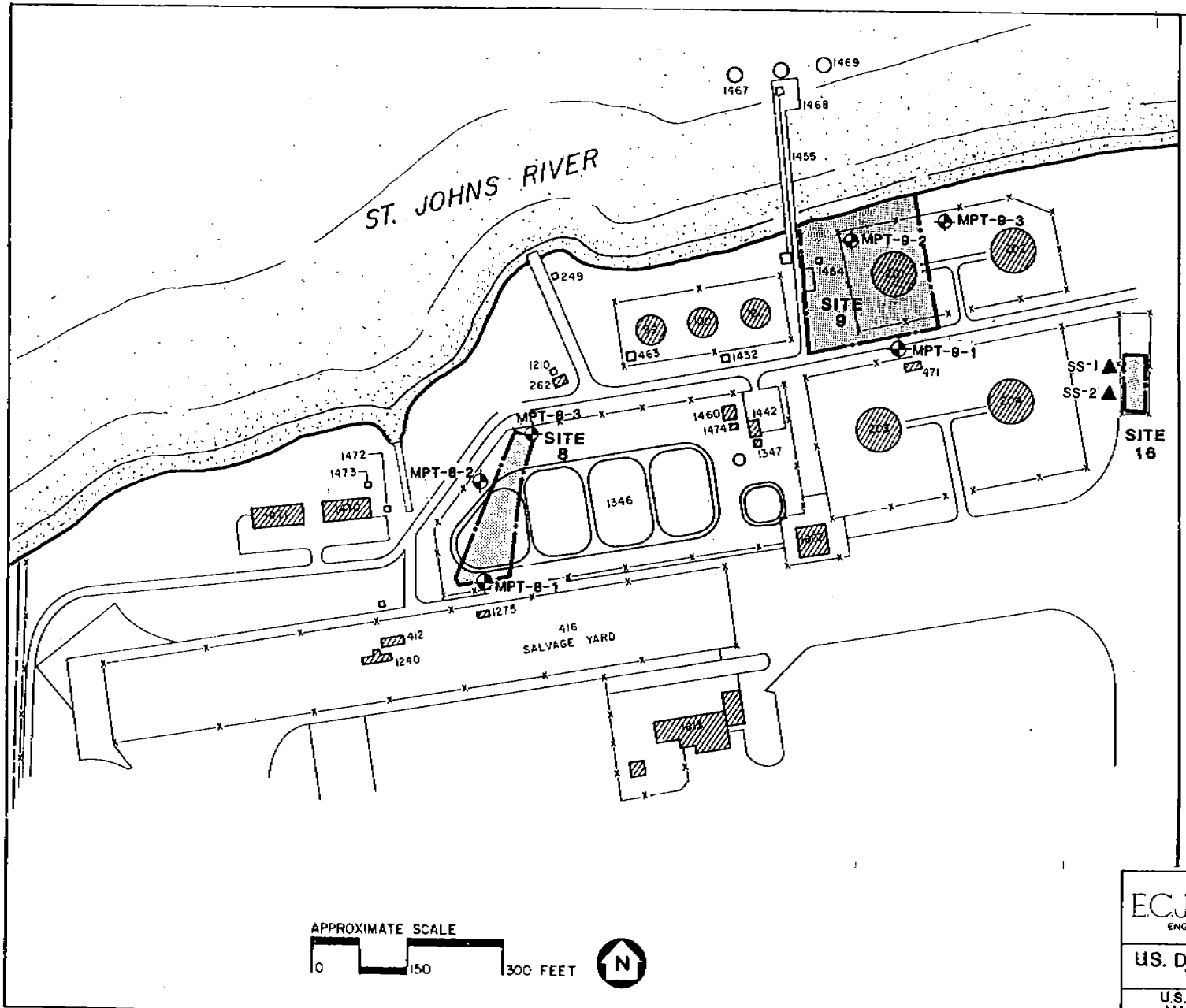
3.5 STUDY OF SITE 8 - WASTE OIL PIT AREA

Site 8, the inactive waste oil pit, is located in the western portion of the waste oil treatment facility (Figure 3-8). The site originally consisted of a 0.2 acre pit excavated to a depth of approximately 6 feet. Triangular in shape, the pit was used from 1973 to 1978 to store waste oily bilge water which was pumped to it directly from ships. In addition, the site received waste oils and other substances mixed with waste oil.

3.5.1 Field Exploration and Sampling Plan

The exploration program at Site 8 consisted of three soil borings completed with monitoring well installation, three soil samples and three groundwater samples. The location of these explorations is presented in Figure 3-8 and the specific rationale for each monitoring well location is as follows:

- MPT-8-1 is a shallow monitoring well located southwest of Site 8 and is upgradient of the site.
- MPT-8-2 is a shallow monitoring well located northwest of Site 8 and is downgradient of Site 8.

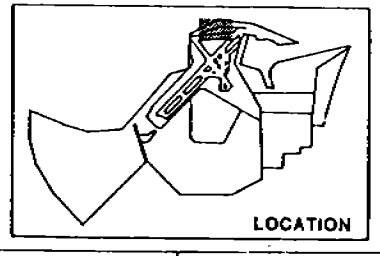


LEGEND

- MPT-8-1 — LOCATION OF MONITORING WELLS
- SS-1 ▲ — SOIL SAMPLING LOCATIONS (SS-1 AND SS-2)
- SITE LOCATION AREA
- x—x—x FENCE

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM FWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



E.C JORDAN CO. ENGINEERS & SCIENTISTS	LOCATIONS OF EXPLORATIONS SITE 8,9, & 16
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-8

- MPT-8-3 is a shallow monitoring well located north of Site 8 and is downgradient of Site 8.

One soil sample was collected from each boring for laboratory chemical analysis. The soil samples were collected from the unsaturated soils just above the water table. Upon well completion and development, a groundwater sample was collected from each for submittal to the laboratory. The analytical program for samples collected at Site 8 is presented in Table 3-2.

Water level readings observed in the monitoring wells were used to assess groundwater flow direction. Rising head tests were conducted to determine hydraulic conductivity.

3.5.2 Hydrogeology

The shallow surface soils at Site 8 consist mainly of fine to medium quartz sand. A thin (less than 0.5 feet) clay layer was noted in boring MPT-8-1 at 15 feet BLS. This clay layer was not noted in borings MPT-8-2 and MPT-8-3.

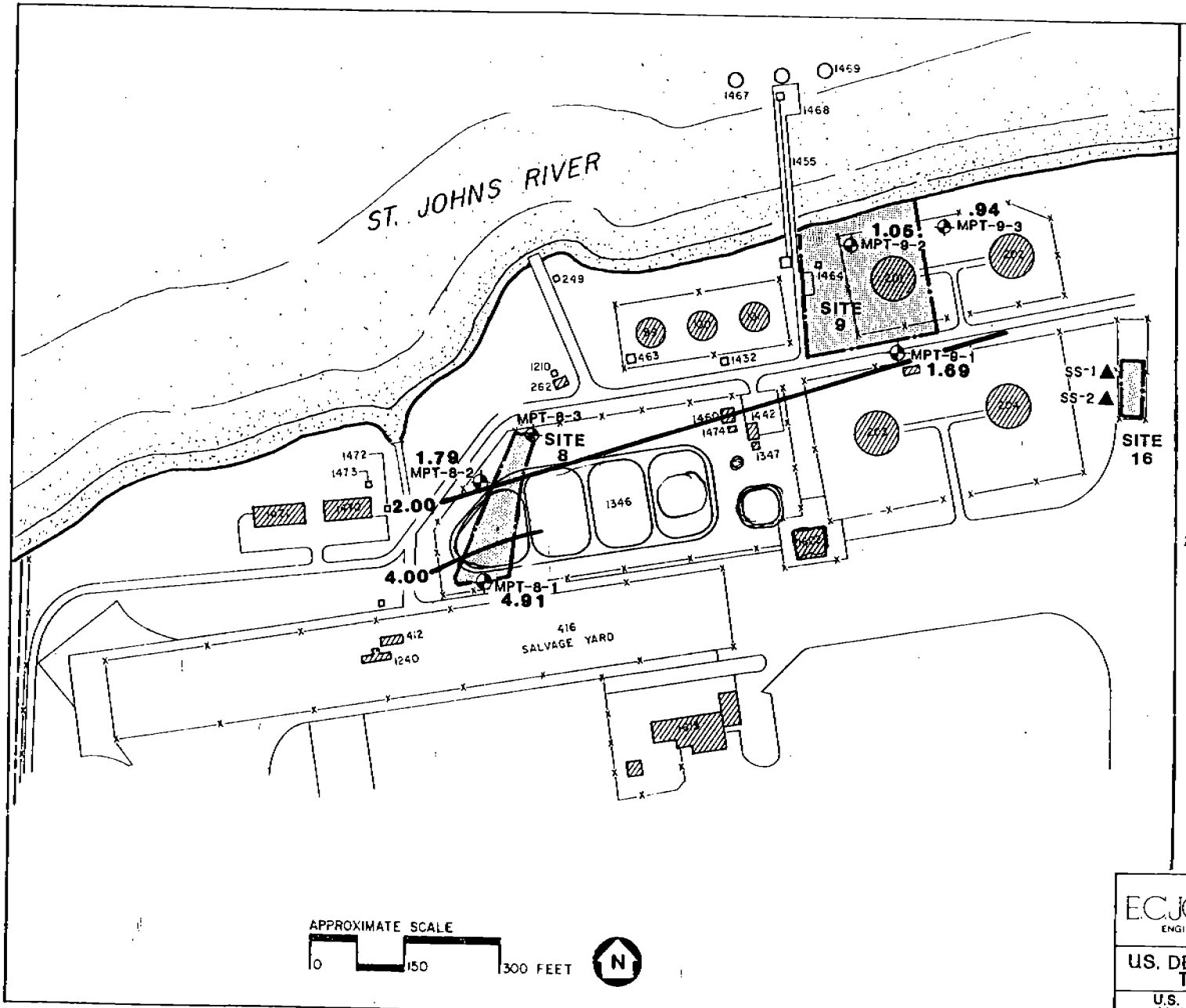
Water level measurements were collected on two occasions at Site 8. Water level measurements in monitoring well MPT-8-3 were not used to assess flow direction due to the presence of free product. Water level measurements obtained from monitoring wells on Site 8 and Site 9, on 8 October 1987, indicate an average hydraulic gradient of 0.01 feet per foot across Site 8 (Figure 3-9). Groundwater flows north-northwest directly towards the St. Johns River which is located approximately 275 feet north of monitoring well MPT-8-3.

Assuming a conservative estimate of 0.25 for the effective porosity of the soil medium and a value for the hydraulic conductivity of 2.8 ft/day (upper limit of aquifer test procedure), the seepage velocity within the surficial aquifer was calculated to be greater than 0.1 ft/day. Due to the actual hydraulic conductivity exceeding the test procedure's maximum limit, a more accurate calculation of the seepage velocity can not be made.

3.5.3 Chemical Distribution

The results of the analyses on soil and groundwater samples obtained at Site 8 are presented in Table 3-8. Chemicals at concentrations equal to or greater than their laboratory detection limits are presented on Figure 3-10.

Soil - Trichlorofluoromethane (Freon) was detected at a concentration of 79 ug/kg in the soil sample collected from

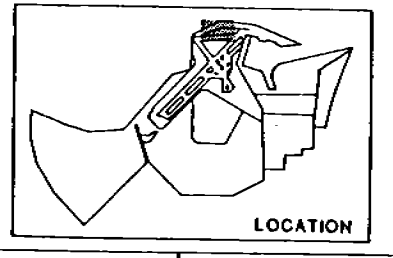


LEGEND

- MPT-8-1 — LOCATION OF MONITORING WELLS
- SS-1 — SOIL SAMPLING LOCATIONS (SS-1 AND SS-2)
- SITE LOCATION AREA
- FENCE
- 2.00 — EQUIPOTENTIAL LINE, FEET MSL

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.

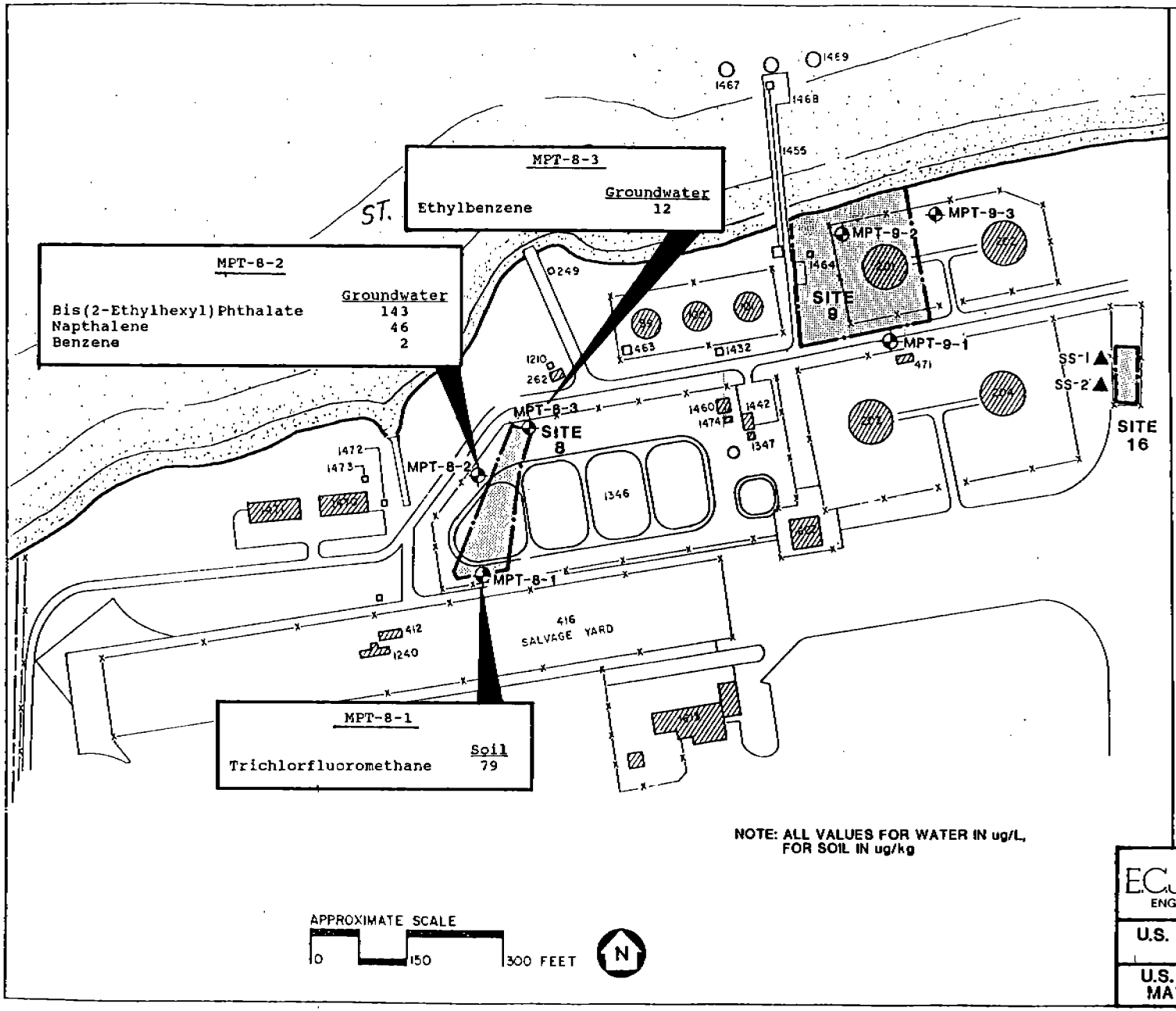


E.C JORDAN CO. ENGINEERS & SCIENTISTS	POTENTIOMETRIC SURFACE MAP ACROSS SITES 8,9 & 16
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-9

TABLE 3-8
SUMMARY OF CHEMICAL ANALYSIS SITE 8
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

MEDIA	PARAMETER	MPT-8-1	MPT-8-1DUP	MPT-8-2	MPT-8-3
SOIL	VOLATILE ORGANICS				
	Trichlorofluoromethane	79 ug/kg	BDL	BDL	
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL	
	PESTICIDES & PCB's	BDL	BDL	BDL	
	TOTAL METALS	BDL	BDL	BDL	
GROUNDWATER	VOLATILE ORGANICS	BDL	BDL	BDL	
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL	BDL
	Bis(2-ethylhexyl)phthalate	BDL	BDL	143 ug/l	BDL
	Napthalene	BDL	BDL	46 ug/l	BDL
	Benzene	BDL	BDL	2 ug/l	BDL
	Ethylbenzene	BDL	BDL	BDL	12 ug/l
	PESTICIDES & PCBs	BDL	BDL	BDL	BDL
	Endrine aldehyde	BDL	BDL	BDL	0.05 ug/l
	G-BHC	BDL	BDL	BDL	0.03 ug/l
	TOTAL METALS				
	Lead	BDL	2 ug/l	BDL	41 ug/l

NOTE: BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)



LEGEND

MPT-8-1 ⊕ LOCATION OF MONITORING WELLS

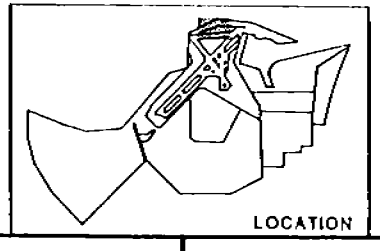
SS-1 ▲ SOIL SAMPLING LOCATIONS (SS-1 AND SS-2)

SITE LOCATION AREA

FENCE

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=300'.



NOTE: ALL VALUES FOR WATER IN ug/L, FOR SOIL IN ug/kg

APPROXIMATE SCALE
0 150 300 FEET
N

E.C. JORDAN CO. ENGINEERS & SCIENTISTS	CHEMICAL DISTRIBUTION SITE 8
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-10

boring MPT-8-1 (7-9 ft BLS). No other chemicals were detected in any of the three soil samples collected at Site 8.

Groundwater - Petroleum free product was observed in monitoring well MPT-8-3. The thickness of this petroleum hydrocarbon layer was measured and found to be approximately 0.9 feet. Ethylbenzene was detected at 12 ug/l in the sample collected from monitoring well MPT-8-3. Endrin aldehyde and G-BHC (lindane) were also detected in the sample collected from monitoring well MPT-8-3. Endrin aldehyde was found at 0.05 ug/l and G-BHC was detected at a concentration 0.03 ug/l. No other organic compound was detected in this sample. However, the high concentration of an unidentified hydrocarbon resulted in the detection limits for both base/neutral and acid extractable organics to be raised significantly (up to 250 times for base/neutral compounds). Total lead in the sample obtained from monitoring well MPT-8-3 was found at 41 ug/l.

Naphthalene (46 ug/l), benzene (2 ug/l), and bis (2-ethylhexyl) phthalate (143 ug/l) were detected in the groundwater sample obtained from monitoring well MPT-8-2. The only chemical detected in the sample collected from monitoring well MPT-8-1 was lead. The concentration of total lead in a duplicate sample was found to be 2 ug/l and in the other was below detection.

3.5.4 Evaluation of Chemical Distribution

Volatile Organics - Trichlorofluoromethane was found in the soil sample collected upgradient of Site 8 but was not detected in groundwater. Trichlorofluoromethane is a highly volatile fluorocarbon chloride commonly known as Freon 11. Although no standards exist for this chemical, the concentration of 79 ug/kg is not expected to pose a significant threat to human health or the environment. Benzene (2 ug/l) and ethylbenzene (12 ug/l) detected in the groundwater samples from MPT-8-2 and MPT-8-3 are indicative of petroleum contamination. No USEPA ambient water quality criteria for chronic exposure in marine environments exists for either of these compounds.

Endrin aldehyde (0.05 ug/l) and G-BHC (0.03 ug/l) were detected in the groundwater sample collected from MPT-8-3. The concentration of endrin aldehyde exceeds the USEPA ambient water quality criteria of 0.0023 ug/l for chronic exposure in marine environments. No corresponding criteria for chronic exposure in marine environments has been established by the USEPA for G-BHC.

Other Organics - Naphthalene and bis (2-ethylhexyl) phthalate were detected in the groundwater sample collected from monitoring well MPT-8-2. The naphthalene (46 ug/l) is

indicative of petroleum contamination and bis (2-ethylhexyl) phthalate is a constituent of plastics. Neither compound is currently regulated and no ambient water quality criteria has been established by the USEPA.

Inorganics - Total lead was detected at 2 ug/l in the groundwater sample collected from monitoring well MPT-8-2. This concentration is below the USEPA ambient water quality criteria (5.6 ug/l) for chronic exposure in marine environments.

3.5.5 Conclusions

Based on a review of available information from previous studies and the findings of the ESI conducted by Jordan, the following conclusions are made for Site 8:

1. The shallow subsurface geology at Site 8 consists of permeable fine sands.

2. Shallow groundwater flows north, discharging into the St. Johns River.

3. A layer of floating petroleum hydrocarbon product was observed in MPT-8-3.

4. Benzene, ethylbenzene, naphthalene, and bis (2-ethylhexyl) phthalate were detected in the groundwater at low concentrations. No ambient water quality criteria for marine environments has been established by the USEPA for these compounds.

3.5.6 Recommendations

Due to the presence of free product in the vicinity of monitoring well MPT-8-3 and an elevated concentration of naphthalene and endrin aldehyde in groundwater, Site 8 is recommended to undergo an environmental risk assessment to assess any threat to the marine environment which might result from contaminants migrating from the site.

3.6 STUDY OF SITE 9 - FUEL SPILL AREA

Site 9, the fuel spill area, is located in the Naval Supply Center (NSC) fuel farm and is north and west of Tank 201 (Figure 3-8). This site was recently identified from stained soil samples obtained from a boring program which was part of a construction plan. Although the source and quantity of fuel is unknown, it is believed to have originated in the fuel farm

area. It is suspected that the fuel is either JP-4, JP-5, or diesel fuel-marine.

3.6.1 Field Exploration and Sampling Plan

The exploration program for Site 9 consisted of three soil borings completed with monitoring well installation, three soil samples, and three groundwater samples. The location of these explorations is presented in Figure 3-8 and the specific rationale for each monitoring well location is presented as follows:

- MPT-9-1 is a shallow monitoring well located northeast of Tank 203 and south of Tank 201 (south of Site 9) and is upgradient of the suspected fuel spill area.
- MPT-9-2 is a shallow monitoring well located northwest of Tank 201 and is downgradient of the suspected fuel spill area.
- MPT-9-3 is a shallow monitoring well located northeast of Tank 201 and is anticipated to be downgradient of the suspected fuel spill area.

One soil sample was collected from each boring in the unsaturated soil just above the water table and submitted for laboratory chemical analysis. After monitoring well installation and development, groundwater samples were collected from each monitoring well and submitted to the laboratory for chemical analysis. Water level measurements observed in these wells, were used to assess the groundwater flow direction beneath the site.

3.6.2 Hydrogeology

The shallow surface deposits at Site 9 consist mainly of fine quartz sands with shells. Two thin clay lenses (less than 0.5 feet thick) were identified in boring MPT-9-1 at about 6 feet BLS. The clay lenses were not identified in either MPT-9-2 or MPT-9-3. Monitoring wells were screened in the fine to medium sand with shells.

Water levels were measured in the monitoring wells twice during the study. The water level measurements were used to calculate a hydraulic gradient of 0.003 feet per foot across Site 9. Groundwater flows north, directly to the St. Johns River which is located approximately 30 feet north of MPT-9-2 and MPT-9-3.

Rising head tests were conducted on monitor wells installed during this investigation. The upper limit for hydraulic conductivity was calculated to be 2.8 feet day. Assuming a

conservative estimate of 0.25 for the effective porosity of the aquifer, the calculated seepage velocity for the surficial aquifer exceeds 3×10^{-2} ft/day. Due to the actual hydraulic conductivity exceeding the rising head test procedure upper bound, a more accurate calculation of the seepage velocity can not be made.

3.6.3 Chemical Distribution

The results of the analyses of soils and groundwater obtained at Site 9 are presented in Table 3-9. Chemicals which were detected at concentration equal to or greater than the minimum detection limit are shown in Figure 3-11.

Soil - Methylene chloride was detected at 186 ug/kg in the soil sample collected from boring MPT-9-3 (6-8 ft BLS). This was the only compound found above its detection limit in the soil samples collected from Site 9.

Groundwater - Naphthalene (120 ug/l) was detected in the groundwater sample obtained from monitoring well MPT-9-2. No other samples collected from monitoring wells at Site 9 had detectable levels of any volatile or semivolatile organics. The pesticides aldrin and 4,4'-DDE were detected at 0.07 ug/l and 0.04 ug/l, respectively, in the groundwater sample obtained from monitoring well MPT-9-1. Total lead was detected in the groundwater samples from monitoring wells MPT-9-2 (2.0 ug/l) and MPT-9-3 (3.0 ug/l). Total mercury (0.8 ug/l) was detected in the groundwater sample collected from monitoring well MPT-9-3.

3.6.4 Evaluation of Chemical Distribution

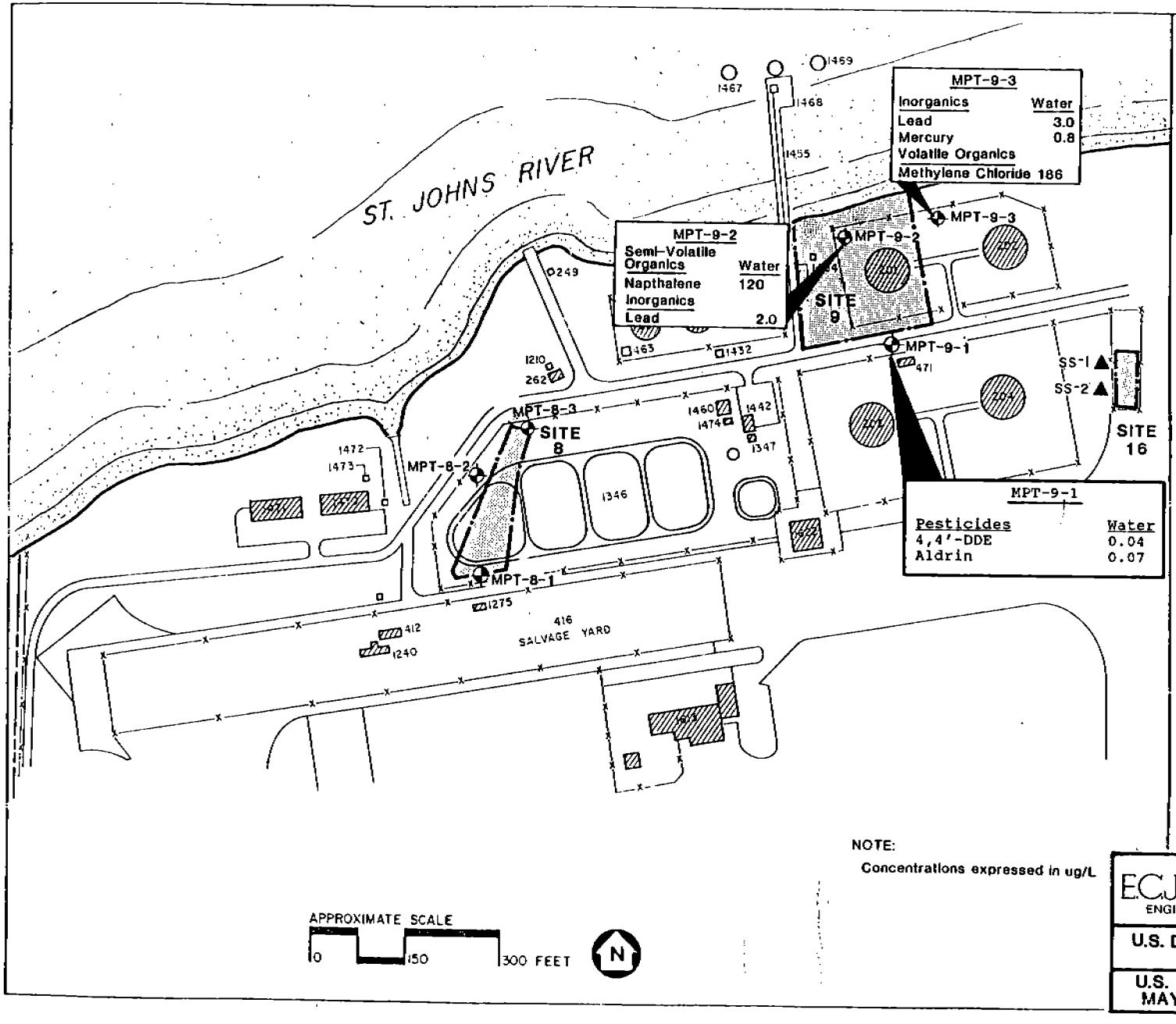
Volatile Organics - Methylene chloride (186 ug/kg) was found in the soil sample obtained from boring MPT-9-3; however, it was not detected in any of the groundwater samples taken from Site 9. No criteria exists for this compound in soils.

Other Organics - Naphthalene (120 ug/l) was detected in the groundwater sample collected from monitoring well MPT-9-2. This concentration exceeds the target level for total naphthalene (100 ug/l) set by FDER in Chapter 17-70, FAC. The naphthalene is most likely a contaminant from a fuel spill. The pesticides B-BHC (0.07 ug/l) and 4,4'-DDE (0.04 ug/l) were detected in the groundwater sample collected from monitoring well MPT-9-1. The concentration for 4,4'-DDE is above the USEPA ambient water quality criteria (0.001 ug/l) for chronic toxicity to saltwater aquatic life. No ambient water quality criteria for marine environments has been established by the USEPA for B-BHC.

TABLE 3-9
SUMMARY OF CHEMICAL ANALYSES SITE 9
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

MEDIA	PARAMETER	MPT-9-1	MPT-9-2	MPT-9-3
SOIL	VOLATILE ORGANICS			
	Methylene Chloride	BDL	BDL	186 ug/kg
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL
	PESTICIDES & PCB's	BDL	BDL	BDL
	TOTAL METALS	BDL	BDL	BDL
GROUNDWATER	VOLATILE ORGANICS	BDL	BDL	BDL
	SEMIVOLATILE ORGANICS			
	Naphthalene	BDL	120 ug/L	BDL
	PESTICIDES & PCB's			
	Aldrin	0.07 ug/L	BDL	BDL
	4,4'-DDE	0.04 ug/L	BDL	BDL
	TOTAL METALS			
	Lead	BDL	2 ug/L	3 ug/L
	Mercury	BDL	BDL	0.8 ug/L

NOTE: BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)



LEGEND

MPT-8-1 ⊕ LOCATION OF MONITORING WELLS

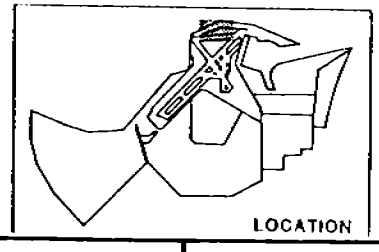
SS-1 ▲ SOIL SAMPLING LOCATIONS (SS-1 AND SS-2)

SITE LOCATION AREA

FENCE

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



LOCATION

NOTE:
Concentrations expressed in ug/L

E.C. JORDAN CO. ENGINEERS & SCIENTISTS	CHEMICAL DISTRIBUTION SITE 19
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-11

Inorganics - Concentrations of total lead (2 to 3 ug/l) in groundwater were detected at levels below the corresponding USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments. Total mercury detected in the groundwater sample obtained from monitoring well MPT-9-3 was 0.8 ug/l and exceeds the USEPA ambient water quality criteria (0.025 ug/l) for chronic exposure in saltwater environments.

3.6.5 Conclusions

Based on a review of available information from previous studies and the findings of the ESI conducted by Jordan, the following conclusions are made for Site 9:

1. The shallow subsurface geology at Site 9 consist of permeable sands and shells.

2. Shallow groundwater flows north towards the St. Johns River.

3. Naphthalene (120 ug/l) detected in a downgradient groundwater sample is indicative of a petroleum spill at the site. This concentration exceeds the FDER target level (100 ug/l total naphthalenes) for groundwater cleanup of petroleum contamination established in Section 17.70.011(5)(a), FAC.

4. The concentration of the pesticide 4,4'-DDE (0.04 ug/l) in the upgradient well exceeds the USEPA ambient water quality criteria (0.001 ug/l) for chronic exposure in marine environments.

5. Mercury detected in the groundwater sample from monitoring well MPT-9-3 (0.8 ug/l) exceeds USEPA ambient water quality criteria of 0.025 ug/l for chronic exposure in marine environments.

3.6.6 Recommendations

Site 9 is recommended to undergo an environmental risk assessment due to the elevated level of total mercury which exceeds USEPA ambient water quality criteria for chronic exposure in marine environments.

3.7 STUDY OF SITE 13 - OLD FIRE TRAINING AREA(S)

During a site visit on 26 August 1987, additional information regarding the extent of the Old Fire Training Area was brought to Jordan's attention. Aerial photos showed at least two additional areas for fire training existed north of the one

identified in the Initial Assessment Study. These three areas are shown on Figure 3-12.

These sites were used as fire fighting training areas from 1973 to 1982. The areas are reported to have consisted of low, earthen berms constructed on an abandoned asphalt runway. Materials used in the training exercises included waste oil, transformer oil, solvents, and fuels (JP-4, JP-5, AVGAS and DFM). Fuels and other items not combusted during training exercises remained in the pit or ran off the side of the runway.

During new construction activities the southernmost fire training area was disturbed to a depth of 4 to 6 feet for construction of a new pipeline. The soils were spread over the area and subsequently paved with asphalt as part of a parking lot. It is not known what activities took place at the two northernmost fire training areas. These sites are now covered by a ramp area, a building, paved roads, parking areas, and grass.

3.7.1 Field Exploration and Sampling Plan

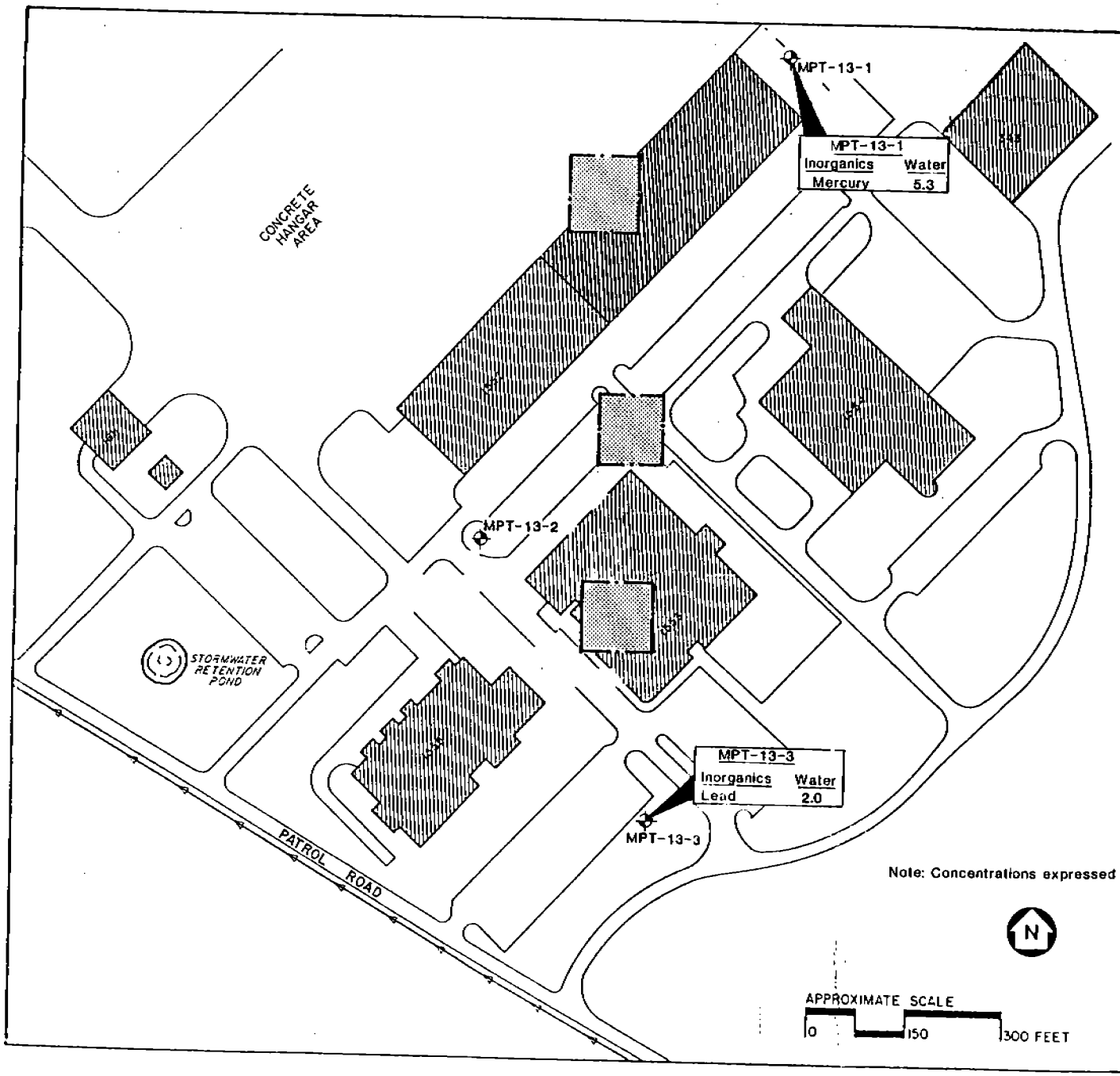
The exploration program at Site 13 consisted of three soil borings completed with monitoring well installations, three soil samples, and three groundwater samples. The locations of these explorations are presented on Figure 3-12 and the specific rationale for each monitoring well location is as follows:

- MPT-13-1 is a shallow monitoring well located northeast of the northernmost fire training area and is downgradient of Site 13.

- MPT-13-2 is a shallow monitoring well located southwest of the center fire training area and northwest of the southernmost fire training area. This well appears to be in an upgradient position of the three training areas.

- MPT-13-3 is a shallow monitoring well located south of the southernmost fire training area and is downgradient of Site 13 and upgradient of the drainage ditch.

The depth of each borings was 10 feet below ground surface. Well screens were 7 feet in length and set in fine to medium grained sand. One soil sample was collected from each monitoring well boring and submitted for chemical analysis. Soil samples were taken in the unsaturated zone just above the water table. Upon well development, a groundwater sample was collected from each well and submitted for laboratory analysis.



LEGEND

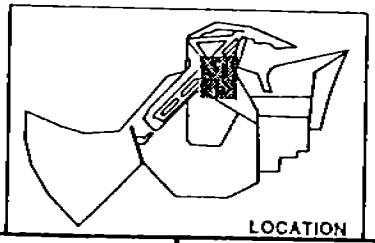
MPT-13-1 — LOCATION OF MONITORING WELLS

SUSPECTED SITE 13 LOCATION AREAS

STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



LOCATION

E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

LOCATIONS OF EXPLORATIONS AND CHEMICAL DISTRIBUTION SITE 13

U.S. DEPARTMENT OF THE NAVY

NIRP EXPANDED SITE INVESTIGATION

U.S. NAVAL STATION MAYPORT, FLORIDA

5097-06 FIGURE 3-12

The analytical program for samples collected at Site 13 is presented in Table 3-2.

3.7.2 Hydrogeology

Ground surface elevations across the site range from 7 to 10 feet MSL. Much of the site is now covered by roads, parking lots, hangar pads, and building. A few grassy areas are present within medians and around buildings.

Surficial geology at Site 13 is similar to that underlying Sites 2, 4, 5, and 6. From the surface to around 0 to -2 feet MSL the soil is comprised of a fine to medium sand with occasional shells and shell fragments. Below the sand lies a stiff, dark olive clay. The thickness of the clay layer is unknown but is at least 2 feet in places (see boring logs in Appendix A-5).

Water levels were measured on three occasions in the three monitoring wells located around the site (see Appendix A-7). This data plus inference made from local topography suggest that groundwater is flowing in a radial pattern in the vicinity of Site 13 (see Figure 2-4). Flow trends towards the turning basin in the eastern portion of the site and towards the drainage ditch network throughout the southwestern portion of the site. Due to the paucity of data, no flow net could be generated for this site.

3.7.3 Chemical Distribution

The results of analyses of soils and groundwater obtained at Site 13 are presented in Table 3-10. Additionally, chemicals which were detected at concentrations greater than their corresponding laboratory detection limits are presented on Figure 3-10.

Soil - No volatiles, semivolatiles, pesticides, PCBs or metals were detected in any of the three analytical soil samples.

Groundwater - No volatile or semivolatile organics, pesticides, or PCBs were detected in the groundwater samples collected at Site 13. However, trace metals were detected in two samples. Total lead was detected in the sample obtained from monitoring well MPT-13-3 at 2 ug/l and total mercury was detected in the sample from well MPT-13-1 at 5.3 ug/l.

3.7.4 Evaluation of Chemical Distribution

Volatile and Semivolatile Organics - Volatile and semivolatile organic compounds were not detected in either the soil or groundwater samples collected at Site 13.

TABLE 3-10
SUMMARY OF CHEMICAL ANALYSES SITE 13
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

MEDIA	PARAMETER	MPT-13-1	MPT-13-2	MPT-13-3
SOIL	VOLATILE ORGANICS	BDL	BDL	BDL
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL
	PESTICIDES & PCB's	BDL	BDL	BDL
	TOTAL METALS	BDL	BDL	BDL
GROUNDWATER	VOLATILE ORGANICS	BDL	BDL	BDL
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL
	PESTICIDES & PCB's	BDL	BDL	BDL
	TOTAL METALS			
	Lead	BDL	BDL	2 ug/L
	Mercury	5.3 ug/L	BDL	BDL

NOTE: BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9)

Pesticides and PCBs - Pesticides and PCBs were not detected in either soil or groundwater at Site 13.

Inorganics - Priority pollutant metals were not detected in any of the soil samples collected at Site 13. Total lead was reported at 2 ug/l in the groundwater sample collected from monitoring well MPT-13-3. This concentration is below the ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments set by the USEPA.

Total mercury was reported in the groundwater sample collected from well MPT-13-1 at 5.3 ug/l which is above the ambient water quality criteria of 0.025 ug/l for chronic exposure in marine environments set by the USEPA.

3.7.5 Conclusions

Based on a review of available information from previous studies and the findings of this Expanded Site Investigation, the following conclusions are made for Site 13:

1. The subsurface geology consists of fine to medium grained sands overlying a clay of unknown thickness (at least 2 feet thick).

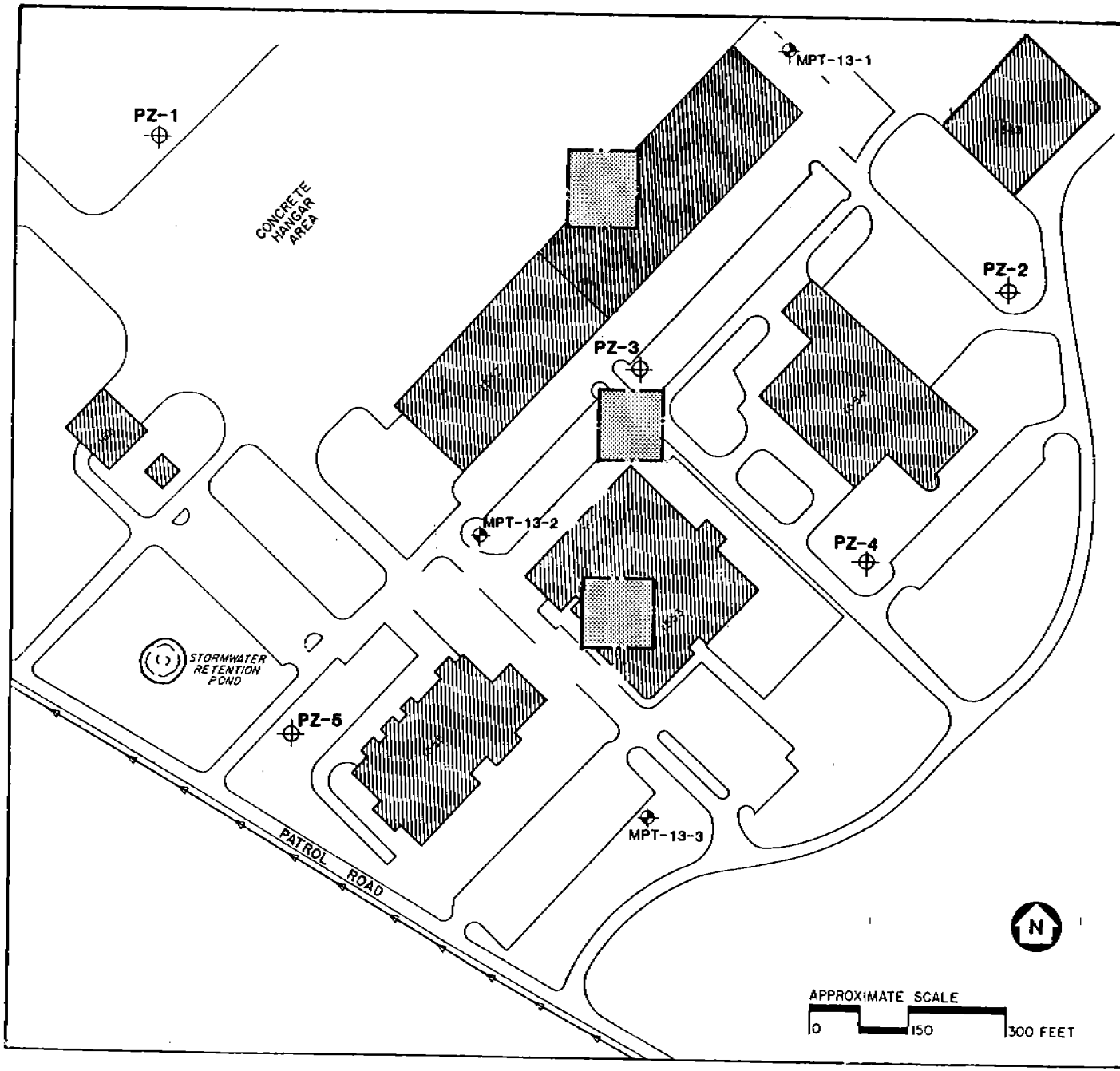
2. The general groundwater flow direction in the surficial aquifer can not be adequately assessed based on the limited number of wells; although it appears to be radial in the vicinity of Site 13.

3. Volatile and semivolatile organics, pesticides, and PCBs were not detected in either soil or groundwater.

4. Priority pollutant metals were detected in groundwater but not soils. Mercury was detected at 5.3 ug/l and lead was detected at 2 ug/l. The concentration of mercury exceeds the USEPA ambient water quality criteria (0.025 ug/l) for chronic exposure in marine environments.

3.7.6 Recommendations

Due to the uncertainty of groundwater flow direction, the presence or absence of contamination at Site 13 has not been adequately verified. It is therefore recommended that a Phase II Expanded Site Investigation be conducted at this site. The initial investigation under a Phase II study should involve the installation of five piezometers in the configuration shown in Figure 3-13. The intent of the piezometer installation program will be to establish groundwater flow direction. Once groundwater flow has been determined it is proposed that at

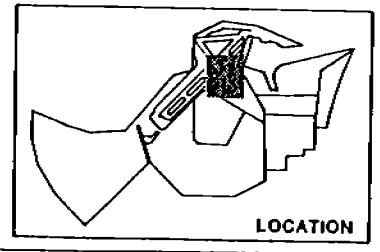


LEGEND

- MPT-13-1 — LOCATION OF MONITORING WELLS
- SITE LOCATION AREA
- STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW
- PZ-1 — PROPOSED PIEZOMETER LOCATIONS

NOTES:

1. THE LOCATION AND BOUNDARIES OF SITE 13 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM PWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY, 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'



E.C. JORDAN CO. ENGINEERS & SCIENTISTS	**PROPOSED PIEZOMETER INSTALLATION LOCATIONS SITE 13 PHASE II**
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-13

least one additional monitoring well be installed at a position downgradient of each of the three fire training areas. Upon development, a groundwater sample will be collected from each monitoring well for submittal to the laboratory. Chemical analyses of the groundwater samples will be the same as the present program (see Table 3-2).

3.8 STUDY OF SITE 14 - MERCURY/OILY WASTE SITE

Site 14 is located west of the Fleet Training Center, Buildings No. 1456 and 1388 (Figure 3-14). The site consists of two areas located in or adjacent to the concrete pad used for fire fighting training activities. The first area was used to store 55-gallon drums containing a waste, mercuric nitrate solution. The other area is located around an oil-water separator. This separator removes oily wastes from wastewaters generated during fire fighting training exercises. In the past the oil/water separator was reported to have malfunctioned and contaminated the soils directly behind Building 1456 with oils and oily wastes.

3.8.1 Field Exploration and Sampling Plan

The exploration program at Site 14 consisted of two soil borings completed with monitoring well installations, two soil samples, and two groundwater samples. The location of these explorations are presented in Figure 3-14 and the specific rationale for monitoring well locations are presented below.

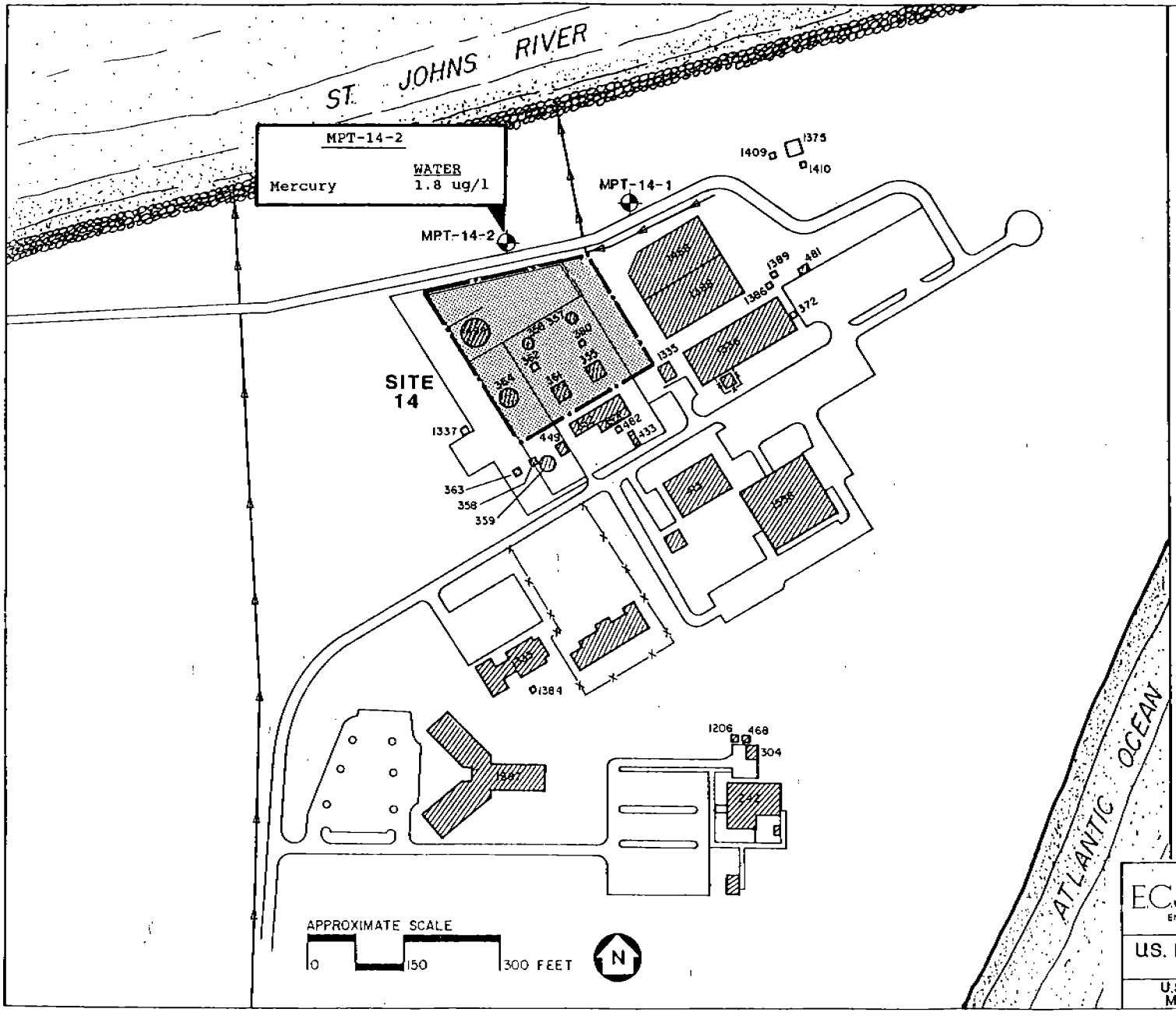
- MPT-14-1 is a shallow monitoring well located north-northeast of the site and is downgradient of the oil/water separator and upgradient of the St. Johns River.

- MPT-14-2 is a shallow monitoring well located north of Site 14 and is downgradient of the fire training area and upgradient of the St. Johns River.

One soil sample was collected from each soil boring in the unsaturated soils above the groundwater table and was submitted to the laboratory for chemical analysis (see Table 3-2). Subsequent to monitoring well installation, a groundwater sample was collected from each monitoring well and submitted for laboratory chemical analysis (see Table 3-2).

3.8.2 Hydrogeology

The surficial deposits at Site 14 consist mainly of fine to medium quartz sand with shells. The lithology in the vicinity of monitoring well MPT-14-1 consists of fine to medium sand with shells to a depth of 13 feet BLS. The lithology around



LEGEND

MPT-14-1 — LOCATION OF MONITORING WELLS

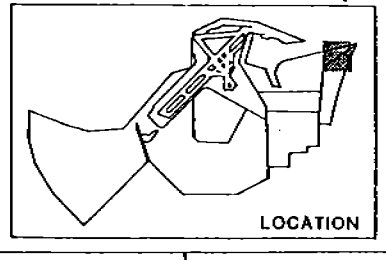
STORM DRAINAGE DITCH INDICATING DIRECTION OF FLOW.

X—X—X FENCE

SITE LOCATION AREA

NOTES:

1. THE LOCATION AND BOUNDARIES OF SITE 14 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM RWD. DRAWING NO. 217 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY, 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'



E.C. JORDAN CO. ENGINEERS & SCIENTISTS	CHEMICAL DISTRIBUTION SITE 14
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-14

well MPT-14-2 is fine sand with shells, to a depth of 10 feet BLS, then changes to fine to medium sands with shells.

The St. Johns River is located approximately 150 feet north of MPT-14-1 and MPT-14-2. The Atlantic Ocean is located approximately 620 feet east of MPT-14-1. The precise groundwater gradient and flow direction cannot be determined for Site 14 due to the fact that only two wells were installed at the Site. However, it is anticipated that the shallow groundwater at Site 14 discharges to the St. Johns River.

3.8.3 Chemical Distribution

Soil - No volatiles, semivolatiles, pesticides, PCBs or EPTOX metals were detected in the soil samples collected at Site 14.

Groundwater - Total mercury was detected in monitoring well MPT-14-2 at 1.8 ug/l. No other compound or element was detected in either of the two groundwater samples obtained at Site 14.

3.8.4 Evaluation of Chemical Distribution

Mercury was the only contaminant detected in groundwater at Site 14. This concentration of total mercury (1.8 ug/l) exceeds the USEPA ambient water quality criteria of 0.025 ug/l established for chronic exposure in marine environment.

3.8.5 Conclusions

Based on a review of the available information and the findings of the ESI conducted by Jordan, the following conclusions are made for Site 14.

1. The shallow subsurface geology consists of fine to medium sand with some shells.

2. Although not well defined due to the number of monitoring wells installed, the shallow groundwater at Site 14 is anticipated to discharge to the St. Johns River.

3. No volatile, semivolatile, organochloride pesticide, or PCB compounds were detected in soils or groundwater at Site 14.

4. The concentration of mercury found in the groundwater at Site 14 exceeds the USEPA ambient water quality criteria (0.025 ug/l) for chronic exposure in marine environments.

3.8.6 Recommendations

Due to the presence of mercury in groundwater, Site 14 is recommended to undergo an environmental risk assessment. The intent of this study will be determine the potential impact on marine flora and fauna in the St. Johns River resulting from mercury migration from Site 14.

3.9 STUDY OF SITE 16 - TRANSFORMER STORAGE YARD

Site 16 is located in the NSC fuel farm on the east side of Tank 204 (see Figure 3-8). The site is situated on an abandoned runway and has been used since 1981 to store out-of-service transformers. At the time of the site visit by ESE approximately 30 non-PCB containing transformers were stored in the area. Minor spills or leaks have been reported to have occurred during storage at the site. It is unknown if PCB transformers were stored in this area. During the time of Jordan's field visit and field exploration and sampling program no transformers were found at this site.

3.9.1 Field Exploration and Sampling Plan

The exploration program at Site 16 consisted of the collection of two surface soil samples in the area immediately to the west of the runway and in the direction of surface runoff. The location of soil samples is presented in Figure 3-8. Soil samples were submitted for laboratory chemical analysis (see Table 3-2).

3.9.2 Hydrogeology

No monitor wells were installed at Site 16. However, due to Site 16's close proximity to Sites 8 and 9, it is anticipated that the geology is similar to that found at Sites 8 and 9. Shallow groundwater at Site 16 is anticipated to be moving towards the St. Johns River, to the north.

3.9.3 Chemical Distribution

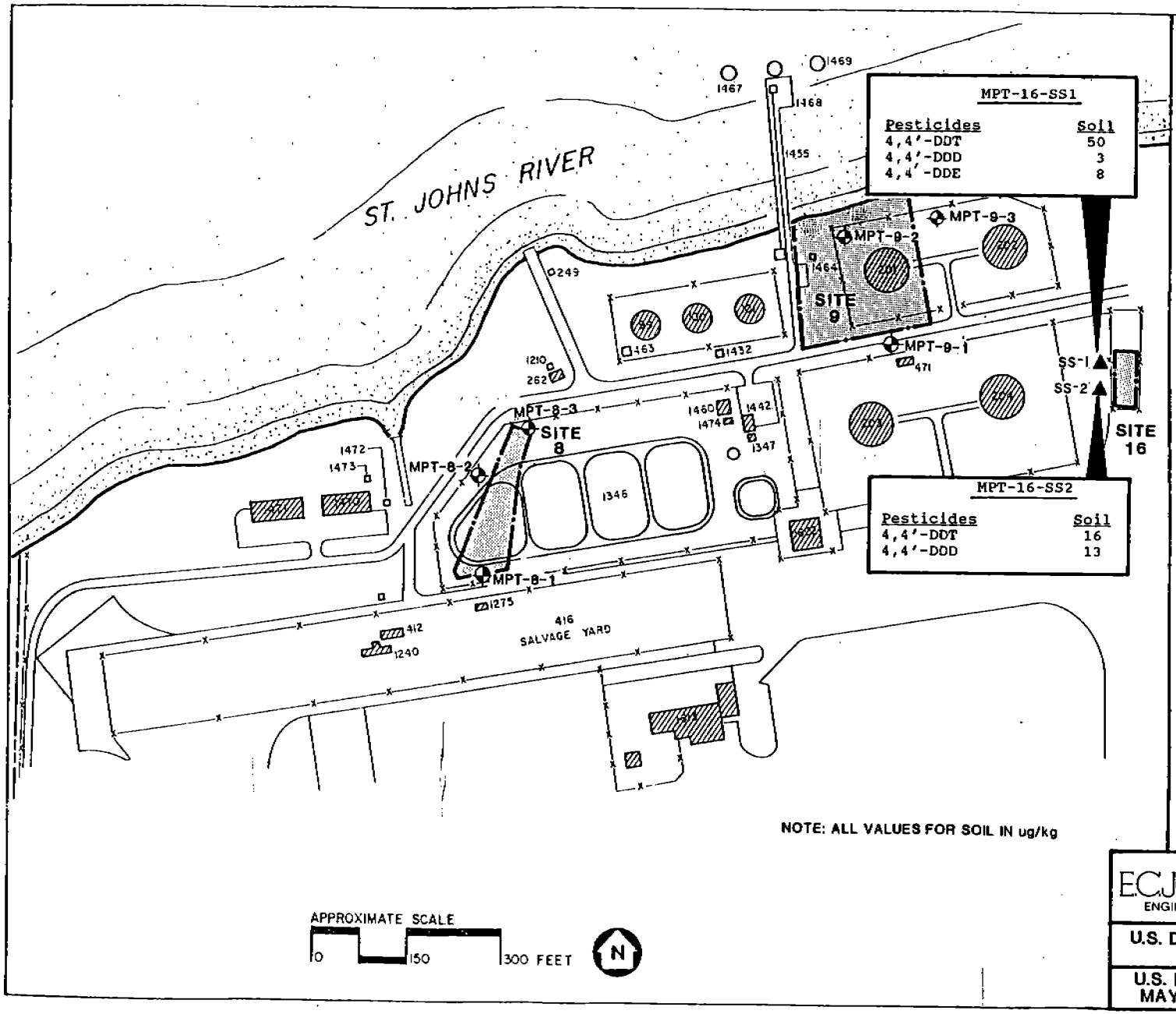
The results of analyses of soil samples collected at Site 16 are presented in Table 3-11. Chemicals detected at concentration equal to or greater than their laboratory minimum detection limit are shown in Figure 3-15.

Soil sample MPT-16-SS1 contained 4,4'-DDT (50 ug/kg), 4,4'-DDD (3 ug/kg), and 4,4'DDE (8 ug/kg). Soil sample MPT-16-SS2 contained the pesticides 4,4'-DDT (16 ug/kg) and 4,4'-DDD (13 ug/kg). PCBs were not detected in either sample.

TABLE 3-11
SUMMARY OF CHEMICAL ANALYSES SITE 16
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

MEDIA	PARAMETER	MPT-16-SS1	MPT-16-SS2	MPT-9-3
SOIL	VOLATILE ORGANICS	BDL	BDL	BDL
	SEMIVOLATILE ORGANICS	BDL	BDL	BDL
	PESTICIDES & PCB's			
	4,4'-DDT	50 ug/kg	16 ug/kg	186 ug/kg
	4,4'-DDD	3 ug/kg	13 ug/kg	BDL
	4,4'-DDE	8 ug/kg	BDL	BDL
	TOTAL METALS	BDL	BDL	BDL

NOTE: BDL - BELOW DETECTION LIMIT (DETECTION LIMITS PRESENTED IN APPENDIX A-9.

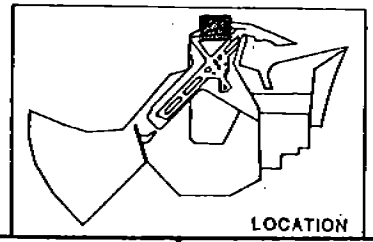


LEGEND

- MPT-8-1 — LOCATION OF MONITORING WELLS
- SS-1 — SOIL SAMPLING LOCATIONS (SS-1 AND SS-2)
- SITE LOCATION AREA
- FENCE

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 2,4,5,&6 SHOWN ON THE FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM FWD DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH 1980, SCALE 1"=500'.



E.C JORDAN CO. ENGINEERS & SCIENTISTS	CHEMICAL DISTRIBUTION SITE 16
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-15

3.9.4 Evaluation of Chemical Distribution

Elevated levels of 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE were found in the two surface soil samples collected at Site 16. The concentration of these compounds are consistent with values derived at other sites and probably reflect a residual concentration resulting from previous use of the insecticide.

3.9.5 Conclusions

Based on a review of available information and the ESI conducted by Jordan, the following conclusions are made for Site 16:

1. The subsurface geology at Site 16 is anticipated to consist of permeable sands and shells.

2. Shallow groundwater at the site is anticipated to flow north to the St. Johns River.

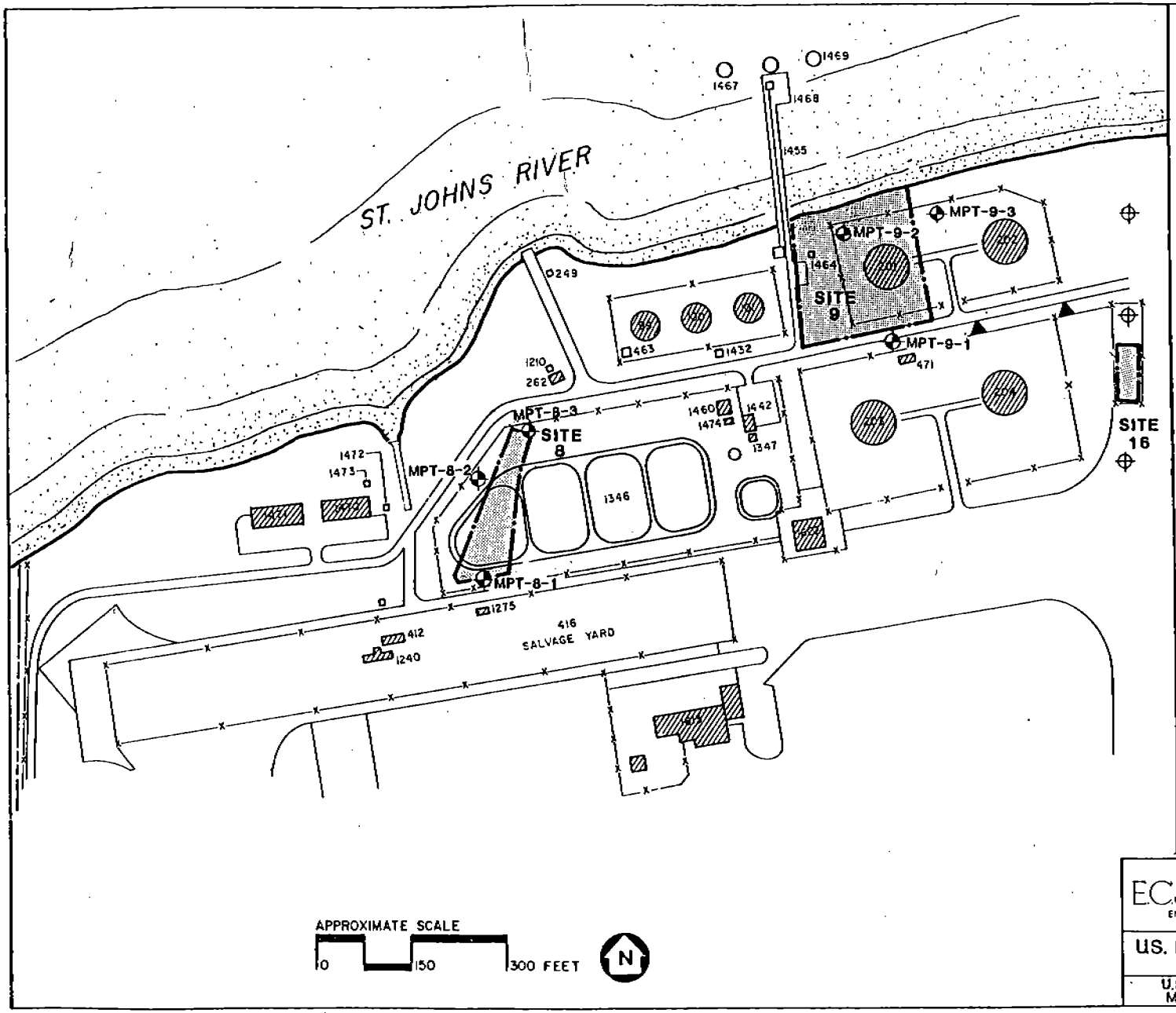
3. Polychlorinated biphenyls (PCBs) were not detected in the soils at Site 16.

4. The pesticide 4,4'-DDT and its degradation products 4,4'-DDD and 4,4'-DDE were detected in elevated levels in the soils at Site 16.

3.9.6 Recommendations

Site 16 is recommended for further study under a Phase II Expanded Site Investigation due to elevated concentration of DDT in the soils. The purpose of this additional work is to: 1) determine if the site has impacted the shallow groundwater, and 2) determine if the pesticides are moving via stormwater erosion. The proposed study includes the installation of three monitor wells, the collection of five additional soil samples, and resampling of monitoring well MPT-9-1 (Figure 3-16).

Groundwater Sampling. Monitoring wells will be installed in the locations shown in Figure 3-16. These monitor wells and MPT-9-1 will be sampled for EPA Method 608 pesticides. These samples will serve to determine if the pesticides detected at Site 16 have migrated downward to the groundwater and if so, the extent of their movement.

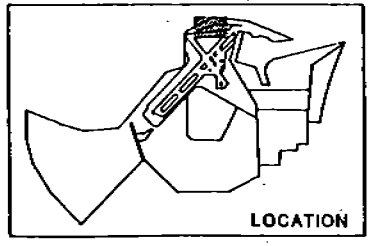


LEGEND

- MPT-8-1 — LOCATION OF MONITORING WELLS
- PROPOSED SOIL SAMPLING LOCATION
- SITE LOCATION AREA
- FENCE
- LOCATION OF PROPOSED MONITOR WELLS

NOTES:

1. THE LOCATIONS AND BOUNDARIES OF SITE 8,9, & 16 SHOWN ON THIS FIGURE ARE APPROXIMATE.
2. BASE MAP PREPARED FROM RWD. DRAWING NO. 2117 TITLED "SITE PLAN U.S. NAVAL STATION MAYPORT, FLORIDA" COMPILED BY THE NAVAL FACILITIES ENGINEERING COMMAND, 22 MAY 1979 AND REVISED 24 MARCH, 1980, SCALE 1"=500'



E.C. JORDAN CO. ENGINEERS & SCIENTISTS	PROPOSED LOCATIONS OF EXPLORATIONS SITE 16
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE 3-16

Soil Sampling. Soils samples will be collected from the top of the water table at the three proposed monitor well locations. These soil samples will determine if there is downward migration of the pesticides through the soil. Additionally, two soil samples should be collected from the ditch running from Site 16 to MPT-9-1 as shown in Figure 3-16. These shallow soil samples will be used to determine if the pesticides at Site 16 are migrating during storm events.

SECTION 4

4.0 SUMMARY

Based upon a review of available information and upon the findings of the Expanded Site Investigation conducted by Jordan, the conclusions made for Sites 1, 2, 4, 5, 6, 8, 9, 13, 14, and 16 can be summarized as follows:

Site 1 - Landfill A

1. The shallow subsurface geology at Site 1 consists of fine sands with a thin clay layer located between 7 to 10 feet below land surface.

2. The shallow groundwater at Site 1 flows north, towards the St. Johns River.

3. The pesticide 4,4'-DDE was detected in low concentrations in both soil and groundwater at Site 1.

4. The concentrations of 4,4'-DDE in groundwater (0.01 ug/l and 0.14 ug/l) exceeded the USEPA ambient water quality criteria of 0.001 ug/l for chronic exposure in saltwater environments.

5. Lead was found in the groundwater at a concentration (122 ug/l and 26 ug/l) above the USEPA ambient water quality criteria of 5.6 ug/l for chronic exposure in marine environments.

Site 2 - Landfill B

1. The surficial geology at Site 2 is comprise of a fine to coarse sand containing traces of ls and shell fragments. This deposit overlies to 3-foot thick clay layer located approximately feet BLS.

2. It is anticipated that the groundwater flow direction in the surficial aquifer is north towards the peripheral drainage ditch and is influenced by a groundwater mound which has developed under the northeastern dredge spoil area.

3. Chlorobenzene (44 ug/kg) and toluene (553 ug/kg) were detected in soils at Site 2. No criteria for these compounds in soils currently exist.

4. Groundwater samples collected at Site 2 contained no detectable levels of volatile organic compounds, priority pollutant pesticides, or PCBs.

5. Di-n-butyl phthalate was detected at a concentration of 20 ug/l in the groundwater sample collected from MPT-2-95. No criteria for this compound has been established.

6. The concentration of PCB-1260 in the soil sample obtained from boring MPT-2-9 (2,576,000 ug/kg) exceeds the TSCA standard for removal (50,000 ug/kg).

Site 4 - Landfill D

1. The surficial deposits at Site 4 consist of fine to coarse sand, with traces of shell fragments, overlying a dark olive, clay layer starting at 10 feet BLS.

2. The groundwater flow direction in the surficial aquifer at Site 4 is anticipated to be radial towards the peripheral drainage ditch due to mounding of groundwater under the northeastern dredge spoil area.

3. Volatile organics, semivolatile organics, pesticides, and PCBs detected in groundwater at Site 4 do not exceed USEPA ambient water quality criteria for chronic exposure in a marine environment.

4. Total lead detected in groundwater sample MPT-2-8 (160 ug/l) at Site 4 exceeds the USEPA ambient saltwater quality criteria of 5.6 ug/l for chronic exposure in marine environments.

Site 5 - Landfill E

1. The surficial deposit at Site 5 is comprised of a fine to medium sand containing traces of shell fragments. This deposit overlies a clay layer located at approximately 10 feet BLS.

2. Groundwater flow in the surficial aquifer is anticipated to be directed towards the drainage ditch system located around the site. Flow is anticipated to be influenced by mounding of groundwater which is occurring under both spoil areas.

3. Because of brackish groundwater and extensive dredge and fill activity at NAVSTA, the terrain conductivity survey produced no anomalous results which could be interpreted as a leachate plume.

4. Volatile organics, semivolatile organics, pesticides, and metals in soils around Site 5 were not detected. The concentration of PCB-1260 found in the soil

sample collected from boring MPT-2-1 does not exceed the TSCA criteria for removal.

5. Benzene (1 ug/l) and chlorobenzene (139 ug/l) were detected in the groundwater sample contained from monitoring well MPT-2-3. No ambient water quality criteria for chronic exposure in marine environments has been developed by the USEPA for these two compounds.

6. Pesticides and PCBs were not detected in groundwater at Site 5.

7. Total hexavalent chromium was reported at 100 ug/l in three separate groundwater samples from Site 5. This level exceeds USEPA ambient water quality criteria (50 ug/l) for chronic exposure in marine environments.

8. Surface water sample SW-1 contained vinyl chloride (3 ug/l), trans-1,2-dicloroethene (6 ug/l), hexavalent chromium (100 ug/l), and 4,4'-DDD (20 ug/l). The concentrations of hexavalent chromium and 4,4'-DDD exceed their corresponding USEPA ambient water quality criteria of 50 ug/l and 0.001 ug/l, respectively, for chronic exposure in marine environments. No criteria for chronic exposure in marine environments has been established for vinyl chloride or trans-1,2-dichloroethene by USEPA.

Site 6 - Landfill F

1. The surficial geology at Site 6 is comprised of a fine to medium sand with few shell fragments. This deposit overlies a dark olive clay layer found at a depth of approximately 10 feet BLS.

2. The groundwater flow direction in the surficial aquifer under Site 6 is north towards the peripheral drainage ditch.

3. Concentrations of volatile organics, semivolatile organics and total metals in groundwater at Site 6 are below USEPA ambient water quality criteria for chronic exposure in marine environment, when applicable.

4. Heptachlor was detected at 0.03 ug/l in the groundwater sample collected from MPT-2-15S and exceeds the USEPA ambient water quality criteria

(0.0036 ug/l) for chronic exposure in a marine environment.

5. PCB-1260 (190 ug/kg) detected in soil sample MPT-2-2 is below the TCSA criteria of 50,000 ug/kg.

6. Surface water sample SW-3, collected adjacent to Site 6, contained 4,4'-DDE at 0.01 ug/l. This concentration exceeds ambient water quality criteria of 0.001 ug/l for chronic exposure in marine environments.

Site 8 - Waste Oil Pit

1. The shallow subsurface geology at Site 8 consists of permeable fine sands.

2. Shallow groundwater flows north, discharging into the St. Johns River.

3. A layer of floating petroleum hydrocarbon product was observed in MPT-8-3.

4. Benzene, ethylbenzene, naphthalene, and bis (2-ethylhexyl) phthalate were detected in the groundwater at low concentrations. No ambient water quality criteria for marine environments has been established by the USEPA for these compounds.

Site 9 - Fuel Spill Area

1. The shallow subsurface geology at Site 9 consist of permeable sands and shells.

2. Shallow groundwater flows north towards the St. Johns River.

3. Naphthalene (120 ug/l) detected in a downgradient groundwater sample is indicative of a petroleum spill at the site. This concentration exceeds the FDER target level (100 ug/l total naphthalenes) for groundwater cleanup of petroleum contamination established in Section 17.70.011(5)(a), FAC.

4. The concentration of the pesticide 4,4'-DDE (0.04 ug/l) in the upgradient well exceeds the USEPA ambient water quality criteria (0.001 ug/l) for chronic exposure in marine environments.

5. Mercury detected in the groundwater sample from monitoring well MPT-9-3 (0.8 ug/l) exceeds USEPA

ambient water quality criteria of 0.025 ug/l for chronic exposure in marine environments.

Site 13 - Old Fire Training Areas

1. The subsurface geology consists of fine to medium grained sands overlying a clay of unknown thickness (at least 2 feet thick).

2. The general groundwater flow direction in the surficial aquifer can not be adequately assessed based on the limited number of wells; although it appears to be radial in the vicinity of Site 13.

3. Volatile and semivolatile organics, pesticides, and PCBs were not detected in either soil or groundwater.

4. Priority pollutant metals were detected in groundwater but not soils. Mercury was detected at 5.3 ug/l and lead was detected at 2 ug/l. The concentration of mercury exceeds the USEPA ambient water quality criteria (0.025 ug/l) for chronic exposure in marine environments.

Site 14 - Mercury/Oily Waste Site

1. The shallow subsurface geology consists of fine to medium sand with some shells.

2. Although not well defined due to the number of monitoring wells installed, the shallow groundwater at Site 14 is anticipated to discharge to the St. Johns River.

3. No volatile, semivolatile, organochloride pesticide, or PCB compounds were detected in soils or groundwater at Site 14.

4. The concentration of mercury found in the groundwater at Site 14 exceeds the USEPA ambient water quality criteria (0.025 ug/l) for chronic exposure in marine environments.

Site 16 - Transformer Storage Yard

1. The subsurface geology at Site 16 is anticipated to consist of permeable sands and shells.

2. Shallow groundwater at the site is anticipated to flow north to the St. Johns River.

3. Polychlorinated biphenyls (PCBs) were not detected in the soils at Site 16.

4. The pesticide 4,4'-DDT and its degradation products 4,4'-DDD and 4,4'-DDE were detected in elevated levels in the soils at Site 16.

4.1 SUMMARY OF RECOMMENDATIONS

Table 4-1 presents a summary of recommendations for the 10 sites investigated under the ESI. Two sites, Sites 13 and 16, are recommended for a Phase II Expanded Site Investigation in that the presence or absence of groundwater contamination has not been adequately verified. Site 2 is recommended for a remedial action program due to the concentration of PCB-1260 in soil exceeding the Toxic Substances Control Act standard for removal. The remaining sites are recommended to undergo an environmental risk assessment as a result of elevated levels of various priority pollutants in groundwater or surface water.

4.2 PRELIMINARY HRS SCORES

Table 4-2 presents the preliminary hazardous ranking system (HRS) scores for the 10 sites investigated during the ESI. Tabulation sheets used to develop the HRS scores are presented for each site, in Appendix A-11. As presented in Table 4-2, scores range from 4.52 at Site 9 to 13.1 at Site 5.

TABLE 4-1

SUMMARY OF RECOMMENDATIONS
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

SITE	RECOMMENDATION	REASON or CHEMICAL(S) of CONCERN
1	Risk Assessment	4,4'-DDD, Lead in Groundwater
2	Remedial Action	PCB-1260 in Soil
4	Risk Assessment	Lead in Groundwater
5	Risk Assessment	Vinyl chloride in surface water/ Chromium in Groundwater
6	Risk Assessment	Heptachlor in Groundwater
8	Risk Assessment	Groundwater
9	Risk Assessment	Napthalene in Groundwater
13	Phase II ESI	Release to groundwater not verified
14	Risk Assessment	Mercury in groundwater
16	Phase II ESI	Release to groundwater not verified

TABLE 4-2
PRELIMINARY HRS SCORES
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

SITE	PRELIMINARY HRS SCORE
SITE 1	9.45
SITE 2	10.14
SITE 4	9.87
SITE 5	13.10
SITE 6	12.09
SITE 8	6.73
SITE 9	4.52
SITE 13	9.05
SITE 14	8.22
SITE 16	8.98

REFERENCES

APPENDIX A—1

APPENDIX A-1

Summary of Existing Chemical Data

APPENDIX A-1
TABLE 1
SUMMARY OF EXISTING CHEMICAL DATA
EXPANDED SITE INVESTIGATION
NAVSTA MAYPORT, FLORIDA

REFERENCE	GERAGHTY & MILLER (1984)							
LOCATION	S-1	S-2	S-3	S-4	S-5	S-6	S-7	SW-1
DATE	4/14/84	4/14/84	4/14/84	4/14/84	4/14/84	4/14/84	4/14/84	4/14/84
pH	7.9	7.6	7.6	7.5	7.2	7.6	7.5	7.4
SPECIFIC CONDUCTANCE								
ARSENIC, MG/L	<0.002	0.002	<0.002	<0.002	0.072	0.006	0.005	<0.002
BARIUM, MG/L	0.004	0.006	0.014	0.004	0.008	0.03	0.02	0.008
IRON, MG/L	0.321	0.035	0.262	0.033	0.043	1.65	0.4	0.201
MANGANESE, MG/L	0.038	<0.002	0.166	0.041	0.029	1.52	1.806	0.018
SELENIUM, MG/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003
ZINC, MG/L	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	<0.010	0.018
CHLORIDE, MG/L	18.2	5.6	22.3	2,116	18,190	3,470	10,800	9,849
FLUORIDE, MG/L	0.816	0.317	0.377	1.574	1.143	0.571	0.63	0.743
HYDROGEN SULFIDE, MG/L	1.2	<0.1	<0.1	65	130	0.35	10.1	<0.1
NITRATE, MG/L N	0.007	0.466	0.76	0.007	0.378	0.116	0.022	0.001
SULFATE, MG/L	37.8	14.7	53.2	113.4	110.6	105	546	122.5
SURFACTANTS, MG/L	0.006	0.005	0.012	0.011	<0.001	<0.005	0.006	<0.001
TOTAL DISSOLVED SOLIDS, MG/L	446	196	0.012	4,520	33,990	7,116	21,100	18,161
EPTOX PESTICIDES								
ENDRIN, ppm	<0.00002	0.00011	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
VOLATILE ORGANIC COMPOUNDS								
CHLOROMETHANE, PPB	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.2	<0.1
ACID COMPOUNDS	ALL BELOW DETECTION LIMITS (<2 PPB)							
BASE/NEUTRAL COMPOUNDS	ALL BELOW DETECTION LIMITS (<2 PPB)							

APPENDIX A-1
TABLE 2
SUMMARY OF EXISTING CHEMICAL DATA
EXPANDED SITE INVESTIGATION
NAVSTA MAYPORT, FLORIDA

REFERENCE	GERAGHTY & MILLER (1985)						
LOCATION	S-1	S-2	S-3	S-4	S-5	S-6	S-7
DATE	7/12/84	7/12/84	7/12/84	7/12/84	7/12/84	7/12/85	7/12/85
pH	7.8	7.6	7.3	7.2	6.8	7.6	7.4
SPECIFIC CONDUCTANCE	700	4000	800	>8000	>8000	>8000	>8000
ARSENIC, MG/L	<0.002	-	-	0.004	0.005	0.009	0.007
BARIUM, MG/L	<0.002	-	-	0.011	0.018	0.034	0.041
CADMIUM, MG/L	<0.005	-	-	0.008	0.007	0.015	0.011
CHROMIUM, MG/L	<0.010	-	-	<0.010	<0.010	0.037	<0.010
IRON, MG/L	0.223	-	-	0.058	0.127	0.067	1.26
LEAD, MG/L	0.039	-	-	<0.03	<0.03	<0.03	<0.03
MERCURY, MG/L	<.0002	-	-	<.0002	<0.0002	<0.0002	<0.0002
SELENIUM, MG/L	<0.002	-	-	<0.002	<0.002	<0.002	<0.002
SILVER, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
CHLORIDE, MG/L	18.2	-	-	1943	15,691	7,000	10,983
FLUORIDE, MG/L	0.672	-	-	1.286	0.994	0.664	0.607
NITRATE, MG/L N	0.006	-	-	0.025	0.018	0.021	0.015
SULFATE, MG/L	65.5	-	-	13.8	1,518	58	667
TOTAL DISSOLVED SOLIDS, MG/L	490	1468	329	3043	33,519	11,321	19,028
VOLATILE ORGANIC COMPOUNDS	ALL BELOW DETECTION LIMIT (<1.0 PPB)						

APPENDIX A-1
TABLE 3
SUMMARY OF EXISTING CHEMICAL DATA
EXPANDED SITE INVESTIGATION
NAVSTA MAYPORT, FLORIDA

REFERENCE	GERAGHTY & MILLER (1985)						
LOCATION	S-1	S-2	S-3	S-4	S-5	S-6	S-7
DATE	10/16/84	10/16/84	10/16/84	10/16/84	10/16/84	10/16/84	10/16/84
pH	7.5	7.1	6.9	6.9	6.5	7.3	7.1
SPECIFIC CONDUCTANCE	620	1,480	720	7500	40,900	20,000	31,500
ARSENIC, MG/L	<0.002	-	-	<0.002	0.004	<0.002	<0.002
BARIUM, MG/L	0.005	-	-	0.007	0.012	0.027	0.055
CADMIUM, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
CHROMIUM, MG/L	0.01	-	-	<0.010	<0.010	<0.01	<0.010
LEAD, MG/L	<0.04	-	-	<0.04	<0.04	<0.04	<0.04
MERCURY, MG/L	<0.0001	-	-	<0.0001	<0.0001	<0.0001	<0.0001
SELENIUM, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
SILVER, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
CHLORIDE, MG/L	24.0	-	-	2379	18,290	8,153	23,389
FLUORIDE, MG/L	0.779	-	-	1.52	1.14	0.713	0.574
NITRATE, MG/L N	<0.02	-	-	<0.02	<0.02	<0.02	<0.02
SULFATE, MG/L	46	-	-	20	910	9	710
TOTAL DISSOLVED SOLIDS, MG/L	392	1134	602	4582	32,723	13,755	25,158
VOLATILE ORGANIC COMPOUNDS							
1,1-DICHLOROETHANE, PPB	3.7		<1.0				
SEMIVOLATILE ORGANIC COMPOUNDS	ALL BELOW DETECTION LIMITS (<1 PPB)						

APPENDIX A-1
TABLE 4
SUMMARY OF EXISTING CHEMICAL DATA
EXPANDED SITE INVESTIGATION
NAVSTA MAYPORT, FLORIDA

REFERENCE	GERAGHTY & MILLER (1985)						
LOCATION	S-1	S-2	S-3	S-4	S-5	S-6	S-7
DATE	02/21/85	02/21/85	02/21/85	02/21/85	02/21/85	02/21/85	02/21/85
pH	7.55	6.85	6.8	6.4	6.4	7.1	7.15
SPECIFIC CONDUCTANCE	700	-	-	7,100	45,000	20,000	31,000
ARSENIC, MG/L	<0.002	-	-	<0.002	0.006	<0.002	<0.002
BARIUM, MG/L	0.023	-	-	<0.002	0.017	0.031	0.042
CADMIUM, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
CHROMIUM, MG/L	<0.01	-	-	<0.010	<0.010	<0.01	<0.010
LEAD, MG/L	<0.03	-	-	<0.03	<0.03	<0.03	<0.03
MERCURY, MG/L	<0.0005	-	-	<0.0002	0.0004	<0.0002	0.0009
SELENIUM, MG/L	<0.003	-	-	<0.003	<0.003	<0.003	<0.003
SILVER, MG/L	<0.005	-	-	<0.005	<0.005	<0.005	<0.005
CHLORIDE, MG/L	22.5	-	-	2,260	17,860	6,824	11,912
FLUORIDE, MG/L	0.681	-	-	1.46	1.05	0.591	0.612
NITRATE, MG/L N	<0.02	-	-	<0.02	<0.02	<0.02	<0.02
SULFATE, MG/L	45.	-	-	73	2,250	90.	821
TOTAL DISSOLVED SOLIDS, MG/L	501	7,697	652	4,210	33,025	12,472	21,239
VOLATILE ORGANIC COMPOUNDS	ALL BELOW DETECTION LIMIY (<1.0 PPB)						

APPENDIX A—2

APPENDIX A-2

Field Sampling Techniques

Soil Sampling

During the period of September 9 through September 24, 1987, E.C. Jordan personnel performed the task of collecting soil samples from 28 monitoring well installations at Mayport Naval Station for further chemical analysis to be performed by Pioneer Laboratory. Split-spoon sample collection procedures were conducted in compliance with both the Florida Department of Environmental Regulation's and E.C. Jordan's Quality Assurance Plan for the collection and analysis of samples.

A split-spoon sampler was used to sample the soils from each of the 28 borings. Jordan's drilling supervisor took charge of the sampling device as soon as it was withdrawn from the borehole. The spoon was opened and the sample was collected and documented employing the procedures outlined below:

1. The soil was scanned with a photoionization meter and the value was recorded. Also, the length of the recovered sample was measured and recorded.

2. The samples were visually examined and classified using the Unified Soil Classification System.

3. Samples chosen for chemical analysis were removed and placed in appropriate sampling containers using a clean, stainless steel spatula. Samples that were to be analyzed for VOAs were placed in a 2-ounce wide-mouth glass jar and capped immediately. The sampling jar was filled to capacity to minimize volatilization of the sample into the container headspace. Soils intended for other types of analyses were placed in the appropriate container and capped.

4. The remainder of the samples were placed in 12-ounce soil jars intended for use as headspace photoionization measurement and achieved.

5. All excessively disturbed or loose material found in the sampler that was not representative of the interval sample was discarded at the boring site location.

6. The sampling device was decontaminated with a soap water bath, tap water, isopropanol and rinsed with distilled water.

In some instances, samples from a given boring were not prepared for chemical analysis. In these instances, step 3 of the procedure listed above was omitted and the sample placed in a soil jar.

Immediately after the samples were collected, the jars were labeled, prepared for shipping and placed on ice in a cooler. The chain-of-custody procedures were initiated and the boring log was updated by Jordan's drilling supervisor. Boring logs are usually completed by the driller but to ensure completeness

and documentation, a separate boring log was compiled by Jordan's drilling supervisor. The boring logs include the interpretations of subsurface materials and conditions encountered, sampling locations, and other notes pertinent to the boring procedures. The drilling supervisor's boring log was completed in a site field book and later transferred to a boring log form.

Considerable care was exercised by the sampler while collecting samples for analysis. Some methods to assure that high quality samples were collected are described below:

1. Samples were collected from undisturbed soil below the auger. This was accomplished by monitoring or checking the drill crew's measurements, observing the sampling process and examining the sample once it was retrieved.

2. Portions of the sample that may have become contaminated by contacting the auger were carefully removed and discarded.

Procedures employed to prevent cross-contamination during test boring sampling operations included the following:

1. Samples were taken immediately after the boring was advanced to the desired sampling elevation.

2. The sampling tools were decontaminated prior to taking each sample.

3. The drilling contractor was not permitted to use oil, grease or other petroleum based lubricants on the drill rods, auger or sampling tools.

Two additional soil samples were taken at Site 16. A stainless steel bucket hand auger was used to collect the samples. Procedures employed, as well as the sample jars used, were identical to those already mentioned.

Groundwater Sampling

Labels supplied by Pioneer Laboratory were filled out in the field for each groundwater samples. Each groundwater sample consisted of a set of bottles which included two 40-milliliter vials for volatile organic compounds, two 1-liter amber glass bottles for semivolatile organic compounds, and one 2-liter plastic bottle for metals. Each sample was analyzed for the parameters selected for the project. The pH, temperature and specific conductance of each sample, except MPT-8-3 which contained free product, were determined in the field using a Tripar analyzer.

Monitoring and sampling of groundwater wells proceeded from the upgradient or background wells to the dowgradient or

contaminated wells, as well as this could be determined. The sampling procedure was as follows:

1. After unlocking the well and removing the well cap, the static water level in the well and the depth to the well bottom to the nearest 0.01 foot was then measured using the electronic water level meter and recorded. The distance between the ground and the top of the protective casing with the lid open was also measured and recorded. Upon removal, the water level wire was rinsed with laboratory-grade isopropanol and then distilled water.

2. The volume of stagnant water in the well was then calculated. Volume in gallons equals the length of the column of water in feet in a 2 inch well times 0.1632 (Halliburton Cementing Tables, 1981).

Following the measurements and calculations described above, sampling commenced in the following sequence:

1. Each of the 28 monitoring wells was purged using a 24-inch clear teflon bailer attached to a monofilament line.

2. Monitoring of in-situ parameters included temperature, pH, and specific conductance as well as measuring the volume of water being removed from the well. The in-situ parameters were monitored in a beaker using a Tripar analyzer. Purging of the standing well water was considered complete when either of the following was achieved:

   a. a minimum of three well volumes was purged, and in-situ parameters stabilized (up to 5 volumes); or

   b. the well was pumped dry.

3. The in-situ parameters were then recorded.

4. After purging, the well was allowed to recover before sampling to allow for the settling of suspended particles. The bailer was lowered to the top of the water column for sample collection.

5. Samples were then collected filling the metals sample bottle first so that the clearest water could be obtained. One semivolatile organic compounds (SVOC) bottle (1 liter) was then partially filled and then the two 40-ml VOA's were filled. The remainder of the first SVOC bottle was then filled before the last SVOC bottle was filled.

   All samples were filled directly from the bailer with as little agitation as possible.

6. The bailer was then removed from the well and decontaminated with both isopropyl alcohol and distilled water. It was rinsed with both distilled water and isopropyl alcohol as needed.

7. The sample data record was completed at a later date from the appropriate information recorded in the field log book.

8. The well cap and lock were then secured.

Surface Water Sampling

Surface water samples were collected for analysis to characterize the surface water surrounding Sites 2, 4, 5, and 6. The samples were taken in the following manner:

1. Samples were collected from the surface water body by immersing the sample bottle. All surface water samples were collected from tidally influenced ditches around Sites 2, 4, 5, and 6. The samples were collected upstream of the sampler with the opening of the sampling device oriented upstream but avoiding floating debris. Samples SD/SW-1, SD/SW-2 and SD/SW-B were collected from the bank of the ditch. Sample SD/SW-3 was collected while standing in the ditch.

2. The following parameters were measured in the field:

   a. temperature measurement;
   b. pH measurement; and
   c. specific conductance measurement.

   Measurements were taken in the same manner as groundwater measurements. This information was recorded in the log book, sample labels were completed and chain-of-custody procedures initiated.

3. The sample data record was completed at a later date from information recorded in the log book.

Duplicate Samples and Trip Blanks

Duplicate samples and trip blanks were used in order to assure laboratory quality assurance. Duplicate samples were collected and handled identically to other field samples. A brief summary of the collection is summarized below:

- o all surface water and groundwater duplicates were col- lected identically to the method used for regular samples;

- o duplicate samples were collected at the same time as the other samples and were preserved, handled, and transported the same way;

- in the situation of a soil duplicate sample, the sample was taken from the same depth interval as the original sample but from an adjacent boring.

- trip blanks were prepared in the laboratory before the sampling event and were handle just like any water sample collected for volatile organic analyses.

- one bailer blank was collected and labeled MD-100. The sample was collected from the decontaminated bailer filled with distilled water. All normal water sample bottles were collected for the bailer blank.

REFERENCES

APPENDIX A—3

APPENDIX A-3

Sample Tracking Record

APPENDIX A-3
TABLE 1
SOIL SAMPLE TRACKING RECORD
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FLORIDA

MW#	SS#	DATE SAMPLED	SHIPPED	RECEIVED	ANALYZED	REPORT
MPT-1-1	4	09 SEPT 87	10 SEPT 87	11 SEPT 87	14-28 SEPT 87	02 OCT 87
MPT-1-2	2	10 SEPT 87	10 SEPT 87	11 SEPT 87	14-28 SEPT 87	02 OCT 87
MPT-1-3	2	10 SEPT 87	10 SEPT 87	11 SEPT 87	14-28 SEPT 87	02 OCT 87
MPT-2-1	2	22 SEPT 87	23 SEPT 87	24 SEPT 87	25 SEPT-06 OCT 87	13 OCT 87
MPT-2-2	2	22 SEPT 87	23 SEPT 87	24 SEPT 87	25 SEPT-06 OCT 87	13 OCT 87
MPT-2-3	4	11 SEPT 87	11 SEPT 87	12 SEPT 87	14 SEPT-01 OCT 87	14 OCT 87
MPT-2-4	2	11 SEPT 87	11 SEPT 87	12 SEPT 87	14 SEPT-01 OCT 87	14 OCT 87
MPT-2-5	2	23 SEPT 87	24 SEPT 87	25 SEPT 87	28 SEPT-10 OCT 87	16 OCT 87
MPT-2-5	DUPLICATE	24 SEPT 87	24 SEPT 87	25 SEPT 87	28 SEPT-14 OCT 87	30 OCT 87
MPT-2-6	2	22 SEPT 87	23 SEPT 87	24 SEPT 87	25 SEPT-06 OCT 87	13 OCT 87
MPT-2-7	3	15 SEPT 87	16 SEPT 87	17 SEPT 87	21 SEPT-02 OCT 87	30 OCT 87
MPT-2-8		23 SEPT 87	24 SEPT 87	25 SEPT 87	28 SEPT-10 OCT 87	16 SEP 87
MPT-2-8	DUPLICATE	24 SEPT 87	24 SEPT 87	25 SEPT 87	28 SEPT-14 OCT 87	30 OCT 87
MPT-2-9S						
MPT-2-9D	1	22 SEPT 87	23 SEPT 87	24 SEPT 87	25 SEPT-06 OCT 87	13 OCT 87
MPT-2-10	2	10 SEPT 87	10 SEPT 87	11 SEPT 87	14-28 SEPT 87	02 SEP 87
MPT-2-15	2	14 SEPT 87	15 SEPT 87	16 SEPT 87	17 SEPT-02 OCT 87	14 OCT 87
MPT-8-1	3	17 SEPT 87	18 SEPT 87	19 SEPT 87	24 SEPT-07 OCT 87	30 OCT 87
MPT-8-2	3	18 SEPT 87	18 SEPT 87	19 SEPT 87	23 SEPT-06 OCT 87	14 OCT 87
MPT-8-3	3	16 SEPT 87	17 SEPT 87	18 SEPT 87	19 SEPT-05 OCT 87	14 OCT 87
MPT-9-1	4	15 SEPT 87	16 SEPT 87	17 SEPT 87	21 SEPT-02 OCT 87	30 OCT 87
MPT-9-2	3	16 SEPT 87	17 SEPT 87	18 SEPT 87	19 SEPT-05 OCT 87	14 OCT 87
MPT-9-3	4	16 SEPT 87	17 SEPT 87	18 SEPT 87	19 SEPT-05 OCT 87	14 OCT 87
MPT-13-1	1	18 SEPT 87	18 SEPT 87	19 SEPT 87	23 SEPT-06 OCT 87	14 OCT 87
MPT-13-1	DUPLICATE	24 SEPT 87	24 SEPT 87	25 SEPT 87	28 SEPT-14 OCT 87	30 OCT 87
MPT-13-2	2	15 SEPT 87	16 SEPT 87	17 SEPT 87	21 SEPT-02 OCT 87	30 OCT 87
MPT-13-3	1	18 SEPT 87	18 SEPT 87	19 SEPT 87	23 SEPT-06 OCT 87	14 OCT 87
MPT-14-1	1	17 SEPT 87	18 SEPT 87	19 SEPT 87	24 SEPT-07 OCT 87	30 OCT 87
MPT-14-2	2	17 SEPT 87	18 SEPT 87	19 SEPT 87	24 SEPT-07 OCT 87	30 OCT 87
MPT-16-SS1		30 SEPT 87	30 SEPT 87	01 OCT 87	05 OCT-27 OCT 87	03 NOV 87
MPT-16-SS2		30 SEPT 87	30 SEPT 87	01 OCT 87	05 OCT-27 OCT 87	03 NOV 87

FILE: SS509704

APPENDIX A-3
TABLE 2
GROUNDWATER SAMPLE TRACKING RECORD
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FLORIDA

	DATE				
MW#	SAMPLED	SHIPPED	RECEIVED	ANALYZED	REPORT
MPT-1-1	29 SEPT 87	29 SEPT 87	30 SEPT 87	05 OCT-27 OCT 87	02 NOV 87
MPT-1-2	29 SEPT 87	29 SEPT 87	30 SEPT 87	05 OCT-27 OCT 87	02 NOV 87
MPT-1-3	29 SEPT 87	29 SEPT 87	30 SEPT 87	02 OCT-20 OCT 87	02 NOV 87
MPT-1-3 DUP	29 SEPT 87	29 SEPT 87	30 SEPT 87	02 OCT-20 OCT 87	02 NOV 87
MPT-2-1	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-06 NOV 87	23 NOV 87
MPT-2-2	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
MPT-2-3	01 OCT 87	01 OCT 87	02 OCT 87	04 OCT-29 OCT 87	09 NOV 87
MPT-2-4	06 OCT 87	06 OCT 87	07 OCT 87	08 OCT-06 NOV 87	13 NOV 87
MPT-2-5	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
MPT-2-6	01 OCT 87	01 OCT 87	02 OCT 87	04 OCT-29 OCT 87	09 NOV 87
MPT-2-7S	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-06 NOV 87	23 NOV 87
MPT-2-7D	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-06 NOV 87	23 NOV 87
MPT-2-8	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
MPT-2-9S	01 OCT 87	01 OCT 87	02 OCT 87	05 OCT-27 OCT 87	17 NOV 87
MPT-2-9D	01 OCT 87	01 OCT 87	02 OCT 87	04 OCT-29 OCT 87	09 NOV 87
MPT-2-10	06 OCT 87	06 OCT 87	07 OCT 87	08 OCT-06 NOV 87	13 NOV 87
MPT-2-15S	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
MPT-2-15S DUP	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
MPT-2-15D	02 OCT 87	02 OCT 87	03 OCT 87	04 OCT-04 NOV 87	19 NOV 87
S-4	06 OCT 87	06 OCT 87	07 OCT 87	08 OCT-06 NOV 87	13 NOV 87
S-5	06 OCT 87	06 OCT 87	06 OCT 87	08 OCT-06 NOV 87	13 NOV 87
MPT-8-1	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-06 NOV 87	23 NOV 87
MPT-8-1 DUP	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-12 NOV 87	23 NOV 87
MPT-8-2	07 OCT 87	07 OCT 87	08 OCT 87	11 OCT-12 NOV 87	23 NOV 87
MPT-8-3	08 OCT 87	08 OCT 87	09 OCT 87	14 OCT-23 NOV 87	17 NOV 87
MPT-9-1	29 SEPT 87	29 SEPT 97	30 SEPT 87	02 OCT-20 OCT 87	02 NOV 87
MPT-9-2	28 SEPT 87	28 SEPT 87	29 SEPT 87	30 SEP-14 OCT 87	22 OCT 87
MPT-9-3	28 SEPT 87	28 SEPT 87	29 SEPT 87	30 SEP-14 OCT 87	22 OCT 87
MPT-13-1	01 OCT 87	01 OCT 87	02 OCT 87	05 OCT-27 OCT 87	17 NOV 87
MPT-13-2	01 OCT 87	01 OCT 87	02 OCT 87	05 OCT-27 OCT 87	17 NOV 87
MPT-13-3	01 OCT 87	01 OCT 87	02 OCT 87	05 OCT-27 OCT 87	17 NOV 87
MPT-14-1	29 SEPT 87	29 SEPT 87	30 SEPT 87	05 OCT-27 OCT 87	02 NOV 87
MPT-14-2	29 SEPT 87	29 SEPT 87	30 SEPT 87	05 OCT-27 OCT 87	02 NOV 87

FILE: GW509704

APPENDIX A—4

APPENDIX A-4

Terrain Conductivity Survey
Sites 5 and 6

GENERAL THEORY AND OPERATION

Terrain conductivity surveys, also referred to as electromagnetic induction (EMI) surveys, have traditionally been used in mineral exploration for tracing conductive ore bodies (i.e., massive sulfides). More recently, conductivity surveys have been widely used for tracing conductive contaminant plumes in groundwater. Leachate from municipal landfills tends to be much more conductive than naturally occurring groundwater. Accordingly, the shape, extent, and relative impact of a plume can be studied with terrain conductivity surveys. Such surveys have also been successfully used in studying some organic contamination in soil and groundwater since the conductivity of most organic chemicals is much lower than naturally occurring soils and groundwater.

Since the instrument never comes in contact with the ground, data acquisition is more rapid than conventional, galvanic, earth resistivity surveys. However, quantification of conductivity data to yield a layered-earth solution is more difficult than with conventional earth resistivity.

Two popular instruments used in terrain conductivity surveys are the EM-31 and the EM 34-3, both manufactured by Geonics, Ltd., in Mississauga, Ontario. These instruments, which have proven to be rapid-reconnaissance exploration tools, are used to assess the conductivity values for soil and rock materials.

Simply stated, the instrumentation, which consists of a transmitter and receiver, operates in the following manner. The transmitter is energized by an alternating current that produces a magnetic field, designated as the primary field, H_p. This artificial magnetic field induces small electric currents to flow in the earth which, in turn, produce a secondary magnetic field, H_s. This secondary magnetic field is complexly related to the transmitter/receiver separation and to the operating frequency of the transmitter, both of which are selected by the operator. The ratio of the secondary field to the primary field (H_s/H_p), under conditions that are commonly fulfilled in the field, is linearly proportional to the terrain conductivity values in units of millimhos per meter. Although it is difficult to define the thicknesses and "true" conductivity of individual subsurface layers, the instrument measures very precisely the "apparent" conductivity of a volume of underlying earth materials. The apparent conductivity value is comprised of the sum of the contributions from each layer that is "sampled" by the transmitter-receiver array. The volume (and therefore the depth) of earth materials sampled increases with increasing separation between the transmitter and receiver. The separation is fixed with EM-31 (3 meters) but is operator-selectable with the EM 34-3 at 10, 20 or 40 meters. Each instrument can be used in either the horizontal dipole or vertical dipole mode. Selection of the operational dipole mode depends on the depth of sampling desired, and the desired sensitivity of the instrument to materials at various depths, relative to the transmitter-reciever coil separation.

Table A-1 shows the relationship of the vertical and horizontal dipole modes and coil separation to the effective depth of exploration.

The relative response of the instrument to materials at various depths can be estimated by examining Figure A-1, which shows a comparison of the relative responses for vertical and horizontal dipoles. The vertical axis describes the relative contribution to the secondary magnetic field, arising from a thin layer at a given depth, z. The horizontal axis shows how this response varies as a function of the ratio (z/s), where "z" is the depth of the thin layer described previously and "s" is the transmitter/receiver separation.

Figure A-1 demonstrates that in the vertical dipole mode, the contribution to the secondary magnetic field from near-surface materials is very small but reaches a maximum at a depth "z" of approximately 0.4*s. The contribution is significant, although diminished, at a depth of 1.5*s. This depth represents the effective depth of exploration in the vertical dipole mode (Table A-1).

In the horizontal dipole mode, the contribution to the secondary magnetic field, arising from near-surface materials, is a maximum and decreases with increase depth. The contribution is also significant at a depth of about 0.75*s. This depth represents the effective depth of exploration in the horizontal dipole mode (Table A-1).

TABLE A-1

Terrain Conductivity Measurements
Effective Depth of Exploration

INSTRUMENT	COIL SEPARATION	VERTICAL DIPOLE	HORIZONTAL DIPOLE
EM 31	3m	4.5m	2.25m
EM 34-3	10m	15m	7.5m
	20m	30m	15m
	40m	60m	30m

RESULTS OF CURRENT INVESTIGATION

The results of the present investigation are presented as a series of terrain conductivity profiles, Figures A-2 through A-6. The raw field readings have been normalized by reducing them to a dimensionless unit (a decibel) proportional to the ratio V_r/V_b, where V_r is the raw field reading (in millimhos per meter) and V_b is a calculated "average" background conductivity value. The following equation was used for normalization:

$$V_n = 20*\log_{10}(V_r/V_b)$$

Background values were determined by taking the average terrain conductivity values along a section of Line TC2, as these appear to best represent background conductions.

Lines TC1 and TC1A - The conductivity values for both traverses (Figures A-2 and A-3) are very high and are undoubtedly influenced by the brackish environment of a the tidal marsh in which the work was conducted. There is no information useful in assessing the presence or absence of conductive leachate from the adjacent landfill on these profiles. The fact that conductivity values for line TC1A are somewhat lower than Line TC1 is explained by the fact that TC1 is located approximately 3 to 4 feet higher in elevation (and thus further from the water table) along the access road to the magazine area.

Lines TC2 and TC2A - These traverses are parallel, separated by approximately 50 feet, and are remarkably similar in appearance (Figures A-4 and A-5). The broad zone of high conductivity values which occurs along the first thousand feet of each traverse (from northeast to southwest) may be due to leachate migration from the adjacent landfill. The narrower zone of lower conductivity values (from about 1,200 to 1,600 feet) may reflect relatively less leachate in that area. Conductivity values increase at the end of both traverses, and this trend may be caused by continuing operations in the dredge spoils area; that is, mounded saline groundwater would contribute to elevated conductivity values.

Line TC3 - Line TC3 (Figure A-6)is similar to Lines TC1 and TC1A in that conductivity values are uniformly quite high. Cultural interferences (i.e., buried electrical cables and underground culverts) may account for observed anomalous values between 100 and 160 feet, at 520 feet, and at 1,100 feet. There is no useful information for assessing the presence or absence of conductive leachate from the adjacent landfill on this profile.

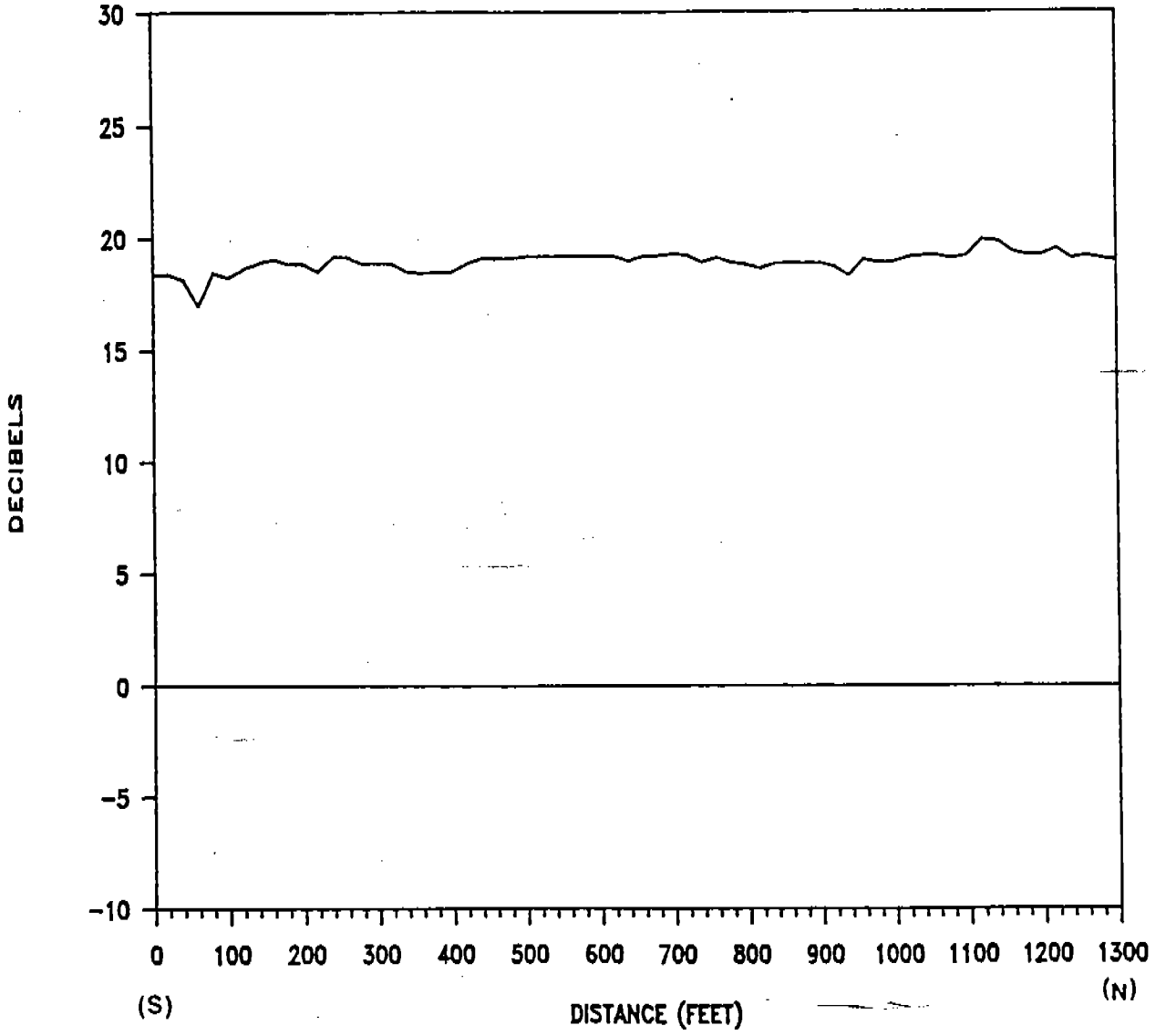
Conversations with local sources at the time of the survey indicate that much of the Mayport Naval Station is located on land made with dredge spoils. This would explain the presence of elevated terrain conductivity values around the Naval Station, as the sediments were imported from a marine (saline)

environment. Under the circumstances, additional survey work is not justified, as it is impossible to differentiate the relative conductivity value at a given location. Other nonelectric geophysical techniques likewise will not be effective in sorting out this kind of information.

However, along Lines TC2 and TC2A, the terrain conductivity profile data has identifiable trends (highs and lows) which may reflect leachate from the landfill (high), brine from the dredge spoils operation (high), and a 400-foot wide zone of relatively low conductivity values between the highs where neither leachate nor brine exist at significant levels. This hypotheses could easily be tested by sampling shallow groundwater at several locations along these traverses.

NORMALIZED TERRAIN CONDUCTIVITY PROFILE

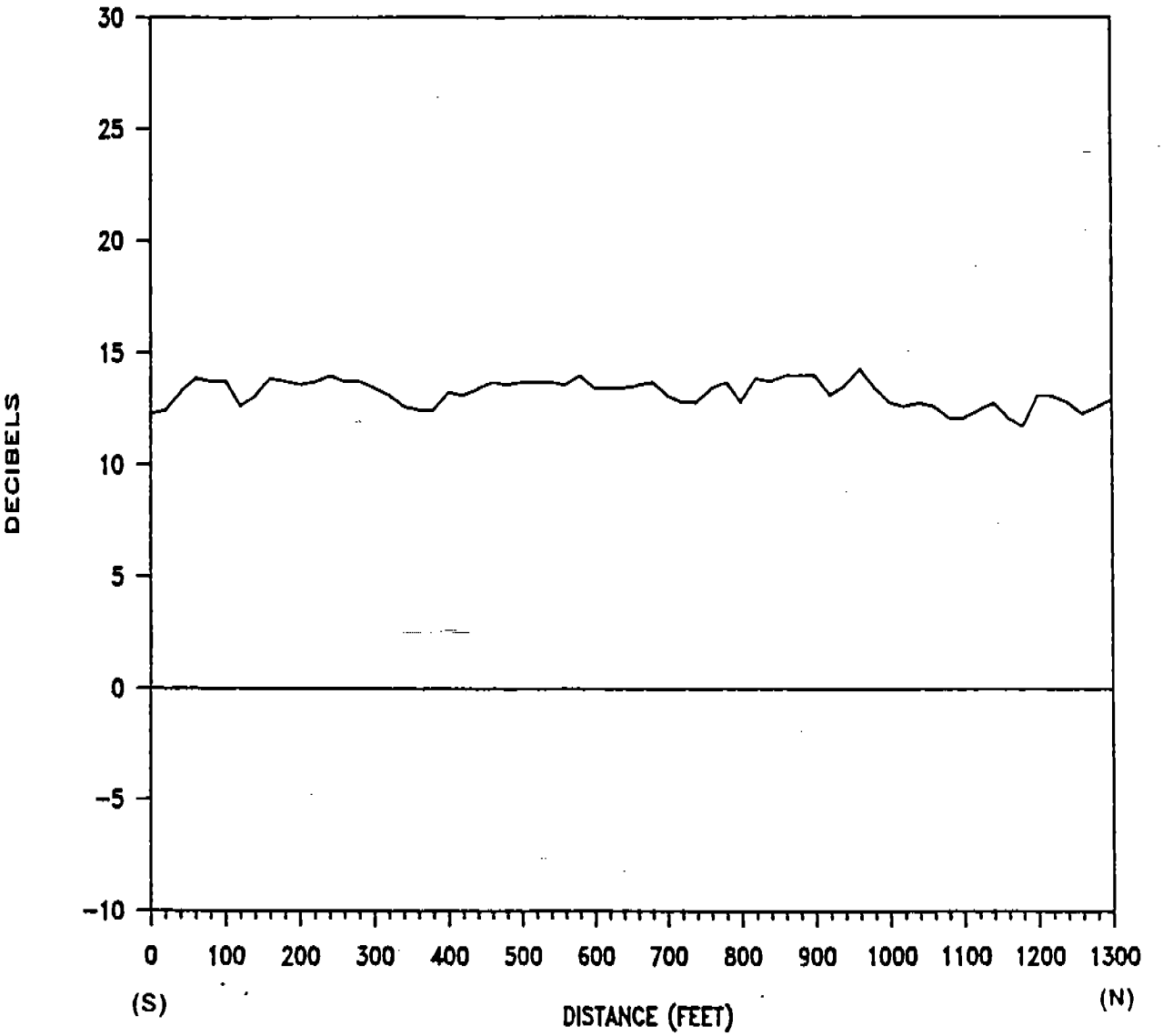
MAYPORT NAVAL BASE – LINE TC1



E.C JORDAN CO ENGINEERS & SCIENTISTS	TERRAIN CONDUCTIVITY PROFILE TRANSECT TC1
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE A-2

NORMALIZED TERRAIN CONDUCTIVITY PROFILE

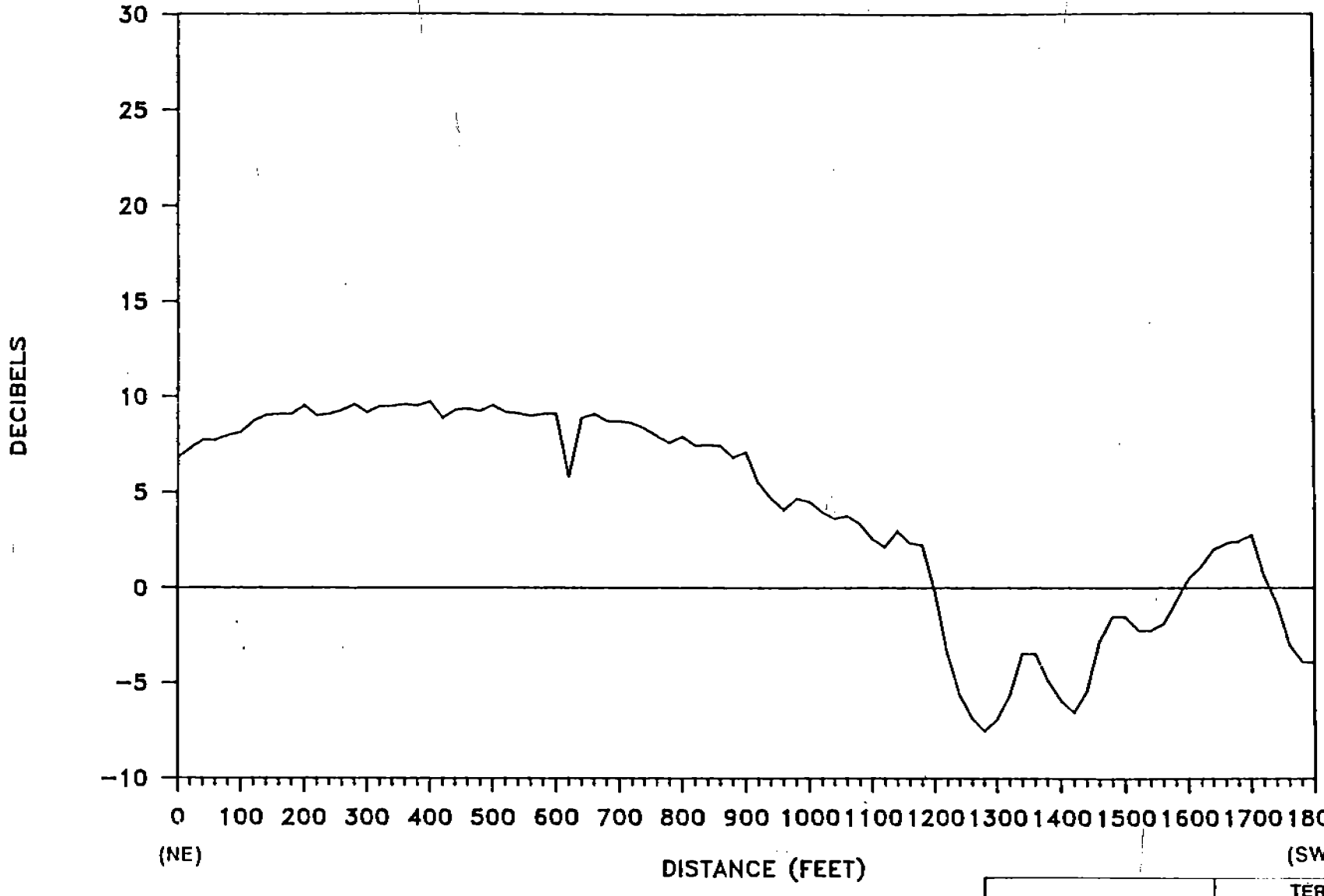
MAYPORT NAVAL BASE – LINE TC1A



E.C. JORDAN CO. ENGINEERS & SCIENTISTS	TERRAIN CONDUCTIVITY PROFILE TRANSECT TC1A
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE A-3

NORMALIZED TERRAIN CONDUCTIVITY PROFILE

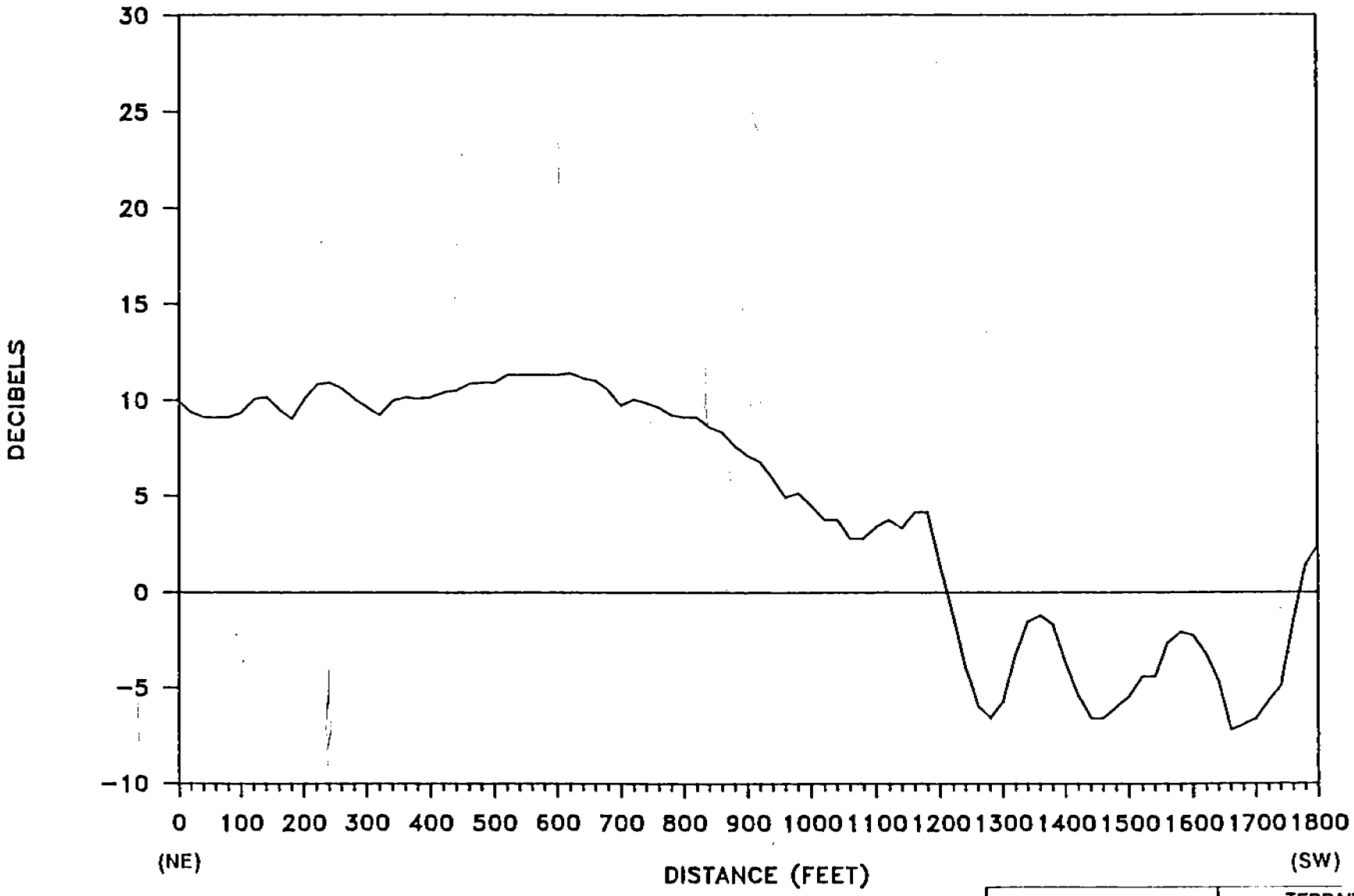
MAYPORT NAVAL BASE – LINE TC2



E.C JORDAN CO. ENGINEERS & SCIENTISTS	TERRAIN CONDUCTIVITY PROFILE TRANSECT TC2
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE A-4

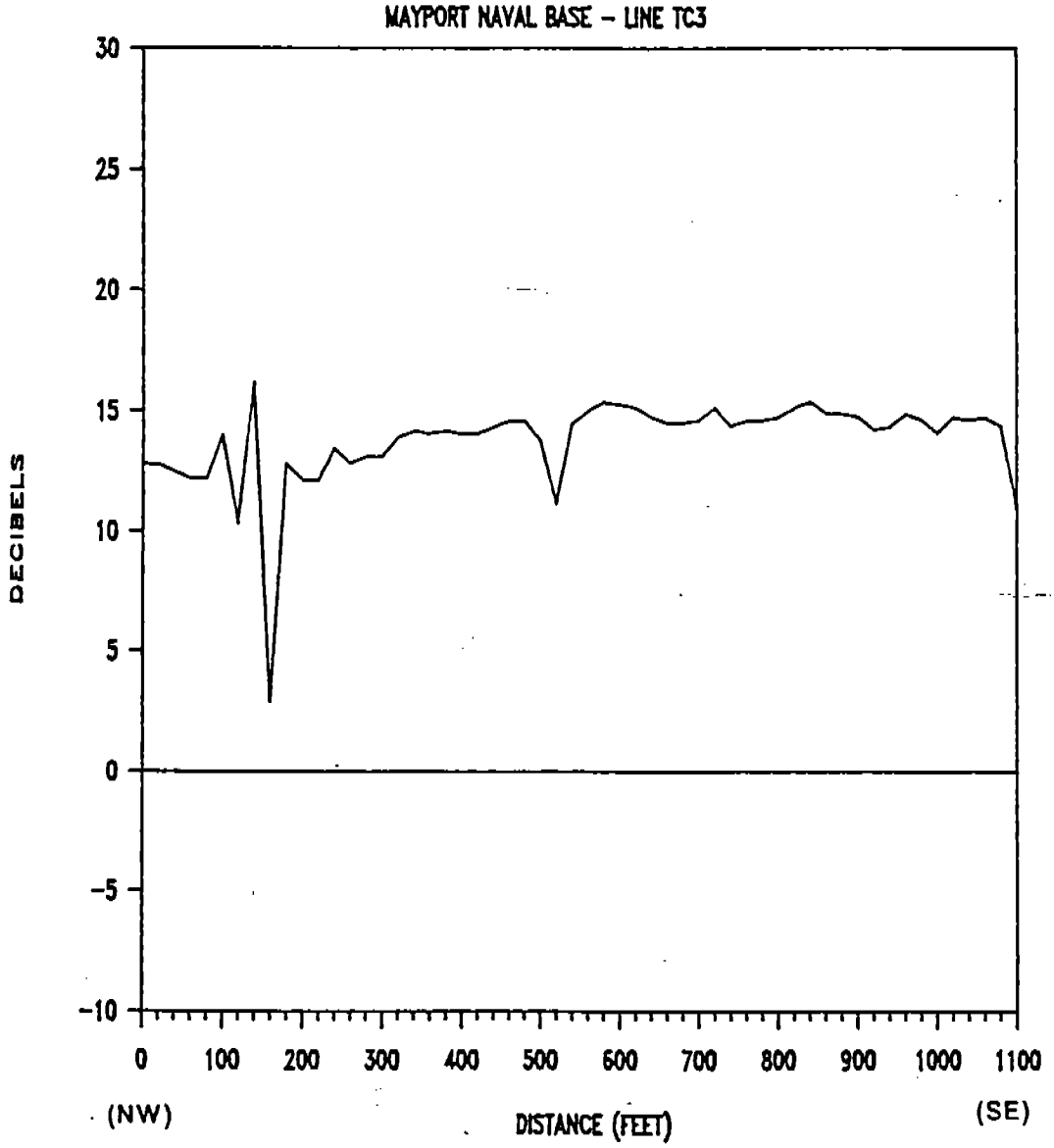
NORMALIZED TERRAIN CONDUCTIVITY PROFILE

MAYPORT NAVAL BASE – LINE TC2A



E.C JORDAN CO. ENGINEERS & SCIENTISTS	TERRAIN CONDUCTIVITY PROFILE TRANSECT TC2A
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE A-5

NORMALIZED TERRAIN CONDUCTIVITY PROFILE



E.C JORDAN CO ENGINEERS & SCIENTISTS	TERRAIN CONDUCTIVITY PROFILE TRANSECT TC3
U.S. DEPARTMENT OF THE NAVY	NIRP EXPANDED SITE INVESTIGATION
U.S. NAVAL STATION MAYPORT, FLORIDA	5097-06 FIGURE A-6

APPENDIX A—5

APPENDIX A-5

Boring Logs

BORING NO. MPT-1-1

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 9 Sept. 1987 COMPLETED 9 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 15 ft. ROCK DRILLED N/A TOTAL DEPTH 15.0 ft.
LOGGED BY R.M. Nugent CHECKED BY M.R. Clark DATE 24 Sept. 1987 BELOW GROUND 7 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
BG	SS-1	0-2	3.3	0.00-0.5' f-c sand, brn, moist, organic matter	3/7/18/18	
				0.5-1.5' f-c sand, gry, moist, little shell fragments		1.6
BG	SS-2	2-4	3.0	0-1.2' as above	2/21/26/30	
				1.2-1.4' f sand, dk brn, moist		1.6
				1.4-1.6' f sand, gry, moist		
BG	SS-3	4-6	6.5	f-m sand, gry, moist, shell fragments	9/19/23/28	
				0.9-1.1' as above but some shell fragments		1.5
BG	SS-4	6-8	2.8	f-m sand, gry, moist, little shell fragments	10/11/8/9	1.5
				0.8-1.0' stiff clay; sat below		
BG	SS-5	8-10	7.2	f sand, lt tan to gry, sat, little shell fragments	7/7/16/16	1.0
BG	SS-6	13-15	3.5	f sand, lt gry, saturated, some shell fragments	5/29/50+	2.0

Materials
end cap
10 ft screen
7.5 ft riser
end cap
2.5 bags sand
1/2 tub bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-1-2

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 10 Sept. 1987 — COMPLETED 10 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 15 ft. — ROCK DRILLED N/A — TOTAL DEPTH 15.0 ft.
LOGGED BY R.M. Nugent — CHECKED BY M.R. Clark — DATE 24 Sept. 1987 — BELOW GROUND 5 ft.

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-1	0-2	10.0	0-0.3' fill, gravel, dk brn moist 0.3+' f sand, gradation from lt brn to lt gry, moist, few shell fragments	22/22/37/31	1.3
SS-2	5-7	4.8	f sand, gry, moist, few shell fragments, trace gravel	24/25/12/22	1.3
SS-3	10-12	13.5	f sand, brn to gry, sat, few shell fragments	6/2	2.0
SS-4	15-17	2.8	f sand, lt gry, few shells and shell fragments, sat	12/32/51+	2.0

Materials
end cap
10 ft screen
7.5 ft riser pipe
end cap
2.5 bags sand
3/4 tub bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-1-3

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 10 Sept. 1987 — COMPLETED 10 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 15 ft. — ROCK DRILLED N/A — TOTAL DEPTH 15 ft.
LOGGED BY R.M. Nugent — CHECKED BY M.R. Clark — DATE 24 Sept. 1987 — BELOW GROUND 5 ft.

SAMPLE NUMBER	DEPTH (ft)	P.I. HEAD SPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-1	0-2	83	f sand, lt brn to gry, dry to moist, few shells and shell fragments, silt	7/14/19	1.5
SS-2	5-7	7.0	f sand, gry, moist, silt, few shell fragments	13/14/6/12	1.3
SS-3	10-12	13.6	f sand, dk gry, sat, few shell fragments, clay lens (0.1' thick)	5/24/50+	2.0
SS-4	15-17	3.1	f sand, tanish gry to lt gry, few shell fragments (diminish w/depth)	24/36/50+	1.5

Materials
end cap
7 ft screen
end cap
2 bags sand
1/3 tub bentonite pellets
1 bag cement
1 protective steel casing

BORING NO. MPT-2-1

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 22 Sept. 1987 — COMPLETED 22 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 10 ft. — ROCK DRILLED N/A — TOTAL DEPTH 10 ft.
LOGGED BY R.M. Nugent — CHECKED BY M.R. Clark — DATE 25 Sept. 1987 — BELOW GROUND app. 4 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
BG	SS-1	0-2	93.1	0-0.6'	f-m sand, dk brn, dry	13/14/18/26	
				0.6-1.2'	f sand, tan, dry, tr shell		1.5
				1.2+	f sand, tan, dry		
BG	SS-2	2-4	35.7		f sand, tan, moist, few shell fragments	7/13/13/14	1.6
				1.4-1.6'	sat		
BG	SS-3	5-7	10.4		f sand, gry, sat, few shell fragments	16/12/5/4	0.7
BG	SS-4	10-12	0		f-m sand, gry, sat, little shell fragments	11/10/1/2	2.0

Materials
end cap
7 ft screen
end cap
2 bags sand
1/3 tub bentonite pellets
1 bag cement
1 protective steel casing
5 ft riser

BORING NO. MPT-2-2

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 22 Sept. 1987 — COMPLETED 22 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 10 ft. — ROCK DRILLED N/A — TOTAL DEPTH 10 ft.
LOGGED BY R.M. Nugent — CHECKED BY M.R. Clark — DATE 25 Sept. 87 — BELOW GROUND app. 4 ft.

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-1	0-2	0	0-0.2	top soil, f sand, dk brn, dry	4/13/14/14	
			0.2-0.9	f sand, tan, moist		1.8
			0.9+	clayey f sand, dk brn to blk, moist, tr shell, stiff		
SS-2	2-4	0	0-0.05	as above	13/17/29/30	
			0.5+	f-m sand, gry, moist		1.5
			1.0-1.5	sat		
SS-3	5-7	0		f-m sand, gry, sat, few shell fragments	11/6/2/1	
			0.6-1.1	clay grad to clay sand		1.9
SS-4	10-12	0		clay, dk olive	5	
						0.5

Materials
end cap
7 ft screen
5 ft riser
2 bags sand
1/3 tub bentonite pellets
1 bag cement
1 protective casing

BORING NO. MPT-2-3

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 11 Sept. 1987 COMPLETED 14 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft. ROCK DRILLED N/A TOTAL DEPTH 15 ft.
LOGGED BY R.M. Nugent CHECKED BY M.R. Clark DATE 25 Sept. 87 BELOW GROUND app. 7 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
BG	SS-01	0-2		0-0.4	topsoil, f-m sand, dk brn, dry, tr shell	6/15/8/9	
				1.0-1.4	f sand, brn, few shell fragments decreasing w/depth		1.4
BG	SS-02	2-4	34.4		f sand, tan, dry increase moisture w/depth	24/35/30/13	1.7
BG	SS-03	4-6	6.7		f-m sand, gry, moist, few shell fragments, tr c sand concretions	23/36/29/35	1.5
BG	SS-04	6-8			f-m sand, gry, some shell fragments	7/9/8/9	1.4
BG	SS-05	10-12	17		f sand, gry, sat, few shell fragments, tr gravel size sand concretions	5/14/28/55	2.0
BG	SS-06	15-17			f sand, gry, sat, few shell fragments	7/50+	2.0

Materials
end cap
10 ft screen
7.5 ft riser
end cap
5 bags sand
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-4

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 11 Sept. 1987 COMPLETED 9 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft. ROCK DRILLED N/A TOTAL DEPTH 15 ft.
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 9 Sept. 87 BELOW GROUND app. 5.1 ft.

SAMPLE NUMBER	DEPTH (ft)	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	0-0.3 top soil w/veg 0.3-1.0 tan f-m sand w/veg and gravel and small shell fragments, moist 1.0-1.5 orangey clayey sand, moist	4/12/17/20	1.5
SS-02	5-7	light gry f sand w/small shell fragments, sat	8/11/5/10	
SS-03	10-12	dk olive uniform clay with decomp organics	4/5/9/10	1.75
SS-04	15-17	0-0.6 same as above 0.6-1.0 greenish gry very f sand 1.0-2.0 interbed sand and clay	3/6/11/16	2.0

Materials
end cap
10 ft screen
6 ft riser
end cap
3 bags sand
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-5

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 23 Sept. 1987 COMPLETED 23 Sept. 1987
METHOD Hollow Stem CASING SIZE 2 in ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 11 ft. ROCK DRILLED N/A TOTAL DEPTH 10 ft.
LOGGED BY M.C. Diblin CHECKED BY R.M. Nugent DATE 13 Oct. 87 BELOW GROUND 3.0 ft.

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	0-2		0.0-0.5	top soil, dk brn f sand, dry	17/23/30/50+	
			0.5-1.6	light dk gry f-m sand, trace coarse sand and shell fragments, dry to moist		1.6
SS-02	5-7	36.2	0.0-1.4	light gry f-c sand, few shell fragments, sat	1/7/10/9	
SS-03	10-12		0.0-0.7	dk olive clay, sat	11/13	0.7

Materials
end cap
7 ft screen
5 ft riser
end cap
3 bags sand
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-6

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 22 Sept. 1987 COMPLETED 22 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2 in ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 10 ft. ROCK DRILLED N/A TOTAL DEPTH 10 ft.
LOGGED BY R.M. Nugent CHECKED BY M.R. Clark DATE 25 Sept. 87 BELOW GROUND appr. 4 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
BG	SS-01	0-2	0	0-0.4	top soil, f sand, dk brn, dry	14/31/35/41	
				0.4-0.8	f-m sand, lt tan, dry, few shell fragments		1.8
				0.8-1.1	clay interbedded w/sand, some shell		
				1.1-1.8	f-m sand, tan, tr gravel, moist		
BG	SS-02	2-4	0		f-m sand, gry, sat, few shell fragments, sat	19/27/26/28	1.5
BG	SS-03	5-7	0		f-c sand, gry, sat, few shell fragments	2/5/7/12	1.5
BG	SS-04	10-12	0	0-0.4	as above	4/5/5/10	
				0.4+	clay (organic), dk olive		1.8

Materials
end cap
7 ft screen
5 ft riser
3 bags sand
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-7S

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 15 Sept. 1987 COMPLETED 15 Sept. 1987
METHOD Hollow Stem CASING SIZE 2 in ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 12 ft. ROCK DRILLED N/A TOTAL DEPTH 12 ft.
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 4.75 ft.

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE		SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	2.8	0-0.2	loamy top soils w/veg	9/20/36/27	
			0.2-0.6	dk brn motted stiff clay w/shell fragments and sand to pebble size grains, dry		1.3
			0.6-1.3	light tank f-m sand w/shell fragments, dry		
SS-02	2-4	5.2	0-1.3	light tan f-m sand w/few shells, dry to moist	13/13/9/11	1.3
SS-03	4-6	8.2	0-0.3	interbed clay/sand grading to sand below, few gravel/pebble concretions	11/27/3/1	1.3
			0.3-1.0	light tan f-m sand w/few shells, moist		
SS-04	10-12	4.8	0-0.9	light gry f-m sand w/shells and fragments, sat	5/2/2/5	
			0.9-1.4	dk olive clay, smelly, moist		1.4

Materials
end cap
7 ft screen
6.5 ft riser
end cap
2 bags sand
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-7D

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 23 Sept. 1987 COMPLETED 23 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 15 ft ROCK DRILLED N/A TOTAL DEPTH 25 ft.
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 13 Sept. 87 BELOW GROUND --

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE		SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	10-12	0-0	0.0-0.2	dk brn, sat, clay	20/31/19/16	
			0.2-1.4	f-c gry sand with some shell fragments, sat		1.4
SS-02	12-14	0.3	0.0-0.4	clayey sand, dk brn, sat, trace shell fragments	3/4/12/17	
			0.4-0.9	dk olive clay, sat		0.9
SS-03	15-17	0.0	0.0-0.4	f-m sand, brn, sat, trace shell fragments		
			0.4-1.2	f sand gray-green, sat, no shells	20/21/21/19	
SS-04	12-19	25.0	0.0-0.9	same as above		0.9
SS-05	25-27	0.0	0.0-1.4	gray-green clay, pliable, sticky		
			1.4-2.0	gray-green sandy clay grading back to clay		

Materials
end cap
10 ft screen
17.5 ft riser
end cap
3.5 bags sand
2/3 bucket bentonite pellets
4 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-8

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 23 Sept. 1987 COMPLETED 23 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 10 ft ROCK DRILLED N/A TOTAL DEPTH 10 ft
LOGGED BY M.C. Diblin CHECKED BY R.M. Nugent DATE 13 Oct. 87 BELOW GROUND 3.0 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	0-2	8.6	0.0-0.4	top soil, f brn sand, dry	13/12/11/14	
			0.4-1.0	tan f-m sand		1.2
SS-02	2-4		1.0-1.2	black, similar to brn asphalt, dry		
				no sample in spoon-augered mat		
				black gravel with f-c sand	18/17/19/21	
SS-03	5-7	6.0	0.0-0.4	dk gry f-c sand, few shells, trace clay, sat	13/19/17/21	0.2
			0.4-0.8	lt gry f-c sand, few shell fragments, sat		0.8
SS-04	10-12	0.0	0.0-2.0	dk olive clay, sat	2/3/2/1	2.0

Materials
1.5 bags sand
end cap
7 ft screen
end cap
5 ft riser
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-9S

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 22 Sept. 1987 COMPLETED 22 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 10 ft. ROCK DRILLED N/A TOTAL DEPTH 10 ft
LOGGED BY R.M. Nugent CHECKED BY R.M. Clark DATE 25 Sept. 87 BELOW GROUND 3 ft

SOIL/ROCK DESCRIPTION	BLOWS/6-IN
SEE LOG FOR MPT-2-9D	

Materials
1.5 bags sand
end cap
7 ft screen
end cap
5 ft riser
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-9D

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 22 Sept. 1987 COMPLETED 22 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 10 ft. ROCK DRILLED N/A TOTAL DEPTH 25 ft
LOGGED BY R.M. Nugent CHECKED BY M.R. Clark DATE 25 Oct. 87 BELOW GROUND appr. 7 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	3.5	0-0.3 f sand, dk brn, dry, om 0.3+ f-m sand, lt brn, dry, few shell fragments	8/9/27/30	1.6
SS-02	5-7	74.3	0-0.3 as above 0.3-0.9 f sand, lt gry, moist, tr shell fragments 0.9+ f sand, lt gry, sat, tr silt and shell	19/26/30/21	1.6
SS-03	9-11	2.3	0-1.5+ as above 1.5+ clay, dk olive, sat	2/2/3/4	2.0
SS-04	11-13	13.0	clay, dk olive, sat	6/6/37/22	1.5
SS-05	13-15	6.7	f sand, lt brn, sat		1.3
SS-06	15-17	0.6	f sand, lt brn, sat 0.4-0.8 seam with few shell fragments	9/15/31	1.2
SS-07	20-22	14.2	f sand, lt brn to gray/green with depth, sat		1.3
SS-08	25-27	14.5	f sand, gry, sat 1.1-1.3 some shell fragments		

Materials
3 bags sand
end cap
10 ft screen
end cap
17.5 ft riser
1 tub bentonite pellets
3 bags cement
1 protective steel casing

BORING NO. MPT-2-10

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 10 Sept. 1987 COMPLETED 10 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2" HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft. ROCK DRILLED N/A TOTAL DEPTH 15 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 5.8 ft

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
BG	SS-01	0-2	7.1	white sandy clay, slightly moist	40/34/40/34	
BG	SS-02	5-7	15.3	f-m lt gry sand with shell, well sorted		1.5
BG	SS-03	10-12	5.1	gry f-m sand, shells and fragments, moist	9/21/16/13	
BG	SS-04	15-17	5.3	dk olive to black silty clay, decomp. veg matter, moist	5/4/4/7	
				light tan f sand with org matter, sat	8/9/11/17	

Materials
6 bags sand
end cap
5 ft screen
end cap
7.5 ft riser
.75 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-15S

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 14 Sept. 1987 COMPLETED 14 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" HNU 11.7/10.2
GROUND EL. Unknown SOIL DRILLED 17 ft. ROCK DRILLED N/A
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87

PROJECT NO. 5097-04
PROTECTION LEVEL D
TOTAL DEPTH 15 ft
BELOW GROUND 5.8 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	2.7	0-0.4 clayey sand with veg 0.4-0.6 tan uniform f sand with shell fragments 0.6-0.7 v dk brn clay with small amt f sand 0.7-1.1 mottled grayish brn poor sorted f-m sand with shell fragments	11/17/20/26	1.1
SS-02	2-4	0	0.0-0.4 light gry to tan f-m sand, dry 0.4-1.0 dk gry, stiff clay with light gry sand, moist 1.0-1.05 m-c grain shell layer 1.05-1.65 light gry to tan f-m sand with thin layers of grayish clay, interlayered, well defined sand layers with Fe oxide bands	9/10/16/20	1.65
SS-3	10-12	4.1	0-0.2 dk brn f-m sandy clay, dry 0.2-0.3 light gry clay, moist 0.3-2.0 dk green/gray olive clay with org material, plastic, moist	1/2/2/2	2.0
SS-4	15-17	4.3	0.0-1.8 green/brn to olive clay w/veg 1.8-2.0 light gry v f clayey sand, moist	4/9/20/13	2.0

Materials
5.5 bags sand
end cap
10 ft screen
end cap
7 ft riser
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-2-15D

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 23 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE HNU 11.7/10.2 COMPLETED 23 Sept. 1987
GROUND EL. SOIL DRILLED ROCK DRILLED N/A PROTECTION LEVEL D
LOGGED BY M.C. Diblin CHECKED BY R.M. Nugent DATE 13 Oct. 87 TOTAL DEPTH 25 ft
BELOW GROUND 7.40 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	10-12	0.0	0.0-2.0	dk olive clay, sat, some org mat	1/1/3/3	2.0
SS-02	12-14	0.0	0.0-1.0	same as above	10/3/7/4	2.0
			1.0-2.0	dk gry clayey sand		
SS-03	15-17	8.6	0.0-0.8	light gry f sand, sat	6/8/13/15	0.8
SS-04	25-27	2.4	0.0-2.0	gry f-m sand with some clay sticky, sat	6/9/6/4	2.0

Materials
3 bags sand
end cap
10 ft screen
end cap
17.5 ft riser
2/3 bucket bentonite pellets
4 bags Portland cement
1 protective steel casing

BORING NO. MPT-8-1

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 17 Sept. 1987 COMPLETED 17 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft ROCK DRILLED N/A TOTAL DEPTH 17 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 9 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	0-2	0.8	0-0.4	dk brn to black top soil	5/15/24/38	
			0.4-1.8	light tan f uniform sand, dry		1.8
SS-02	5-7	186	0-0.4	dk brn f org sandy soil	16/17/33/41	
			0.8-0.9	light tan uniform sand		
			0.9-1.6	light gry f-m sand with shell fragments		1.6
SS-03	7-9		0-1.1	gry f-m sand w/shell fragments	6/9/6/2	
SS-04	10-12	140	0-1.3	dk gry f-m snad with silty black sand layers	1/3/1/2	1.1
			1.3-2.0	light gry f uniform sand with one clay bleb		2.0
SS-05	15-17	52.3	0-0.85	gry f uniform sand with small clay blebs	7/16/14/18	
			0.85-1.0	gry uniform plastic clay		1.7
			1.0-1.7	light gry f-m sand with shell fragments		

Materials
3.5 bags sand
end cap
10 ft screen
end cap
9 ft riser
1 bucket bentonite pellets
1 bags Portland cement
1 protective steel casing

BORING NO. MPT-8-2

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 17 Sept. 1987 — COMPLETED 17 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 17 ft — ROCK DRILLED N/A — TOTAL DEPTH 17 ft
LOGGED BY M.C. Diblin — CHECKED BY M.R. Clark — DATE 24 Sept. 87 — BELOW GROUND appr. 9 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE		SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	71.6	0-0.9	dk brn topsoil with shell fragments and veg	13/20/22/36	2.0
			0.9-1.8	tan f-m sand, few shells		
			1.8-2.0	tan to gry f-m sand with many shells		
SS-02	5-7	17.8	0-0.9	dk brn f sand with shells to light tan sand	17/21/30/56	1.7
			0.3-0.45	dry		
			0.9-1.7	light gry f-m sand w/shell fragments, dry		
SS-03	7-9	168	0-1.1	same as above	12/13/20/22	1.1
SS-04	10-12	176	0-1.1	gry f-m sand with shell fragments grading to f uniform light gry sand at 1.0-1.1, sat	6/9/13/19	1.1
SS-05	15-17	68.9	0-2.0	light gry f-m sand with shell fragment, sat	4/7/9/13	2.0

Materials
3.5 bags sand
end cap
10 ft screen
end cap
10 ft riser
0.75 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-8-3

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 16 Sept. 1987 COMPLETED 16 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft ROCK DRILLED N/A TOTAL DEPTH 15 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 9 ft

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
	SS-01	0-2	14.4	0-1.4 light tan f-m sand w/shell fragments, dry	7/13/20/29	1.4
	SS-02	5-7	1.7	0-.95 light tan f-m sand interbedded with dk brn sand shells	13/14/16/7	1.1
	SS-03	7-9		0.95-1.1 v light tan f-m sand with shells 1.6+ tan m sand with shell fragments and some darker sand	10/10/12/18	1.6
	SS-04	10-12	10.8	0-1.4 gry f-m with shells frags grading to a gry f sand with shells	17/17/15/7	1.4
BG	SS-05	15-17	62.4	0-2.0 gry f-m sand with many shells and fragments	17/21/21/37	2.0

Materials
3 bags sand
end cap
10 ft screen
end cap
7.5 ft riser
0.5 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-9-1

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 15 Sept. 1987 — COMPLETED 15 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 19 ft — ROCK DRILLED N/A — TOTAL DEPTH 20 ft
LOGGED BY M.C. Diblin — CHECKED BY M.R. Clark — DATE 24 Sept. 87 — BELOW GROUND appr. 11 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	1.1	0-.15 dk black surf soil 0.15-0.8 light to dark gry m-c sand w/shell fragments 0.85-1.55 light tan f-m sand with shell fragments one pebble size clay bleb, dry	7/11/21/27	1.55
SS-02	2-4	4.8	0-1.2 v light tan f-m sand with shell fragments, dry	20/22/29/31	1.7
SS-03	4-6	0.0	0.1 f sand with shell fragments, tan to dk brn, dry 1.0-1.7 white f-m sand with large and small shells and fragments, dry	7/13/14/19	1.3
SS-04	6-8	2.4	0.8 same as above 0.8-1.0 gry uniform plastic clay mottled with brn stringers of clay, dry 1.0-1.4 white f-m sand with shell fragments, dry 1.4-1.6 grey sandy clay, moist, plastic		
SS-05	8-10	23.0	0-0.3 tan well sorted f-m sand with large shell fragments, sat 0.3-0.8 tan well sorted vf-f sand, sat 0.8-1.6 off white f-m sand sand with large and small shell fragments, sat	16/21/27/17	1.6
SS-06	15-17	29.1	0-0.3 light gry f-m sand with shell fragments 0.3-2.0 light gry f-m shelly sand (many shell pieces), sat	8/32/50+	2.0

Materials
3.5 bags sand
end cap
10 ft screen
end cap
12 ft riser
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-9-2

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 16 Sept. 1987 COMPLETED 16 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft. ROCK DRILLED N/A TOTAL DEPTH 15.0 ft
LOGGED BY Mark Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND 9 ft

SAMPLE NUMBER	DEPTH (ft)	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
SS-01	0-2	0.00-1.3' light tan f-m sand w/ shell fragments, dry	12/12/15/13	1.3
SS-02	5-7	0.00-1.5' high tan f-m sand w/ shell fragments, dry	17/9/8/8	1.5
SS-03	7-9	0.00-0.5' tan f sand w/ shells 0.5-0.55' blue shells 0.55-1.3' grades to light gry f-m sand w/ shells	17/9/12/13	1.3
SS-04	10-12	0.00-1.5' light grey f-m sand w/ shells and fragments,	7/9/12/13	1.5
SS-05	15-17	0.00-0.4' same as above	2/12/50+	0.4

Materials
end cap
10 ft screen
7.5 ft riser
end cap
2 1/2 bags sand
.75 bucket bentonite
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-9-3

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 16 Sept. 1987 COMPLETED 16 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 17 ft ROCK DRILLED N/A TOTAL DEPTH 15 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 8-10 ft

SAMPLE NUMBER	DEPTH (ft)	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	0-2	0-0.4	light tan org top soil w/veg	4/13/27/29	
		0.4-1.0	dk tan f uniform sand		1.5
		1.0-1.5	light tan f-m sand w/shell frags		
SS-02	2-4	0-0.15	tan f-m sand w/shells	16/20/20/19	
		0.15-0.5	light tan f uniform sand w/dk black clayey sand layer appr .1' thick		1.6
SS-3	4-6	0.5-1.15	same as above	22/13/11/12	
		1.15-1.5	interbedded brown clay and red sand with shells		1.5
SS-04	6-8	0-0.8	dk brown m sand with some shells	12/8/8/7	
		0.8-1.55	tan f-m sand with some large shells, uniform		1.55
SS-05	8-10	0-1.0	tan f-m sand, 50% shelly, grading to very f light tan sand at the bottom	7/22/22/35	1.8
SS-06	15-17	0-2.0	gry f-m sand with many shell and fragments	7/11/22/30	2.0

Materials
11 bags sand
end cap
10 ft screen
end cap
7.5 ft riser
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-13-1

CLIENT USN, NAVFACENGCOM SDIV PROJECT NO. 5097-04
CONTRACTOR Monitor Testing DATE STARTED 18 Sept. 1987 COMPLETED 18 Sept. 1987
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 12 ft ROCK DRILLED N/A TOTAL DEPTH 10 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 25 Sept. 87 BELOW GROUND appr. 3 ft

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
BG	SS-01	1-3	79.9	0-1.4	light tan f-m well graded sand with shell fragments, dry	33/42/43/50	1.4
BG	SS-02	5-7	132	0-0.15	brown very f sand with shell fragments	7/9/14/9	1.4
				0.15-1.4	light gry f uniform sand with few shells, sat		
BG	SS-03	10-12	70.1	0-1	interbedded meduim plastic gry clay and very f clayey sand	1/2/2/2	2.0
				1.0-1.2	uniform plastic meduim gry clay		
				1.2-2.0	brn very f sand, sat		

Materials
2.5 bags sand
end cap
10 ft screen
end cap
6 ft riser
3/4 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-13-2

CLIENT USN, NAVFACENGCOM SDIV — PROJECT NO. 5097-04
CONTRACTOR Monitor Testing — DATE STARTED 15 Sept. 1987 — COMPLETED 15 Sept. 1987
METHOD Hollow Stem — CASING SIZE 2" ID — HNU 11.7/10.2 — PROTECTION LEVEL D
GROUND EL. Unknown — SOIL DRILLED 12 ft — ROCK DRILLED N/A — TOTAL DEPTH 10 ft
LOGGED BY M.C. Diblin — CHECKED BY M.R. Clark — DATE 24 Sept. 87 — BELOW GROUND appr. 3 ft

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	0-2	1.4	0-0.5	dk black top soil		
			0.5-2.0	light gry f-m sand with shell fragments		
SS-02	2-4		0-0.2	same as above	17/31/50+	
			0.2-0.5	tan m sand, many shells and fragments (coquina-like)		1.2
			0.5-1.2	grades to f well sorted uniform sand, gry		
SS-03	5-7	1.0	0-0.2	light gry f-m sand with shell fragments, sat	9/12/22/27	
			0.2-0.45	very dk brn sandy peat, sat		1.3
			0.9-1.3	light gry uniform f sand, no shells		
SS-04	10-12	1.5	0-0.3	same as above	4/4/8/8	
			0.3-1.0	gry soft plastic uniform clay		2.0
			1.0-1.6	dk brn stiff clay with much decomp veg		
			1.6-2.0	dk olive stiff uniform clay		

Materials
2 bags sand
end cap
7 ft screen
end cap
6 ft riser
1 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-13-3

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 18 Sept. 1987 COMPLETED 9 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 12 ft ROCK DRILLED N/A TOTAL DEPTH 10 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND

SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
SS-01	1-3		0-0.2	dk brn sandy topsoil	40/40/50/30+	
			0.2-0.9	light tan f-m sand with shells Fe oxide larger at 0.9		1.4
SS-02	5-7	30.2	0-0.5	dk gry f sand with shells	13/15/20/40	
			0.5-0.9	light gry f sand with shells		1.4
			0.9-1.4	light gry f uniform sand, no shells, sat		
SS-03	10-12	5.1	0-0.6	gry very f clayey sand	1/1/1/2	
			0.6-1.1	dk brn clay decomp veg		2.0
			1.1-1.5	dk olive firm uniform clay high plasticity		
			1.5-2.0	med plasticity gry clay		

Materials
2.5 bags sand
end cap
7 ft screen
end cap
6 ft riser
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-14-1

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 17 Sept. 1987 COMPLETED 17 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 13 ft ROCK DRILLED N/A TOTAL DEPTH 13 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 3.0 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION		BLOWS/6-IN	RECOVERY
BG	SS-01	0-2		0-1.4	light tan f-m w/few shell fragments, visible layering, dry	7/1/420/29	1.4
BG	SS-02	5-7	160	0-1.4	light tan f-m sand w/shell fragments, sat	9/16/31/50	1.4
BG	SS-03	10-12	141	0-2.0	light gry f-m-uniform sand w/shell fragments, sat	7/23/50+	2.0

Materials
3 bags sand
end cap
10 ft screen
no end cap
6 ft riser
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

BORING NO. MPT-14-2

CLIENT USN, NAVFACENGCOM SDIV
CONTRACTOR Monitor Testing DATE STARTED 17 Sept. 1987 COMPLETED 17 Sept. 1987 PROJECT NO. 5097-04
METHOD Hollow Stem CASING SIZE 2" ID HNU 11.7/10.2 PROTECTION LEVEL D
GROUND EL. Unknown SOIL DRILLED 13 ft ROCK DRILLED N/A TOTAL DEPTH 13 ft
LOGGED BY M.C. Diblin CHECKED BY M.R. Clark DATE 24 Sept. 87 BELOW GROUND appr. 3.0 ft.

P.I. AMBIENT AIR	SAMPLE NUMBER	DEPTH (ft)	P.I. HEADSPACE	SOIL/ROCK DESCRIPTION	BLOWS/6-IN	RECOVERY
BG	SS-01	0-2	80.2	0-1.0 light tan f uniform sand with layering	7/12/20/30	1.4
				1.0-1.4 dk tan f uniform sand with shell fragments		
BG	SS-02	2-4		0-1.25 light tan f uniform sand, dry	7/20/25/27	1.65
				1.25-1.4 tan shells and fragments		
				1.4-1.6 light tan uniform sand, sat		
BG	SS-03	5-7	49.7	0-0.85 light gry f uniform sand, sat	5/16/26/50	1.4
				0.85-1.0 c grain shelly gry sand, sat		
				1.0-1.4 light gry f uniform sand, sat		
	SS-04	10-12	59.8	0-2.0 light gry f-m sand with shell fragments, sat	11/31/50+	2.0

Materials
3 bags sand
end cap
10 ft screen
end cap
6 ft riser
1/3 bucket bentonite pellets
1 bag Portland cement
1 protective steel casing

APPENDIX A—6

APPENDIX A-6

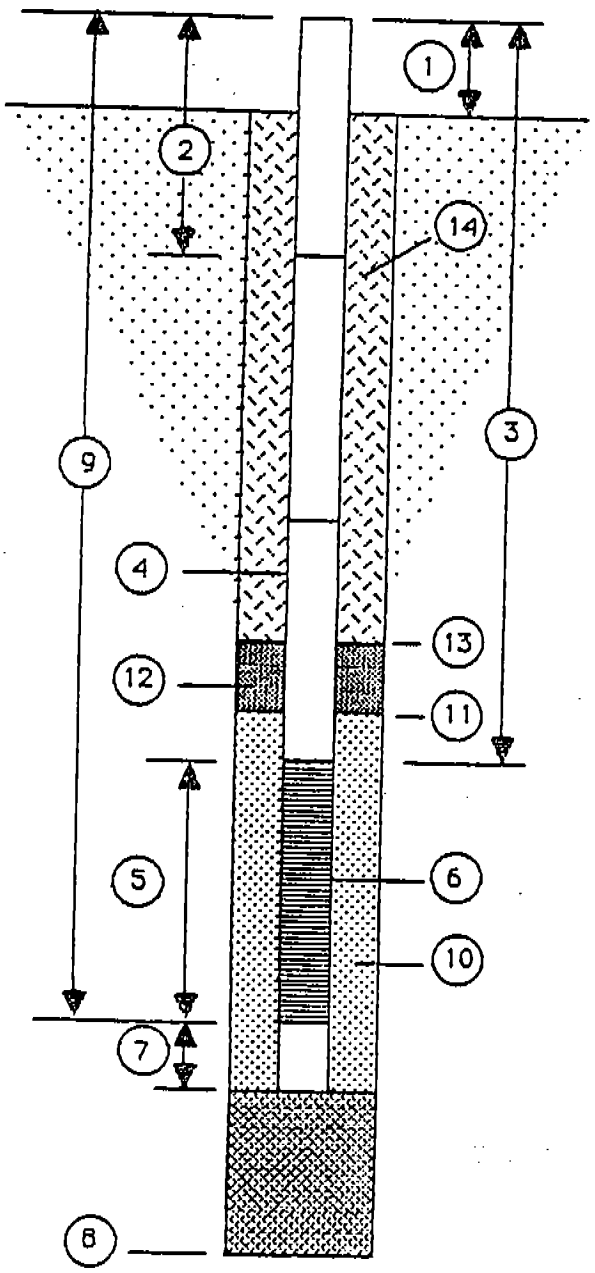
Monitoring Well Installation Data

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-1-1

DATE OF INSTALLATION 9 Sept. 87



1. Height of Casing above ground 2.7'
2. Depth to first Coupling 7.5
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 15.5 Hole Diameter 0.7'
9. Depth To Bottom of Screen 14.8
10. Type of Screen Filter Sand
    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets
    Quantity Used 25 lbs
13. Depth To Top of Seal 3'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

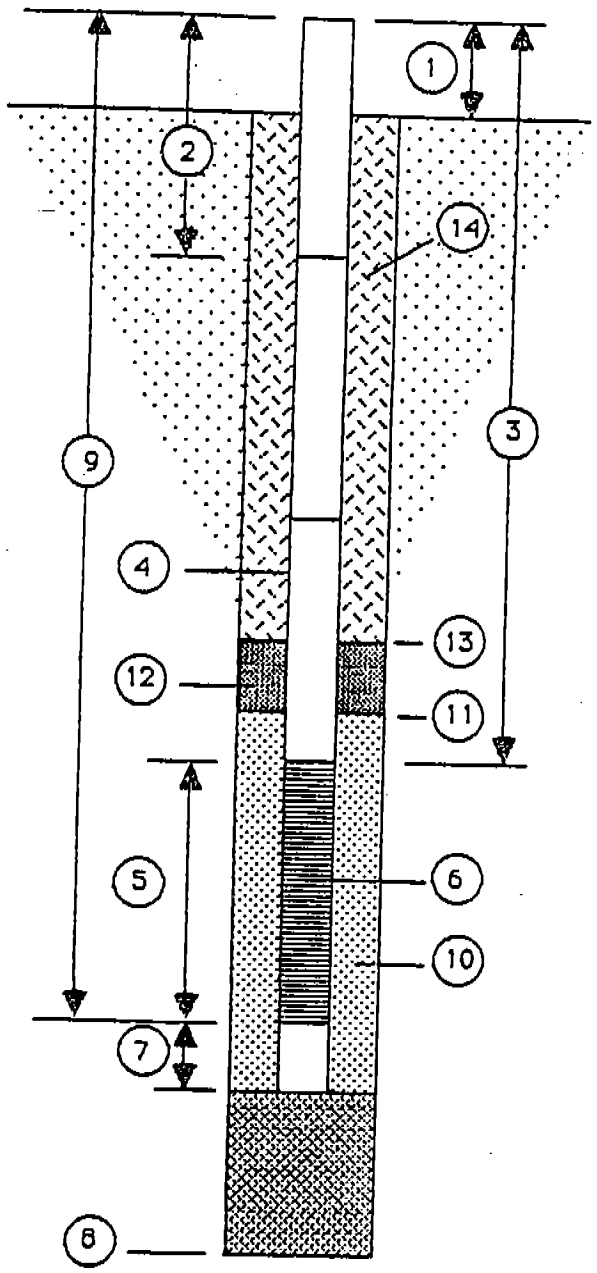
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-1-2

DATE OF INSTALLATION 10 Sept. 87



1. Height of Casing above ground 2.8'
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 14.7'
10. Type of Screen Filter Sand
    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 3'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

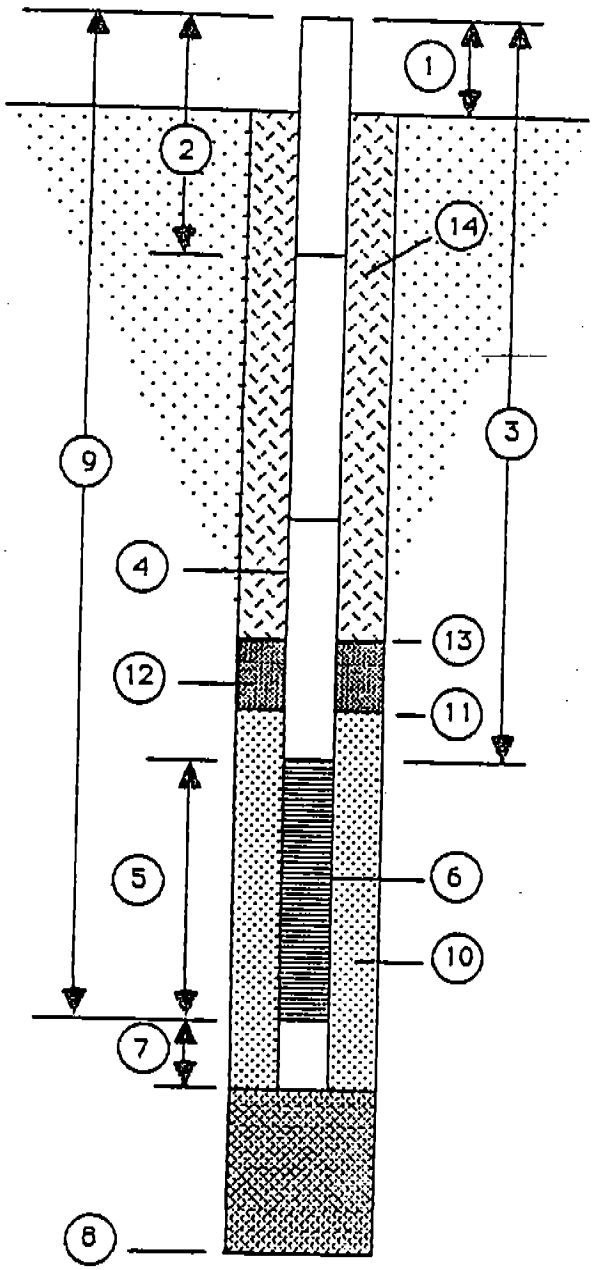
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-1-3

DATE OF INSTALLATION 10 Sept. 87



1. Height of Casing above ground 3.0'
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 14.5
10. Type of Screen Filter Sand
    Quantity Used 450 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 3'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

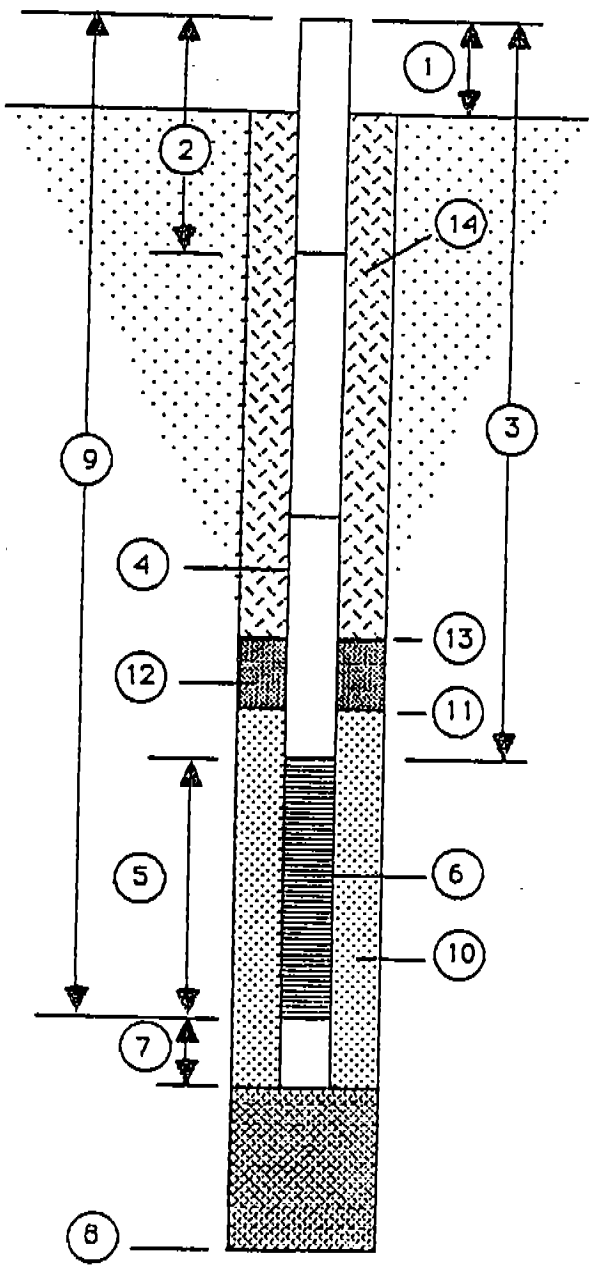
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-1

DATE OF INSTALLATION 22 Sept. 87



1. Height of Casing above ground 2.8'
2. Depth to first Coupling 7'

   Coupling Interval Depths _____
3. Total Length of Blank Pipe 7'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 5'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.2'
10. Type of Screen Filter Sand

    Quantity Used 200 lbs Size 6/20 U/C _____
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture _____

    Method of Placement Tremie Pipe

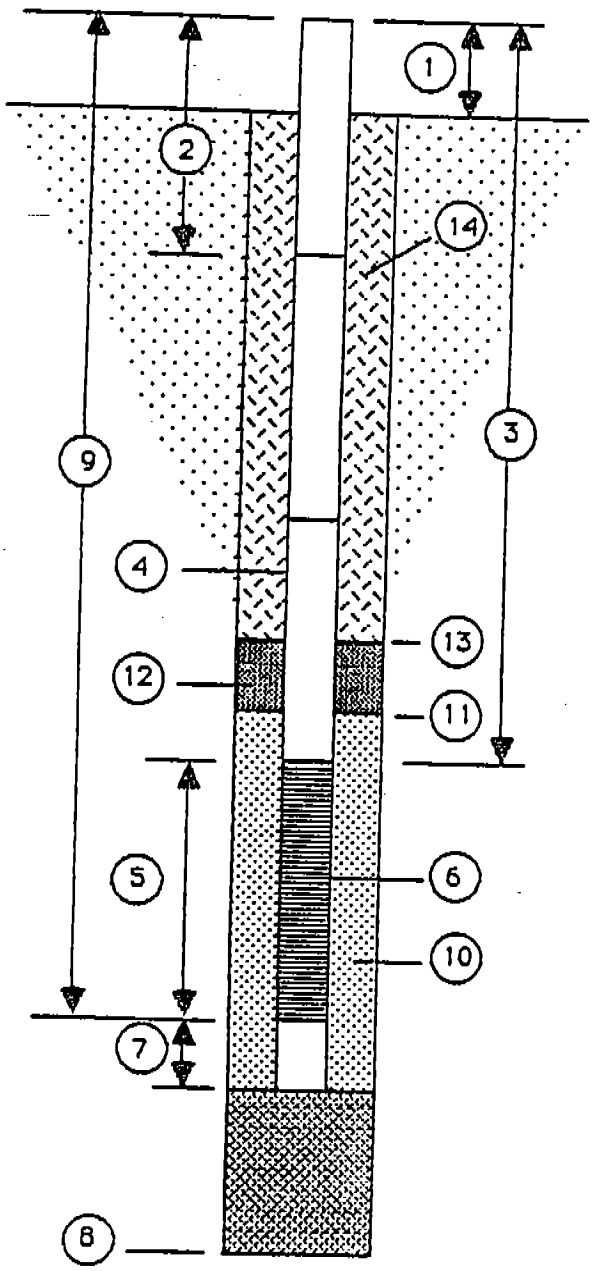
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-2

DATE OF INSTALLATION 22 Sept. 87



1. Height of Casing above ground 2'
2. Depth to first Coupling 7'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 5'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 10'
10. Type of Screen Filter Sand
    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

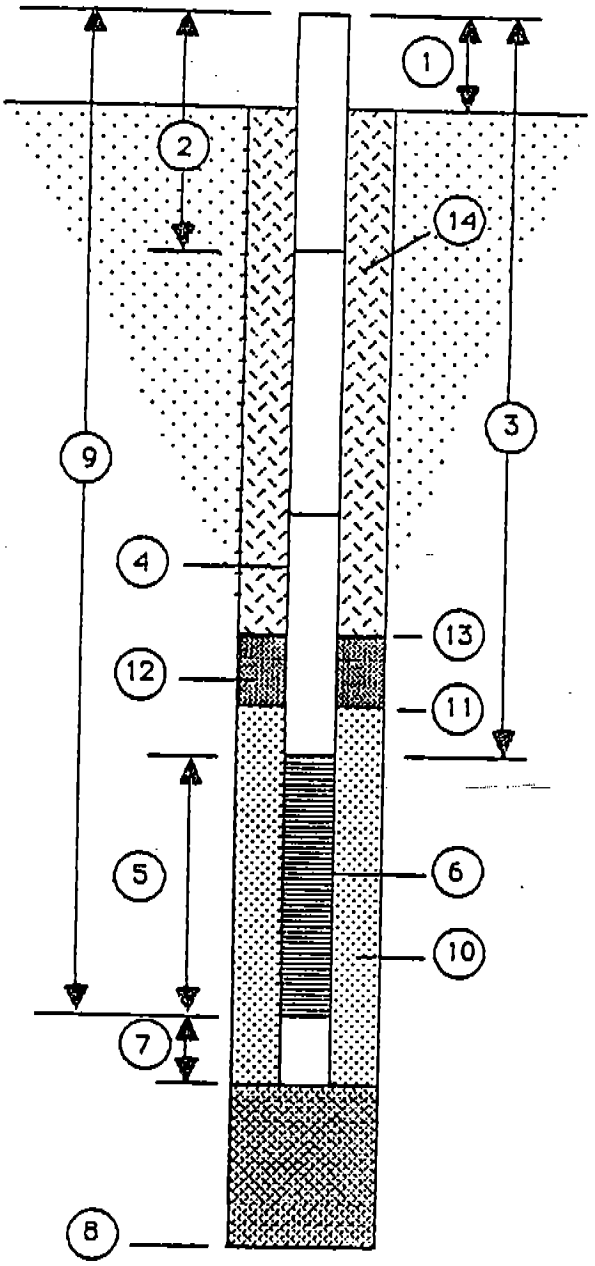
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-3

DATE OF INSTALLATION 14 Sept. 87



1. Height of Casing above ground 2.3'
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 15.2'
10. Type of Screen Filter Sand
    Quantity Used 500 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets
    Quantity Used 50 lbs
13. Depth To Top of Seal 3'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

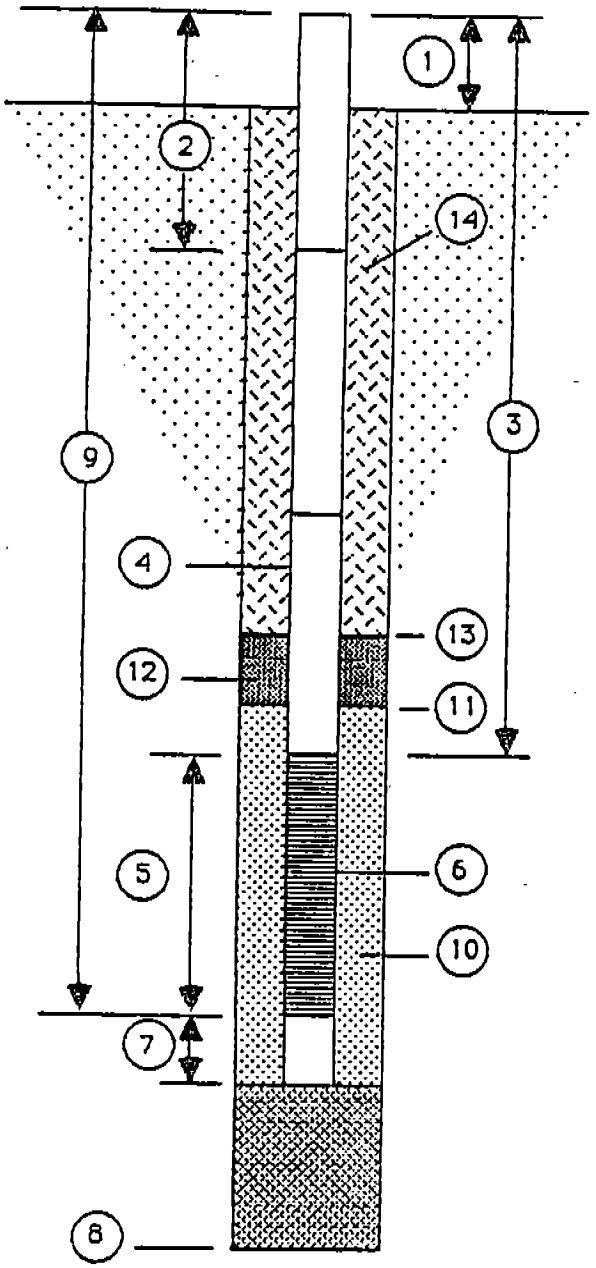
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-4

DATE OF INSTALLATION 11 Sept. 87



1. Height of Casing above ground 3'
2. Depth to first Coupling 6'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 13'
10. Type of Screen Filter Sand

    Quantity Used 300 lbs Size 6/20 U/C.
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 50 lbs
13. Depth To Top of Seal 1.5'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

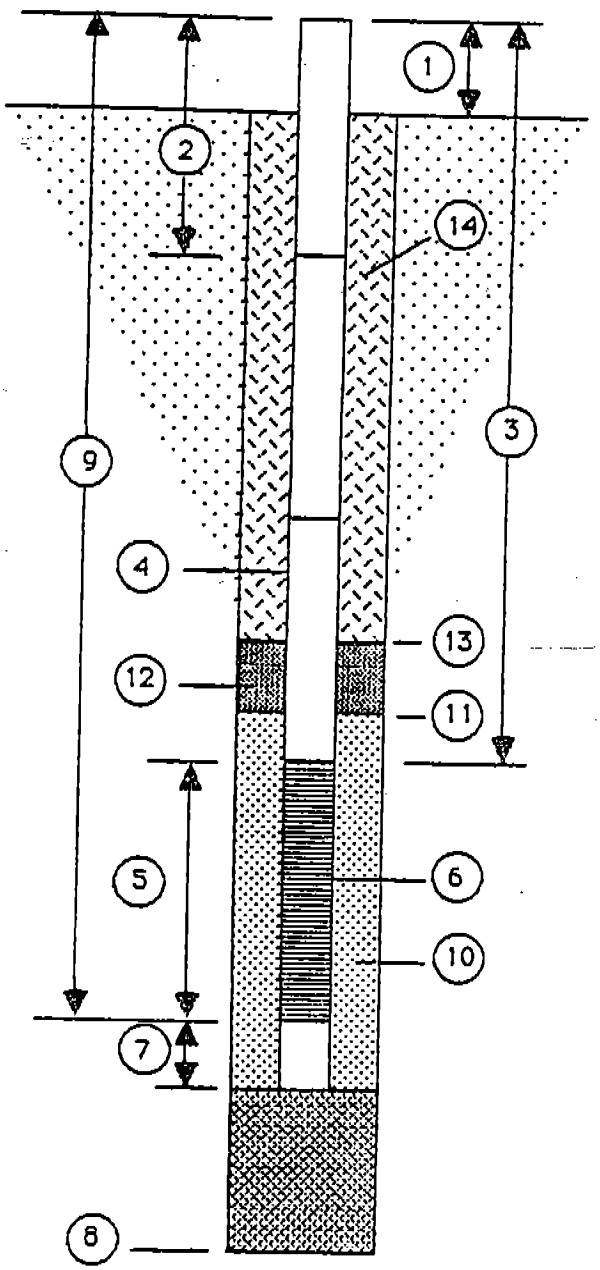
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-5

DATE OF INSTALLATION 23 Sept. 87



1. Height of Casing above ground 2.4'
2. Depth to first Coupling 5'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 11' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.6'
10. Type of Screen Filter Sand

    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

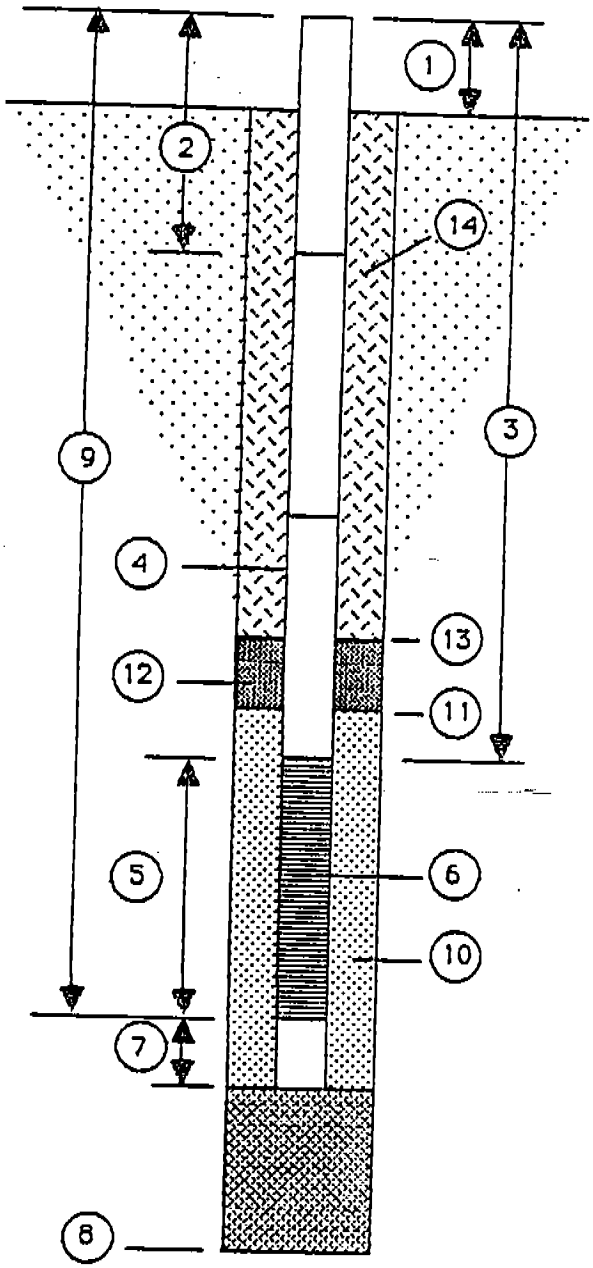
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-6

DATE OF INSTALLATION 22 Sept. 87



1. Height of Casing above ground 2.4'
2. Depth to first Coupling 5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.6'
10. Type of Screen Filter Sand
    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

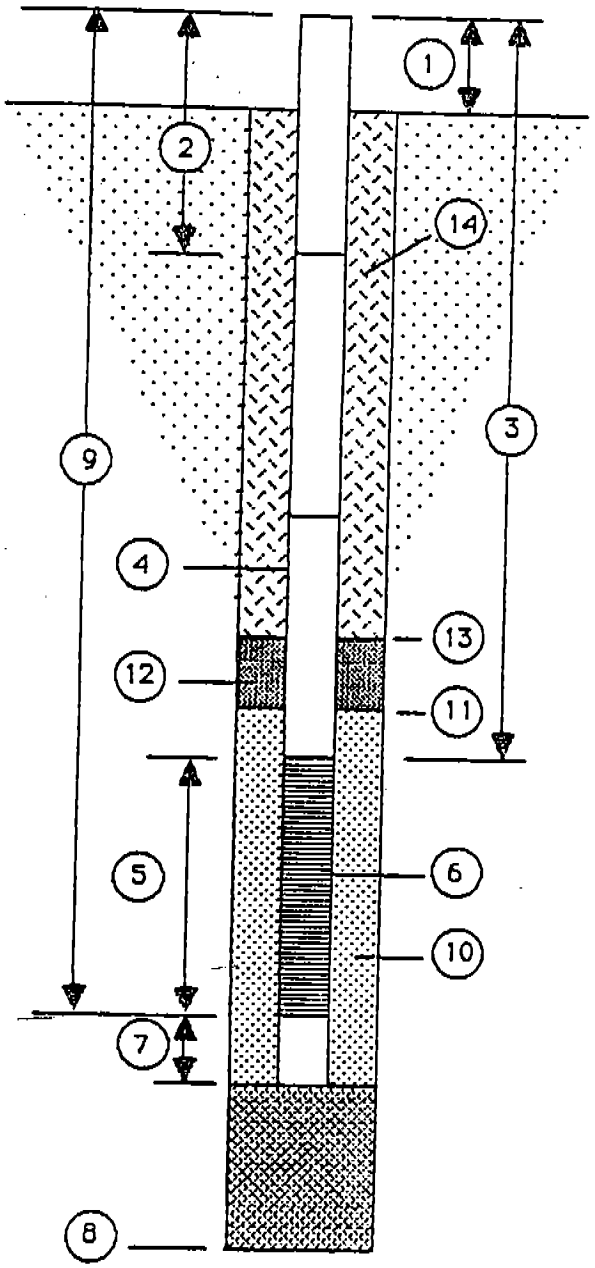
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-7S

DATE OF INSTALLATION 15 Sept. 87



1. Height of Casing above ground 2.8'
2. Depth to first Coupling 6.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen _____
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 10.7'
10. Type of Screen Filter Sand
    Quantity Used 200 lbs Size 6/20 U/C _____
11. Depth To Top of Filter 3.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2.5'
14. Type of Grout Portland Cement
    Grout Mixture _____
    Method of Placement Tremie Pipe

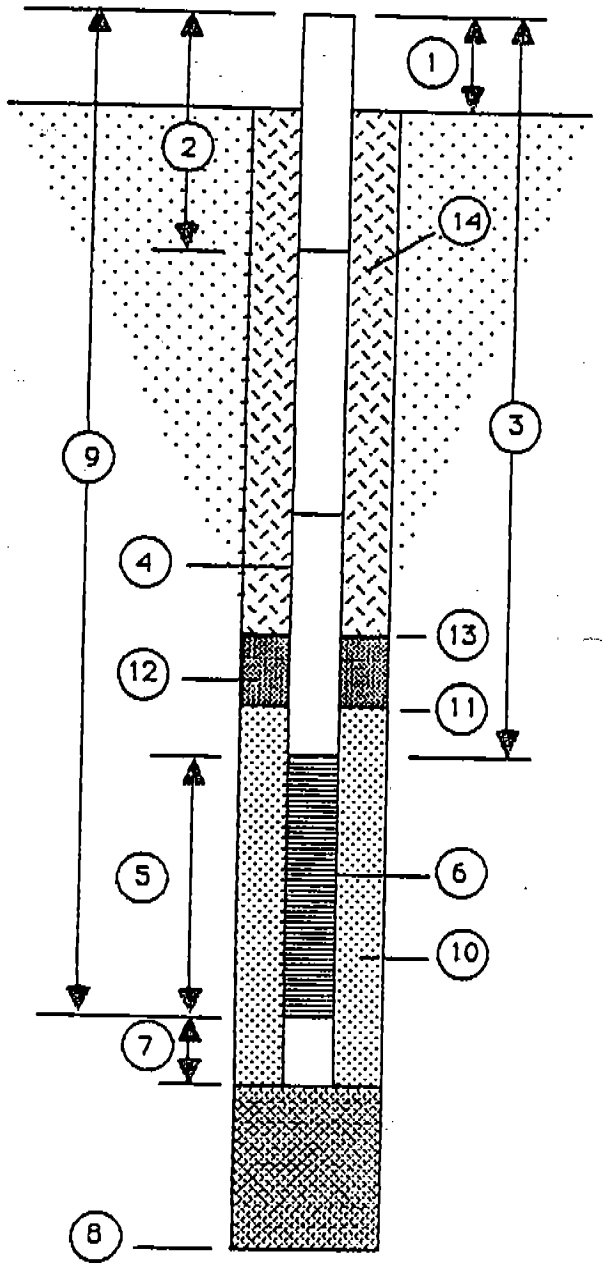
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-7D

DATE OF INSTALLATION 23 Sept. 87



1. Height of Casing above ground 2'
2. Depth to first Coupling 7.5'

   Coupling Interval Depths 10'
3. Total Length of Blank Pipe 17.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 27' Hole Diameter 0.7
9. Depth To Bottom of Screen 25.5'
10. Type of Screen Filter Sand

    Quantity Used 350 lbs Size 6/20 U/C
11. Depth To Top of Filter 13.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 32 lbs
13. Depth To Top of Seal 11'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

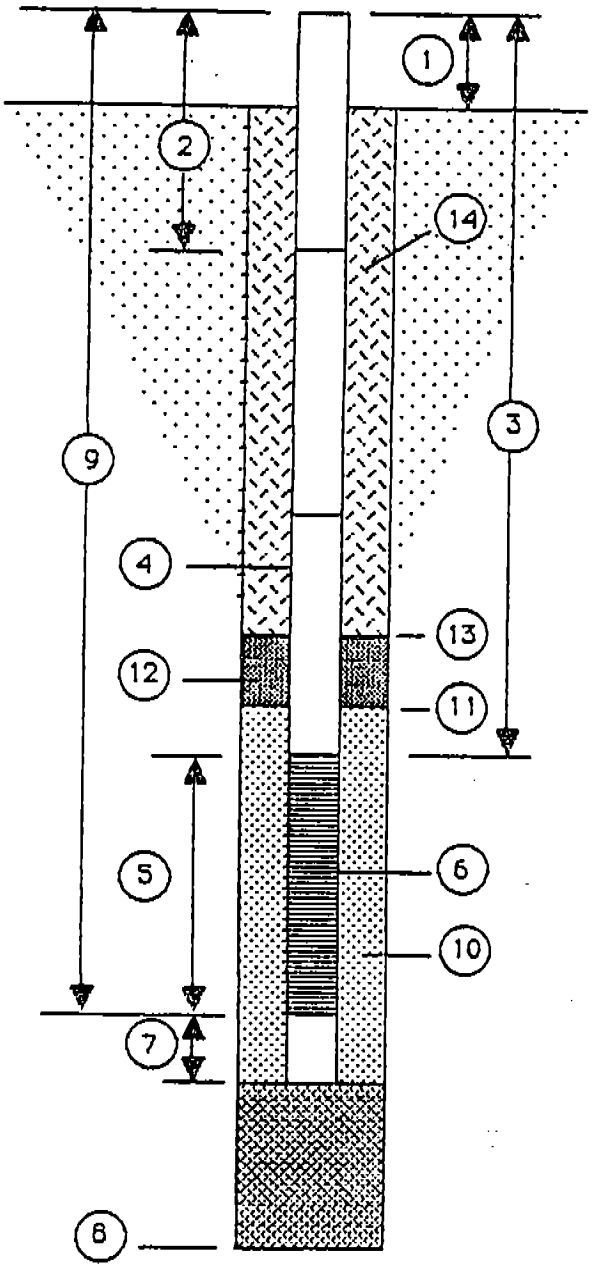
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-8

DATE OF INSTALLATION 23 Sept. 87



1. Height of Casing above ground 2.3'
2. Depth to first Coupling 5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.7'
10. Type of Screen Filter Sand
    Quantity Used 150 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

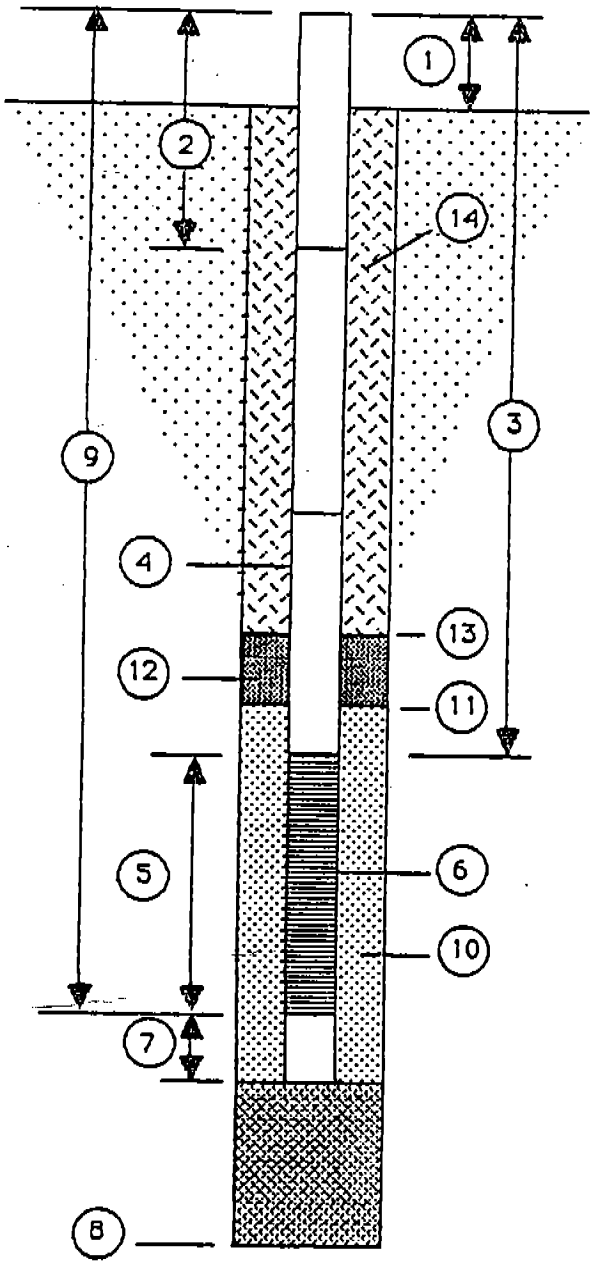
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-9S

DATE OF INSTALLATION 22 Sept. 87



1. Height of Casing above ground 3'
2. Depth to first Coupling 5'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 10' Hole Diameter 0.5
9. Depth To Bottom of Screen 9'
10. Type of Screen Filter Sand

    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

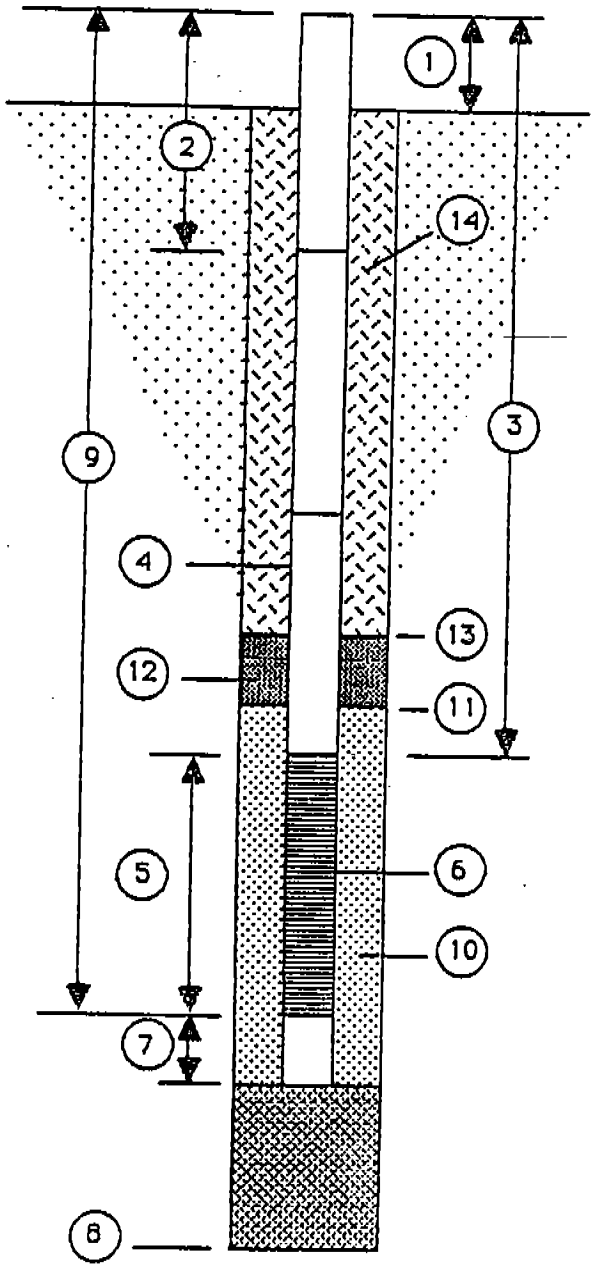
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-9D

DATE OF INSTALLATION 22 Sept. 87



1. Height of Casing above ground 3'
2. Depth to first Coupling 7.5'
   Coupling Interval Depths 10'
3. Total Length of Blank Pipe 17.5
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 27 Hole Diameter 0.7
9. Depth To Bottom of Screen 24.5
10. Type of Screen Filter Sand
    Quantity Used 300 lbs Size 6/20 U/C
11. Depth To Top of Filter 13'
12. Type of Seal Bentonite Pellets
    Quantity Used 50 lbs
13. Depth To Top of Seal 10'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

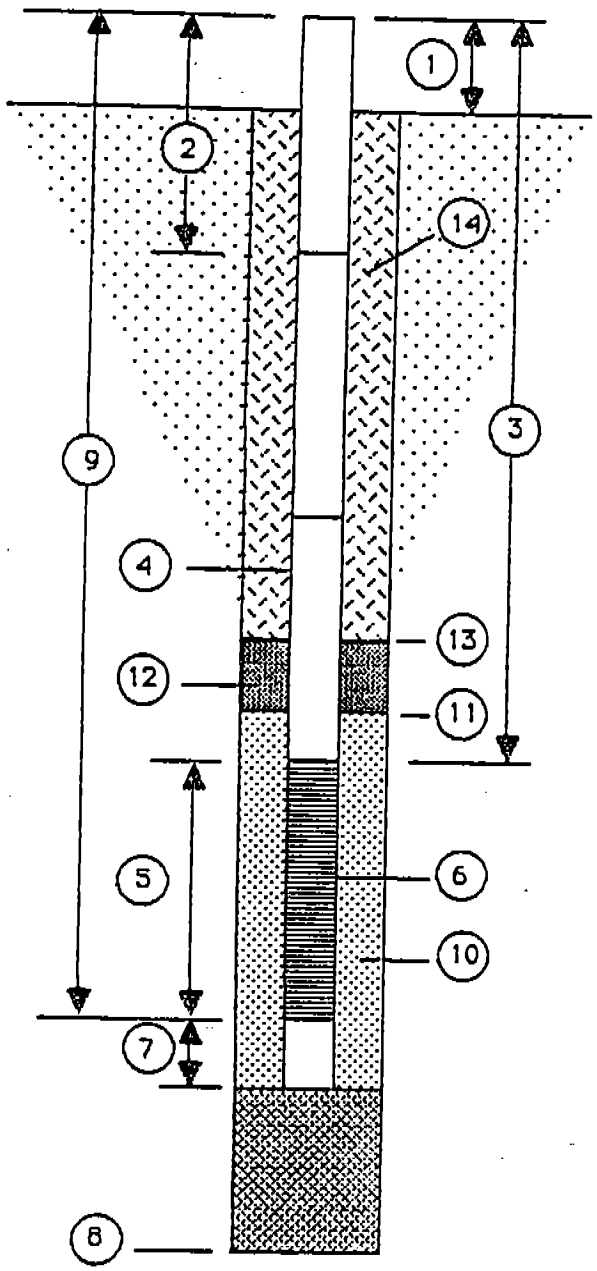
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-10

DATE OF INSTALLATION 10 Sept. 87



1. Height of Casing above ground 3.1
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 5'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.4
10. Type of Screen Filter Sand
    Quantity Used 600 lbs Size 6/20 U/C
11. Depth To Top of Filter 3'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

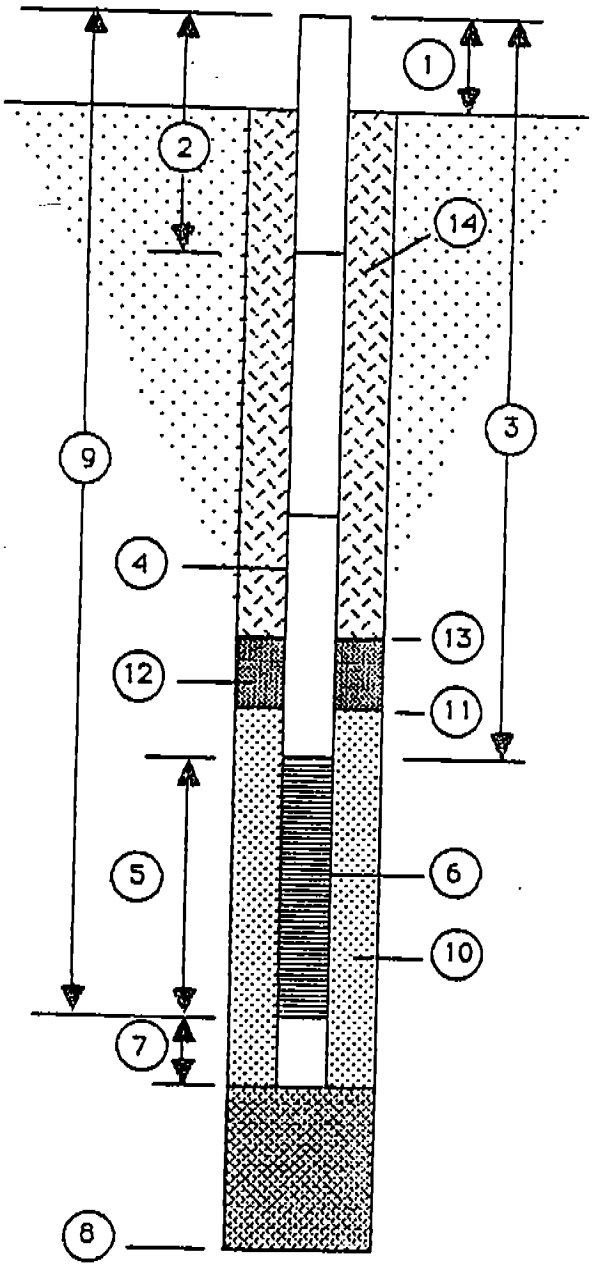
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-15S

DATE OF INSTALLATION 14 Sept. 87



1. Height of Casing above ground 3.2'
2. Depth to first Coupling 7'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 13.2
10. Type of Screen Filter Sand

    Quantity Used 550 lbs Size 6/20 U/C
11. Depth To Top of Filter 3'
12. Type of Seal Bentonite Pellets

    Quantity Used 50 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

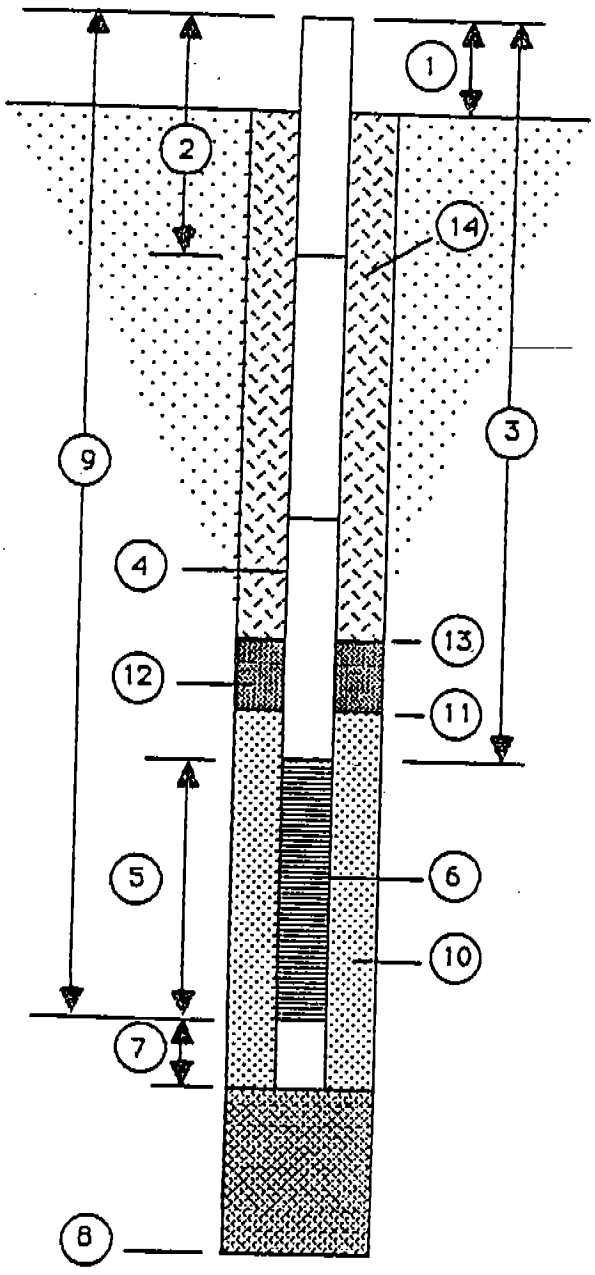
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-2-15D

DATE OF INSTALLATION 23 Sept. 87



1. Height of Casing above ground 2.2'
2. Depth to first Coupling 7.5'
   Coupling Interval Depths 10'
3. Total Length of Blank Pipe 17.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 27' Hole Diameter 0.7'
9. Depth To Bottom of Screen 25.3'
10. Type of Screen Filter Sand
    Quantity Used 300 lbs Size 6/20 U/C
11. Depth To Top of Filter 13'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 11'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

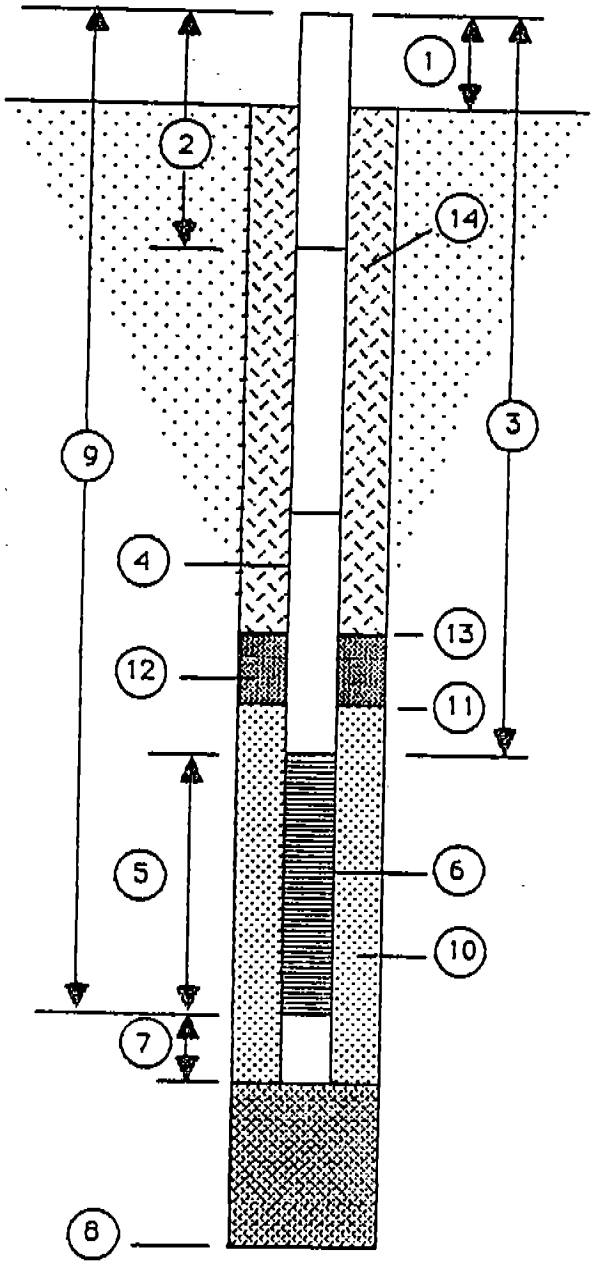
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-8-1

DATE OF INSTALLATION 17 Sept. 87



1. Height of Casing above ground 2.9
2. Depth to first Coupling 9'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 9'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 16.1
10. Type of Screen Filter Sand

    Quantity Used 350 lbs Size 6/20 U/C
11. Depth To Top of Filter 5.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 50 lbs
13. Depth To Top of Seal 3.5'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

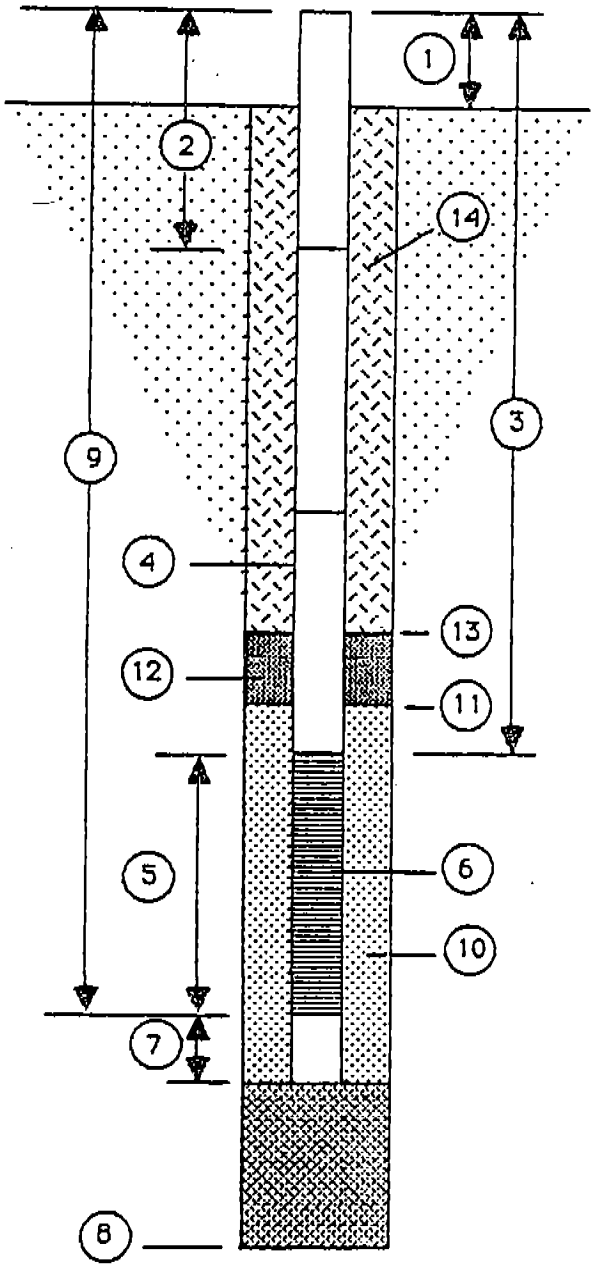
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-8-2

DATE OF INSTALLATION 17 Sept. 87



1. Height of Casing above ground 2.6'
2. Depth to first Coupling 10'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 10'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 18' Hole Diameter 0.7'
9. Depth To Bottom of Screen 17.4'
10. Type of Screen Filter Sand
    Quantity Used 350 lbs Size 6/20 U/C
11. Depth To Top of Filter 5'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 3'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

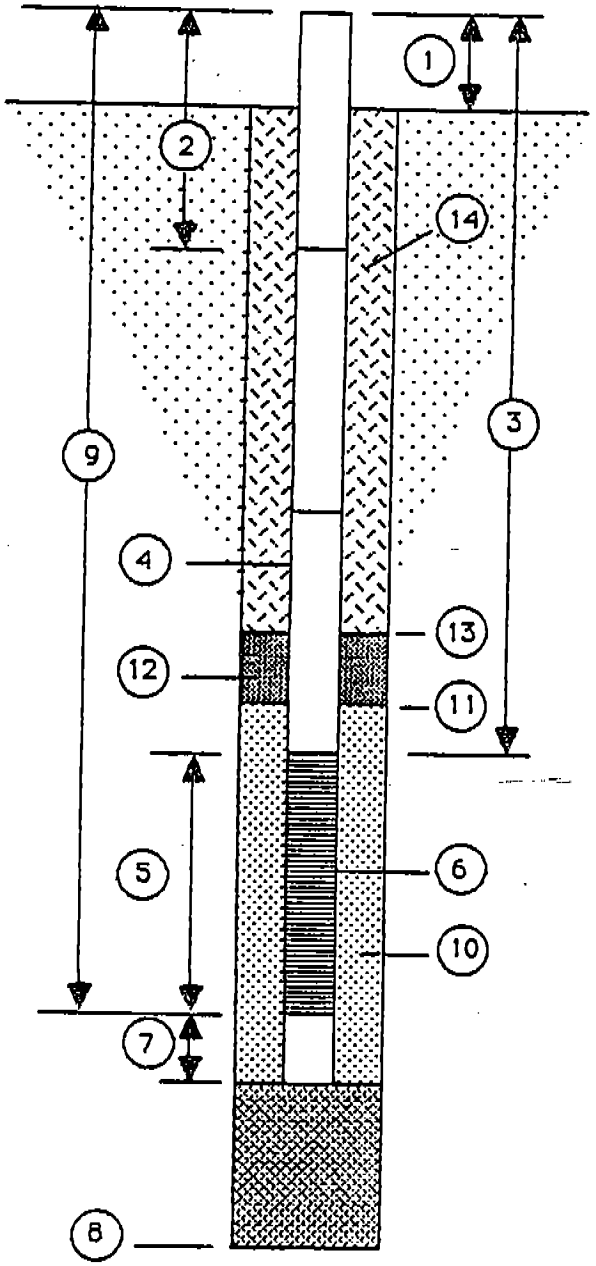
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-8-3

DATE OF INSTALLATION 16 Sept. 87



1. Height of Casing above ground 2.8
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 14.7
10. Type of Screen Filter Sand
    Quantity Used 300 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets
    Quantity Used 25 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

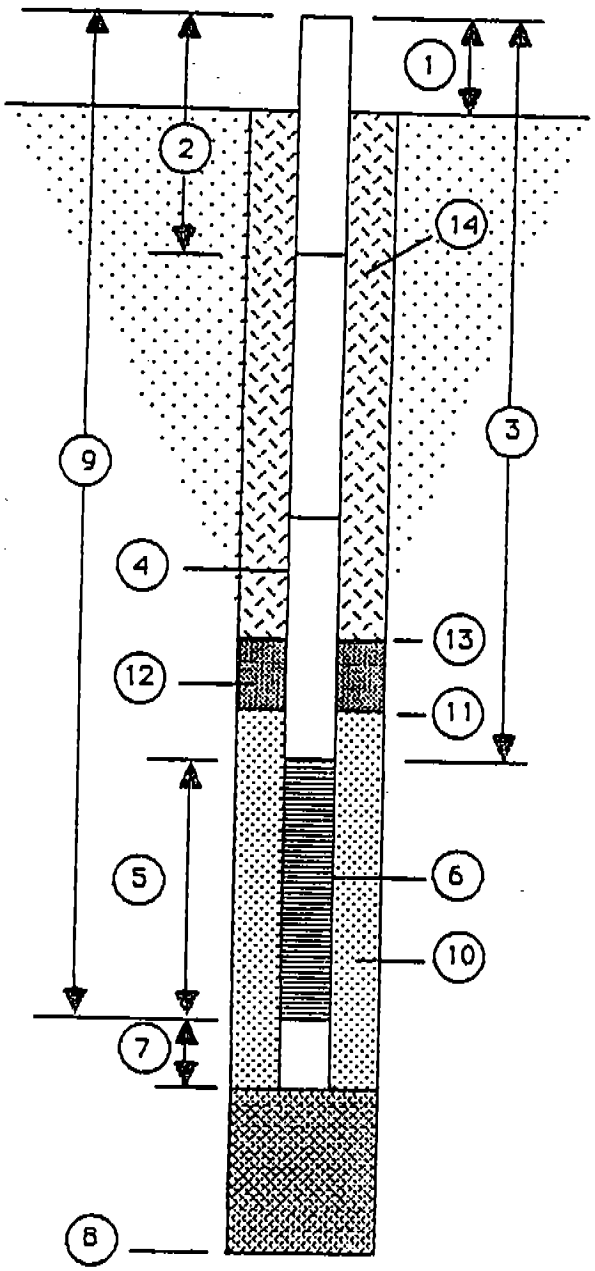
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10060
CHARLESTON, S. C. 29411-0060

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-9-1

DATE OF INSTALLATION 15 Sept. 87



1. Height of Casing above ground 2.9'
2. Depth to first Coupling 2'
   Coupling Interval Depths 10'
3. Total Length of Blank Pipe 12'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 20' Hole Diameter 0.7'
9. Depth To Bottom of Screen 19.1'
10. Type of Screen Filter Sand
    Quantity Used 350 lbs Size 6/20 U/C
11. Depth To Top of Filter 7'
12. Type of Seal Bentonite Pellets
    Quantity Used 50 lbs
13. Depth To Top of Seal 5'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

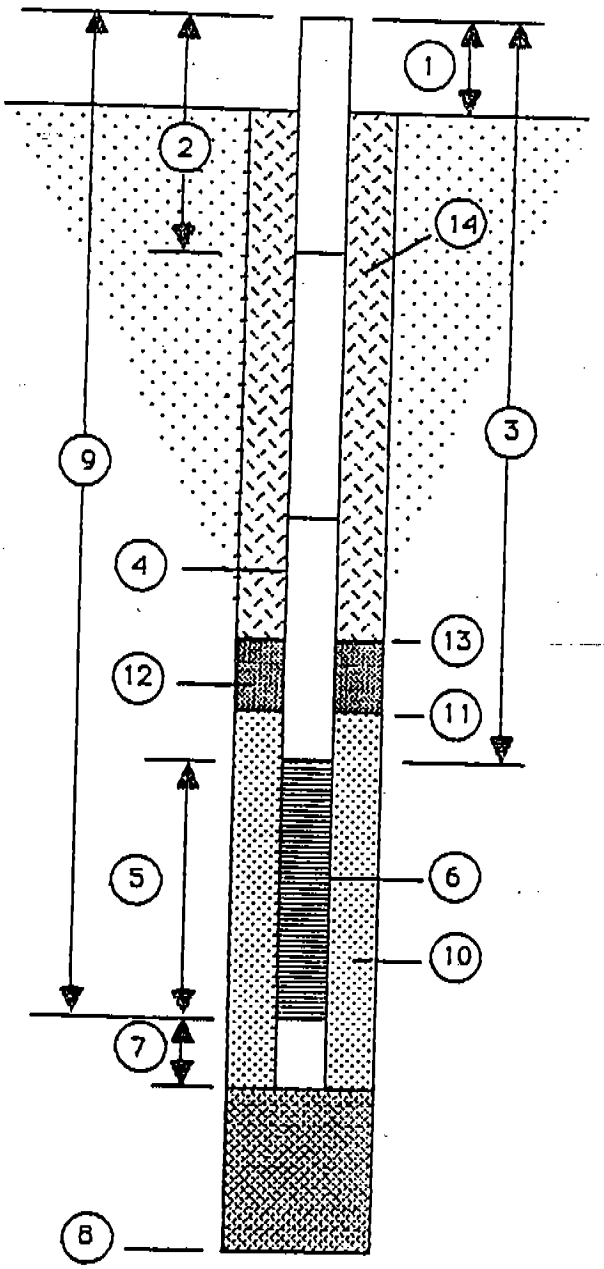
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-9-2

DATE OF INSTALLATION 16 Sept. 87



1. Height of Casing above ground 3.1
2. Depth to first Coupling 7.5'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 14.1'
10. Type of Screen Filter Sand
    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

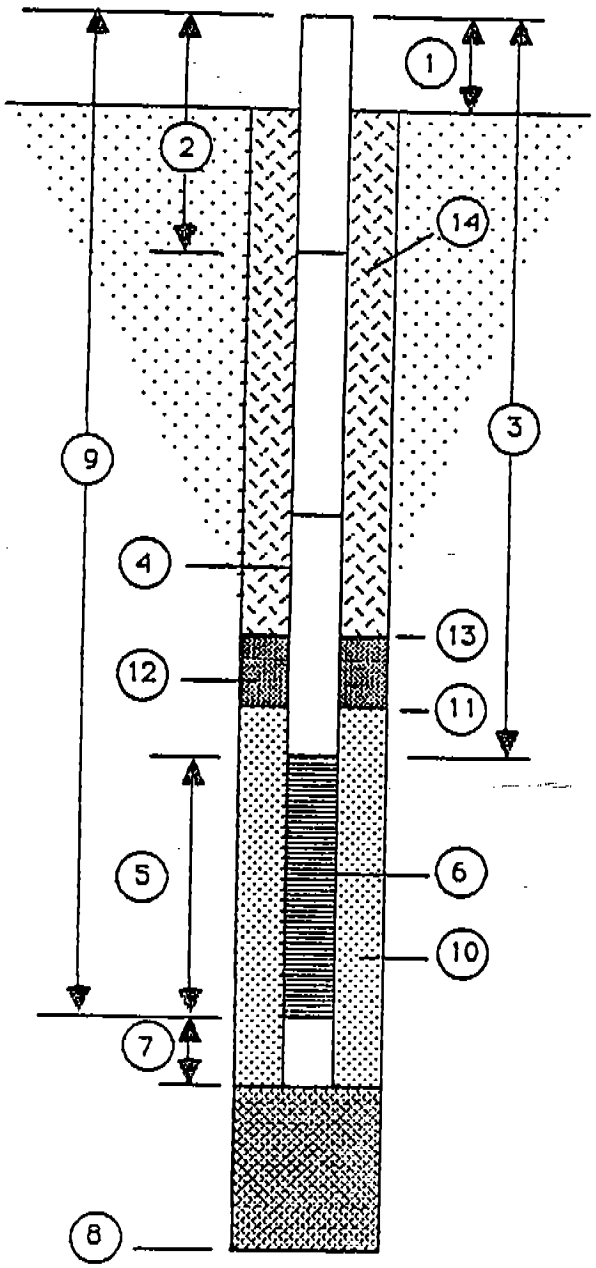
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-9-3

DATE OF INSTALLATION 16 Sept. 87



1. Height of Casing above ground 2.5'
2. Depth to first Coupling 7.5'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 7.5'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 17' Hole Diameter 0.7'
9. Depth To Bottom of Screen 15'
10. Type of Screen Filter Sand

    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 4'
12. Type of Seal Bentonite Pellets

    Quantity Used 50 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

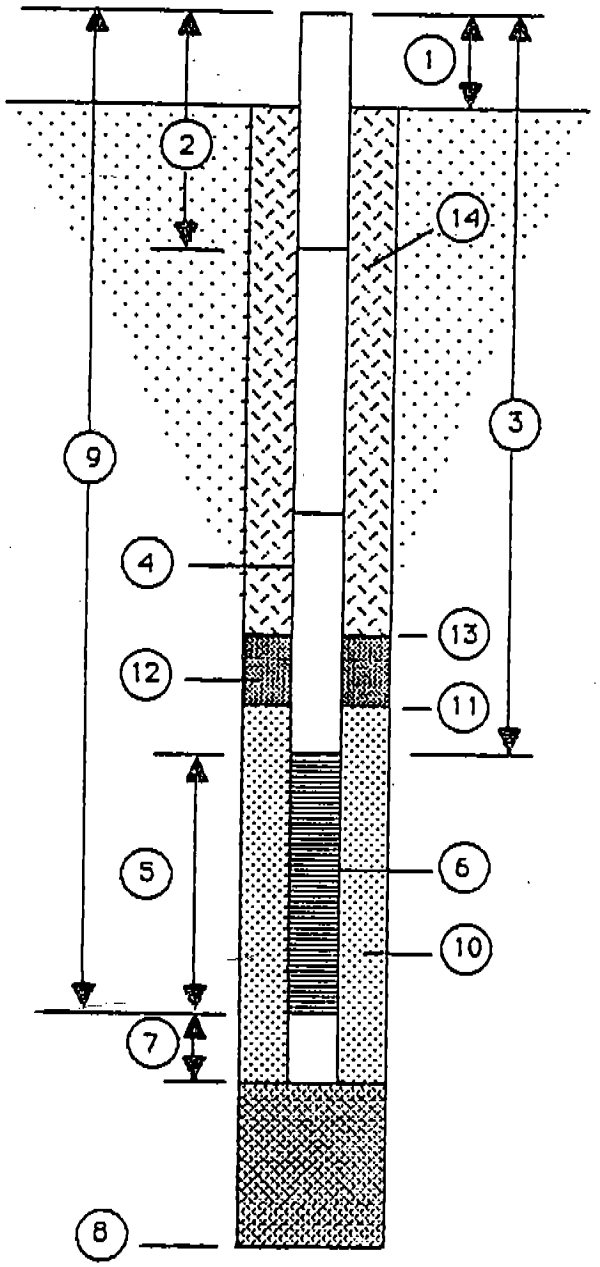
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10060
CHARLESTON, S. C. 29411-0060

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-13-1

DATE OF INSTALLATION 18 Sept. 87



1. Height of Casing above ground 2.8'
2. Depth to first Coupling 6'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 10.2'
10. Type of Screen Filter Sand
    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 3'
12. Type of Seal Bentonite Pellets
    Quantity Used 37 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

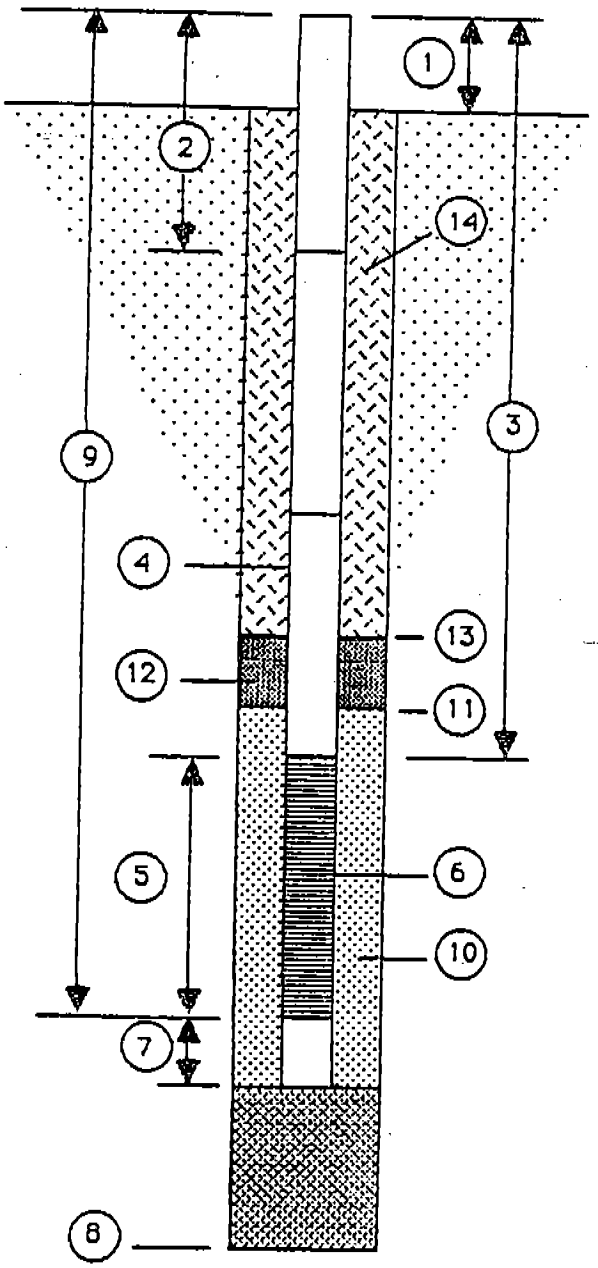
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-13-2

DATE OF INSTALLATION 15 Sept. 87



1. Height of Casing above ground 3.5'
2. Depth to first Coupling 6'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 9.5'
10. Type of Screen Filter Sand
    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 50 lbs
13. Depth To Top of Seal 1.5'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

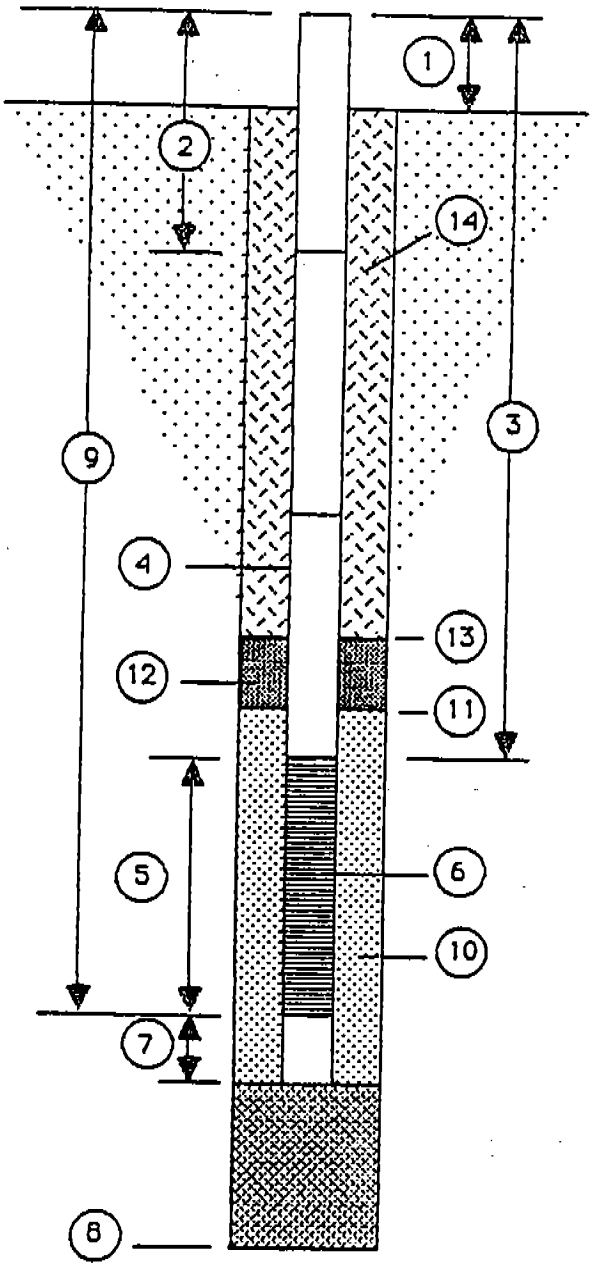
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-13-3

DATE OF INSTALLATION 18 Sept. 87



1. Height of Casing above ground 3.0
2. Depth to first Coupling 6'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 7'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 12' Hole Diameter 0.7'
9. Depth To Bottom of Screen 10'
10. Type of Screen Filter Sand
    Quantity Used 250 lbs Size 6/20 U/C
11. Depth To Top of Filter 3'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

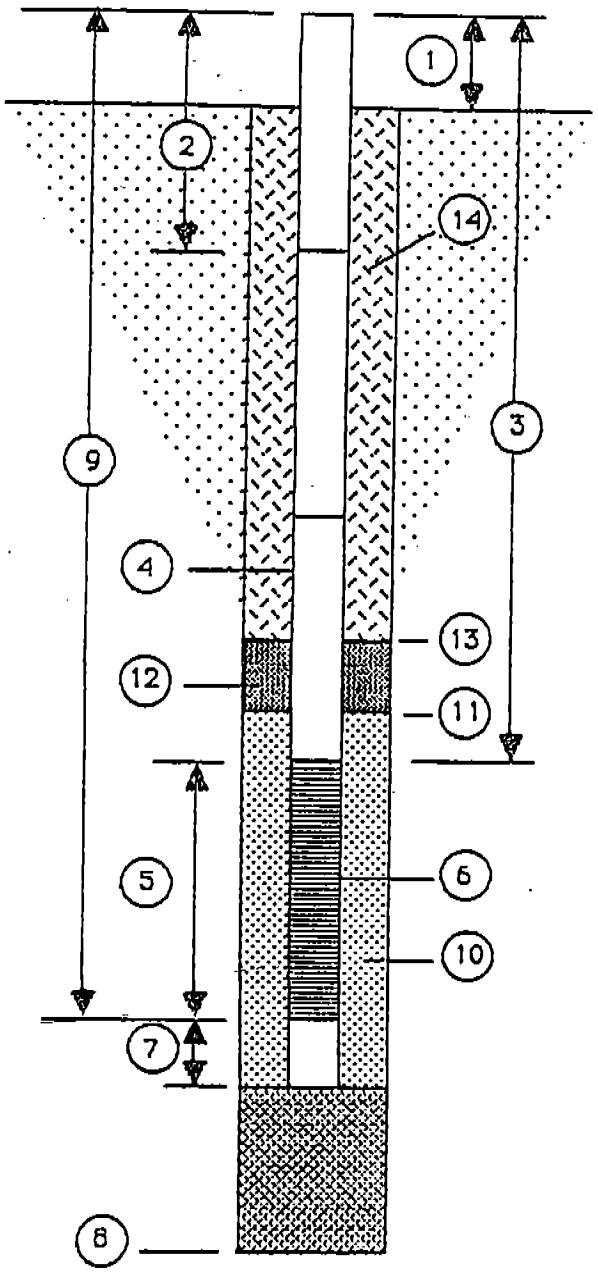
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-14-1

DATE OF INSTALLATION 17 Sept. 87



1. Height of Casing above ground 3'
2. Depth to first Coupling 6'
   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 13' Hole Diameter 0.7'
9. Depth To Bottom of Screen 13'
10. Type of Screen Filter Sand
    Quantity Used 200 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets
    Quantity Used 16 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement
    Grout Mixture
    Method of Placement Tremie Pipe

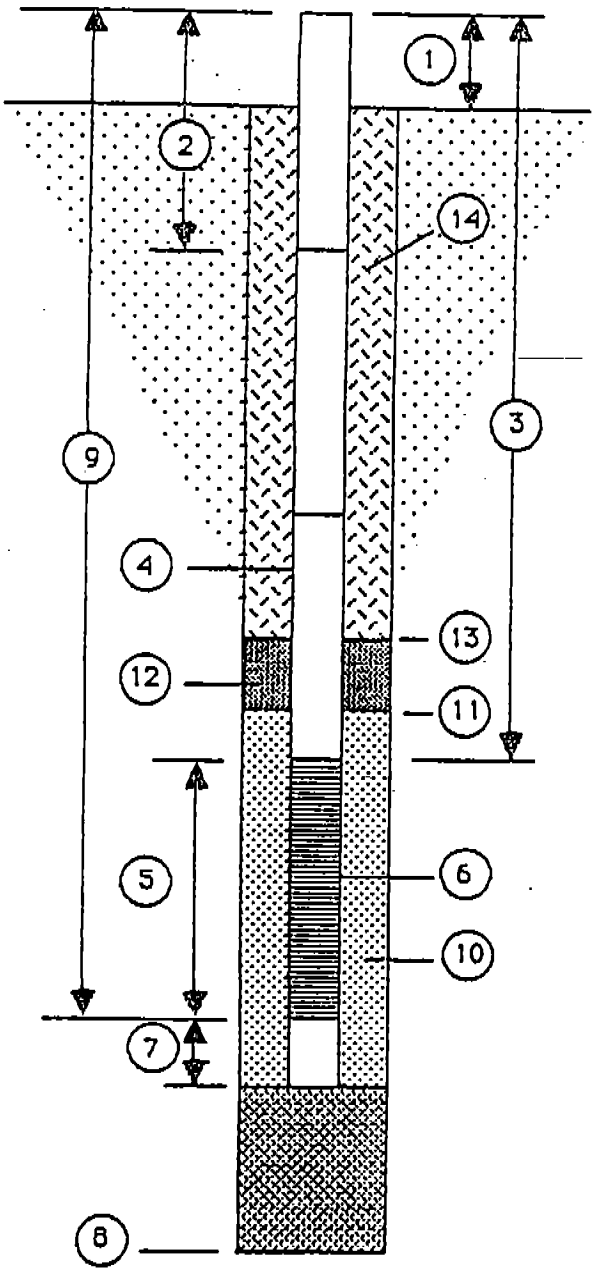
COMMENTS ON INSTALLATION:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR., P. O. BOX 10068
CHARLESTON, S. C. 29411-0068

WELL CONSTRUCTION DETAILS

WELL NUMBER MPT-14-2

DATE OF INSTALLATION 17 Sept. 87



1. Height of Casing above ground 3'
2. Depth to first Coupling 6'

   Coupling Interval Depths N/A
3. Total Length of Blank Pipe 6'
4. Type of Blank Pipe Schedule 40 PVC, 2" ID
5. Length of Screen 10'
6. Type of Screen Schedule 40 PVC, #10 Slot
7. Length of Sump 0.5'
8. Total Depth of Boring 14 Hole Diameter 0.7'
9. Depth To Bottom of Screen 13'
10. Type of Screen Filter Sand

    Quantity Used 300 lbs Size 6/20 U/C
11. Depth To Top of Filter 2.5'
12. Type of Seal Bentonite Pellets

    Quantity Used 50 lbs
13. Depth To Top of Seal 2'
14. Type of Grout Portland Cement

    Grout Mixture

    Method of Placement Tremie Pipe

COMMENTS ON INSTALLATION:

APPENDIX A—7

APPENDIX A-7

Groundwater Level Observations

APPENDIX A-7
GROUNDWATER LEVEL OBSERVATIONS
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FL

LOCATION	ELEVATION GROUND (Mean Sea Level)	ELEVATION TOP OF SCREEN (Mean Sea Level)	Water Elevation (Feet above Mean Sea Level) 9/14	9/18	9/24	10/8	1987
Site 1							
MPT-1-1	14.30	9.60	5.99	5.79	5.62	5.19	
MPT-1-2	14.07	9.37	5.07	4.85	4.78	4.54	
MPT-1-3	11.90	7.40	4.41	4.27	4.09	3.79	
Sites 2, 4, 5, & 6							
MPT-2-1	8.43	4.23				4.80	
MPT-2-2	5.56	0.56				3.19	
MPT-2-3	15.02	9.82	9.86	10.33	11.34	14.88	
MPT-2-4	8.25	5.25	4.81	3.53	3.67	3.11	
MPT-2-5	7.40	4.80				5.85	
MPT-2-6	7.39	4.79				5.42	
MPT-2-7S	7.78	4.08		4.08	3.85	3.45	
MPT-2-7D	7.99	-7.51				3.57	
MPT-2-8	8.16	5.46				5.84	
MPT-2-9S	7.55	5.55				5.46	
MPT-2-9D	7.60	-6.90				2.91	
MPT-2-10	6.93	2.53	5.70	5.86	5.62	5.53	
MPT-2-15S	7.38	3.58	3.79	2.81	3.28	3.08	
MPT-2-15D	7.05	-8.25				2.74	
S-4	7.50			3.70	3.61	3.67	
S-5	6.46		3.17	3.17	3.12	3.08	
Site 8							
MPT-8-1	12.84	6.74		4.91		5.40	
MPT-8-2	11.34	3.94		1.79		1.86	
MPT-8-3	10.85	6.15		0.39 *		0.21 *	
Site 9							
MPT-9-1	11.45	2.35		1.69		1.73	
MPT-9-2	10.28	5.88		1.05		1.76	
MPT-9-3	8.98	3.98		0.94		1.76	
Site 13							
MPT-13-1	10.28	7.08		5.61	5.43	5.20	
MPT-13-2	9.31	6.81		6.65	6.35	6.00	
MPT-13-3	7.48	4.48		5.33	5.45	6.19 ?	
Site 14							
MPT-14-1	4.41	1.41		1.51	1.97	1.84	
MPT-14-2	5.42	2.42		1.78	2.10	1.88	

NOTES:

1. Elevation survey completed by L. D. Bradley Surveyors during 16 September through 8 October 1987.
2. "*" indicates well contains free product and water level measurements may may not be accurate.
3. "?" indicates that this measurements conflicts with previous measurements and may not be accurate.

APPENDIX A—8

APPENDIX A-8

PERMEABILITY TEST RESULTS

APPENDIX A-8
PERMEABILITY TEST RESULTS
EXPANDED SITE INVESTIGATION
NAVAL STATION MAYPORT, FLORIDA

	TEST LOCATION SAMPLE NO.	SOIL DESCRIPTION	ELEVATION OF INTERVAL TESTED	DEPTH OF INTERVAL TESTED	TEST METHOD REMARKS	HYDRAULIC CONDUCTIVITY cm/sec	ft/day
SITE 1	MPT-1-1	SAND/FILL	-0.7 - 5.6	15 - 8.7	RISING HEAD/IN SITU	0.002	5.7
	MPT-1-2	SAND/FILL	-0.9 - 4.6	15 - 9.5	RISING HEAD/IN SITU	0.002	5.7
	MPT-1-3	SAND/FILL	-4.1 - 4.0	16 - 7.9	RISING HEAD/IN SITU	0.0009	2.6
SITES 2,4,5 AND 6	MPT-2-1	SAND/FILL	-2.0 - 2.0	10 - 6	RISING HEAD/IN SITU	0.002	5.7
	MPT-2-2	SAND/FILL	-4.4 - 3.1	10 - 2.5	RISING HEAD/IN SITU	0.0002	0.6
	MPT-2-3	SAND/FILL	0.0 - 11	15 - 4	RISING HEAD/IN SITU	0.002	5.7
	MPT-2-4	SAND/FILL	-5.2 - 3.1	13.5 - 5.2	RISING HEAD/IN SITU	0.00003	0.09
	MPT-2-5	SAND/FILL	-2.6 - 4.9	10 - 2.5	RISING HEAD/IN SITU	0.002	5.7
	MPT-2-6	SAND/FILL	-2.5 - 5.0	10 - 2.5	RISING HEAD/IN SITU	0.001	2.8
	MPT-2-7D	SAND/FILL	-17 - -5.5	25 - 13.5	RISING HEAD/IN SITU	0.0003	0.9
	MPT-2-10	SAND/FILL	-6.1 - 3.9	13 - 3	RISING HEAD/IN SITU	0.00001	0.03
	S-4	SAND/FILL	-7.5 - -2.5	15 - 10	RISING HEAD/IN SITU	0.0003	0.85
	S-5	SAND/FILL	-8.5 - -3.5	15 -10	RISING HEAD/IN SITU	0.002	5.7
SITE 13	MPT-13-1	SAND/FILL	0.3 - 5.3	10 - 3	RISING HEAD/IN SITU	0.001	2.8
	MPT-13-2	SAND/FILL	-0.7 - 6.5	10 - 2.5	RISING HEAD/IN SITU	0.001	2.8
	MPT-13-3	SAND/FILL	-2.5 - 4.5	10 - 3	RISING HEAD/IN SITU	0.0006	1.7
SITE 14	MPT-14-1	SAND/FILL	-8.6 - 1.7	13 - 2.5	RISING HEAD/IN SITU	0.003	8.5

CALCULATION

Hydraulic conductivities were calculated using E.C. Jordan's in-house computer program entitled PERMTEST. The algorithm for calculating the hydraulic conductivity is as follows:

$$K = \frac{(D^2)*\text{Log}(2L/B)*\text{Log}(H1/H2)}{8L\ (T2-T1)}$$

where,

K = Hydraulic conductivity (cm/sec);
D = Diameter of well riser (cm);
L = Length of the test zone (cm);
B = Diameter of borehole (cm);
T1 = First time value (sec);
T2 = Second time value (sec);
H1 = Excess head corresponding to time T1 (cm);
H2 = Excess head corresponding to time T2 (cm).

REFERENCE

Lambe and Whitman, 1969, Soil Mechanics. John Wiley & Sons, New York. pp 284-285

DATA

MPT-1-1

Diameter of riser = .1666
Length of zone = 6.3
Diameter of zone = .7
Static water level = 11.43
Number of readings = 7

Time	Excess Head
.01	.4699993
.25	.1999998
.5	.1300001
.75	7.999992E-02
.1	5.999947E-02
1.5	3.999996E-02
2	2.999973E-02

K = 1.681243E-03 cm/sec

DATA (Cont'd)

MPT-1-2

Diameter of riser = .1666
Length of zone = 4.73
Diameter of zone = .7
Static water level = 12.31
Number of readings = 8

Time	Excess Head
.01	.7399998
.1833	.54
.3333	.3499994
.45	.2599993
.6666	.1899996
.8333	.1699991
1	.1599998
1.1833	.1299992

K = .0017333 cm/sec

MPT-1-3

Diameter of riser = .1666
Length of zone = 8.08
Diameter of zone = .7
Static water level = 10.95
Number of readings = 10

Time	Excess Head
.01	.3299999
.16666	.3900003
.3333	.2799997
.6	.1999998
1.05	.1300001
1.2	7.999992E-02
1.45	6.000042E-02
1.75	5.000019E-02
2	5.000019E-02
2.5	3.999996E-02

K = 8.51628E-04 cm/sec

DATA (Cont'd)

MPT-2-1

Diameter of riser = .16666
Length of zone = 5
Diameter of zone = .7
Static water level = 5.95
Number of readings = 11

Time	Excess Head
.01	1.15
.15	.77
.2833	.46
.4833	.3400002
.5833	.3100004
.75	.3000002
.9166	.2400002
1.066	.2000002
1.3166	.1600003
1.5	.1300001
1.7666	.1000004

K = 1.70337E-03 cm/sec

MPT-2-2

Diameter of riser = .1666
Length of zone = 7.5
Diameter of zone = .7
Static water level = 4.36
Number of readings = 10

Time	Excess Head
.01	5.35
.25	4.19
.4333	4.07
.5833	4.02
.7333	3.9
1.0833	3.8
1.25	3.73
1.5	3.66
1.9166	3.53
2.1666	3.45

K = 1.834983E-04 cm/sec

DATA (Cont'd)

MPT-2-3

Diameter of riser = .16666
Length of zone = 11
Diameter of zone = .7
Static water level = 6.09
Number of readings = 7

Time	Excess Head
.01	1.34
.25	.4899998
.5	.1999998
.75	.1299996
1	9.999752E-03
1.5	3.000021E-02
2	5.999994E-02

K = 2.145925E-03 cm/sec

MPT-2-4

Diameter of riser = .1666
Length of zone = 8.29
Diameter of zone = .7
Static water level = 8.270001
Number of readings = 12

Time	Excess
.01	7.669999
.1666	7.61
.3333	7.549999
.46666	7.49
.7	7.429999
.8333	7.419999
1	7.349999
1.25	7.31
1.5	7.24
1.75	7.19
2.1833	7.02
2.5	6.94

K = 2.608598E-05 cm/sec

DATA (Cont'd)

MPT-2-5

Diameter of riser = .1666
Length of zone = 7.5
Diameter of zone = .7
Static water level = 3.94
Number of readings = 5

Time	Excess Head
.01	1.14
.25	.48
.5833	.2799997
.7833	.1599998
.9666	.1100001

K = 1.763752E-03 cm/sec

MPT-2-6

Diameter of riser = .1666
Length of zone = 7.5
Diameter of zone = .7
Static water level= 4.46
Number of readings = 7

Time	Excess Head
.01	3.25
.25	2.25
.4333	1.81
.75	.8699999
1.0833	.54
1.2833	.4099999
1.5	.3400002

K = 1.103483E-03 cm/sec

DATA (Cont'd)

MPT-2-10

Diameter of riser = .1666
Length of zone = 10
Diameter of zone = .7
Static water level = 4.06
Number of readings = 10

Time	Excess Head
.01	7.65
.25	7.57
.4166	7.52
.6	7.500001
.75	7.48
1.0166	7.460001
1.25	7.43
1.5	7.39
1.75	7.37
2.05	7.33

K = 1.23761E-05 cm/sec

S-4

Diameter of riser = .1666
Length of zone = 5
Diameter of zone = .7
Static water level = 5.94
Number of readings = 15

Time	Excess Head
.01	3.64
.15	3.43
.25	3.22
.3333	3.06
.9	2.57
1.1333	2.36
1.333	2.16
1.5166	2.03
1.7	1.93
1.8666	1.71
2.25	1.56
3	1.46
3.25	1.37
3.5	1.27

K = 2.77509E-04 cm/sec

DATA (Cont'd)

S-5

Diameter of riser = .1666
Length of zone = 5
Diameter of zone = .7
Static water level = 5.06
Number of readings = 14

Time	Excess Head
.01	5.04
.1333	3.26
.21666	2.72
.2833	2.14
.4	1.72
.5666	1.26
.6833	1.11
.8333	.8000002
1.1	.5
1.2333	.3800001
1.416666	.2800002
1.5833	.2000003
1.833	.1199999
2	.1100001

K = 2.095579E-03 cm/sec

DATA (Cont'd)

MPT-13-1

Diameter of riser = .1666
Length of zone = 5.31
Diameter of zone = .7
Static water level = 7.75
Number of readings = 10

Time	Excess Head
.01	2.55
.5	1.42
.7666	1.04
1.1666	.6700001
1.466	.54
1.75	.4799995
2	.4399996
2.5	.3199997
3.1	.2600002
3.5	.23

K = 1.04307E-03 cm/sec

MPT-13-2

Diameter of riser = .16666
Length of zone = 7.2
Diameter of zone = .7
Static water level = 6.39
Number of readings = 6

Time	Excess Head
.01	.4700003
.25	.29
.5	.27
.75	.25
1	.23
1.25	.2000003

K = 1.490305E-03 cm/sec

DATA (Cont'd)

MPT-13-3

Diameter of riser = .16666
Length of zone = 7
Diameter of zone = .7
Static water level = 5.25
Number of readings = 13

Time	Excess Head
.01	3.39
.1666	2.86
.2666	2.53
.6	2.14
.75	1.86
1	1.62
1.2833	1.15
1.5	.9499998
1.75	.73
2.1166	.48
2.5	.4000001
3	.27
3.5	.1900001

K = 5.885321E-04 cm/sec

MPT-14-1

Diameter of riser = .1666
Length of zone = 10.3
Diameter of zone = .7
Static water level = 5.71
Number of readings = 7

Time	Excess Head
.01	.8400002
.16666	.29
.2666	.1900001
.4166	9.000015E-02
.5666	7.999992E-02
.8166	7.000017E-02
.9666	5.999994E-02

K = 3.179011E-03 cm/sec

APPENDIX A—9

APPENDIX A-9

Parameters of Chemical Analyses and Detection Limits

APPENDIX A-9
Parameter of Chemical Analyses and Their Respective Detection Limits

Parameter	Detection Limit[1]	
Volatile Organics	Soil[2]	Water[3]
benzene	11	1
bromodichloromethane	54	5
bromoform	54	5
bromomethane	54	5
carbon tetrachloride	33	3
chlorobenzene	11	1
chloroethane	54	5
chloroform	54	5
chloromethane	54	5
cis-1,3-dichloropropene	54	5
dibromochloromethane	54	5
ethylbenzene	11	1
methylene chloride	54	5
tetrachloroethene	54	5
toluene	11	1
trans-1,2-dichloroethene	54	5
trans-1,3-dichloropropene	54	5
trichloroethene	11	1
trichlorofluoromethane	54	5
vinyl chloride	11	1
1,1,1-trichloroethane	54	5
1,1,2,2-tetrachloroethane	54	5
1,1,2-trichloroethane	54	5
1,1-dichloroethane	54	5
1,1-dichloroethene	54	5
1,2-dichlorobenzene	54	5
1,2-dichloroethane	33	3
1,2-dichloropropane	54	5
1,3-dichlorobenzene	54	5
1,4-dichlorobenzene	54	5
2-chloroethylvinyl ether	54	5
Semivolatile Organics		
acid extractables		
p-chloro-m-cresol	3000	25
pentachlorophenol	3000	30
phenol	1000	5
2,4,6-trichlorophenol	2000	20
2,4-dichlorophenol	1000	10

APPENDIX A-9 (Cont'd)
Parameter of Chemical Analyses and
Their Respective Detection Limits

Parameter	Detection Limit[1]	
Semivolatile Organics (cont.)	Soil[2]	Water[3]
acid extractables (cont.)		
2,4-dimethylphenol	1000	5
2,4-dinitrophenol	3000	30
2-chlorophenol	2000	15
2-nitrophenol	1000	10
4,6-dinitro-o-cresol	6000	50
4-nitrophenol	2000	20
base/neutral extractables		
acenaphthene	1000	10
acenaphthylene	1000	10
anthracene	1000	10
benzidine	1000	10
benzo (A) anthracene	1000	10
benzo (A) pyrene	1000	10
benzo (GHI) perylene	1000	10
benzo (K) fluoranthane	1000	10
bis (2-chloroethoxy) methane	1000	10
bis (2-chloroethyl) ether	1000	10
bis (2-chloroisopropyl) ether	1000	10
bis (2-ethylhexyl) phthalate	1000	10
buytlbenzyl phthalate	1000	10
chrysene	1000	10
dibenzo (A,H) anthracene	3000	25
diethylphthalate	1000	10
dimethylphthalate	1000	10
di-n-butyl phthalate	1000	10
di-n-octyl phthalate	1000	10
fluoranthene	1000	10
fluorene	1000	10
hexachlorobenzene	1000	10
hexachlorobutadiene	1000	10
hexachlorocyclopentadiene	1000	10
hexachloroethane	1000	10
indeno (1,2,3-CD) pyrene	1000	10
isophorone	1000	10
naphthalene	1000	10
nitrobenzene	1000	10
n-nitrosodimethylamine	1000	10
n-nitrosodi-n-propylamine	1000	10

APPENDIX A-9 (Cont'd)
Parameter of Chemical Analyses and Their Respective Detection Limits

Parameter	Detection Limit[1]	
Semivolatile Organics (cont.)		
base/neutral extractables (cont.)	Soil[2]	Water[3]
n-nitrosodiphenylamine	1000	10
phenanthrene	1000	10
pyrene	1000	10
1,2,4-trichlorobenzene	1000	10
1,2-dichlorobenzene	1000	10
1,2-diphenylhydrazine	1000	10
1,3-dichlorobenzene	1000	10
1,4-dichlorobenzene	1000	10
2,4-dinitrotoluene	1000	10
2,6-dinitrotoluene	1000	10
2-chloronaphthalene	1000	10
3,3-dichlorobenzidine	1000	10
3,4-benzofluoranthene	1000	10
4-bromophenyl phenyl ether	1000	10
4-chlorophenyl phenyl ether	1000	10
Pesticides/PCB's		
a-BHC	2.5	0.01
a-endosulfan I	2.5	0.01
aldrin	2.5	0.01
b-BHC	2.5	0.01
b-endosulfan II	2.5	0.01
chlorodane	2.5	0.01
d-BHC	2.5	0.01
dieldrin	2.5	0.01
endosulfan sulfate	2.5	0.01
endrin	2.5	0.07
endrin aldehyde	2.5	0.03
g-BHC (lindane)	2.5	0.01
heptachlor	2.5	0.01
heptachlor epoxide	2.5	0.01
PCB-1016 (arochlor 1016)	50	0.2
PCB-1221 (arochlor 1221)	50	0.2
PCB-1232 (arochlor 1232)	50	0.2
PCB-1242 (arochlor 1242)	50	0.2
PCB-1248 (arochlor 1248)	50	0.2
PCB-1254 (arochlor 1254)	50	0.2
PCB-1260 (arochlor 1260)	50	0.2
toxaphene	50	1
4,4'-DDD	2.5	0.01
4,4'-DDE	2.5	0.01
4,4'-DDT	2.5	0.01

APPENDIX A-9 (Cont'd)
Parameter of Chemical Analyses and Their Respective Detection Limits

Parameter	Detection Limit[1]	
Inorganics (metals)	Soil[2]	Water[3]
silver	500	--
arsenic	500	--
barium	1000	--
cadmium	100	0.1
chromium hexavalent	500	10.0
mercury	10	0.1
lead	500	1.0
selenium	100	--

[1]The detection limit is the lowest concentration which can be estimated with 95 percent confidence.

[2]Denotes soil concentrations in ug/kg (ppb).

[3]Denotes water concentrations in ug/l (ppb).

"--" denotes not tested. Appendix A-4

APPENDIX A—10

APPENDIX A-10

Federal and State Regulations and Criteria for Chemicals Detected at Naval Station Mayport, Florida

APPENDIX A-10

FEDERAL AND STATE REGULATIONS AND CRITERIA FOR CHEMICALS
DETECTED AT NAVAL STATION MAYPORT, FLORIDA

COMPOUND	Priority Pollutants Ambient Water Quality Criteria (for protection of aquatic life) EPA Ambient Water Quality Criteria (Saltwater) Acute	Chronic	Lowest Reported Toxic Concentration (Saltwater) Acute	Chronic	SFUPER(a) Level	State(b) SW Criteria MCL(c)	TSCA SOILS/SD(d) MCL (c)
			ORGANICS				
acenaphthene	---	---	0.97	0.71	---	---	---
benzene	---	---	5.1	---	0.001	---	---
bis (2-ethylhexyl) phthalate	---	---	---	---	---	---	---
chlorobenzene	---	---	10.5	---	---	---	---
di-n-butyl phthalate	---	---	---	---	---	---	---
di-n-octyl phthalate	---	---	---	---	---	---	---
ethylbenzene	---	---	0.43	---	---	---	---
napthalene	---	---	2.35	---	0.01	---	---
phenol	---	---	5.8	---	---	---	---
toluene	---	---	6.3	5.0	---	---	---
trans-1,2-dichloroethane	---	---	---	---	0.003	---	---
trichlorofluoromethane	---	---	---	---	---	---	---
vinyl chloride	---	---	---	---	---	---	---
1,1,1-trichloroethane	---	---	31.2	---	---	---	---
1,4-dichlorobenzene	---	---	1.99	---	---	---	---
2,4-dimethylphenol	---	---	---	---	---	---	---
			PESTICIDES/PCB's				
aldrin	0.0013	---	---	---	---	0.000003	---
heptachlor	0.000053	0.0000036	---	---	---	0.000001	---
4,4'-DDD	0.00013	0.000001	---	---	---	0.000001	---
4,4'-DDE	0.00013	0.000001	---	---	---	0.000001	---
4,4'-DDT	0.00013	0.000001	---	---	---	0.000001	---
PCB - 1260	---	0.00003	0.01	---	---	---	50
			INORGANICS				
cadmium	0.043	0.0093	---	---	---	0.005	---
chromium	1.1	0.05	---	---	---	---	---
lead	0.14	0.0056	---	---	0.05	0.03	---
mercury	0.0021	0.000025	---	---	---	0.0001	---

NOTES:

All values are in mg/kg (ppm) for soils/sediment (SD) and mg/l (ppm) for water.
"---" denotes no standard has been set or was available.

a SFUPER - State of Florida Underground Petroleum Environmental Response minimum criteria (Ch. 17-70, Florida Administrative Code (FAC))

b State of Florida Surface Water (SW) Criteria, Chapter 17-3.121 FAC

c MCL - Maximum Contaminant Level

d TSCA - Toxic Substances Control Act (CFR 40, Part 761.60, paragraph (a) (4))

APPENDIX A—11

APPENDIX A-11

PRELIMINARY HRS SCORE TABULATION SHEETS

Facility name: SITE 1 - LANDFILL A

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 1 IS A FOUR ACRE LANDFILL WHICH OPERATED FROM 1942 TO 1960. THE LANDFILL IS ESTIMATED TO HAVE RECEIVED 190,000 GALLONS OF LIQUID INDUSTRIAL WASTE DURING ITS PERIOD OF OPERATION. GROUNDWATER CONTAMINATED WITH THESE WASTES IS POSSIBLY DISCHARGING TO THE ST. JOHNS RIVER.

Scores: S_M = 9.45 (S_{gw} = 5.42 S_{sw} = 15.44 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
3 Containment	0 1 2 3	1		3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 (5) 6 7 8	1	5	8	
Total Waste Characteristics Score			23	26	
5 Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			3,105	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 5.42			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 (5) 6 7 8	1	5	8	
Total Waste Characteristics Score			23	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			9936	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{SW} = 15.44		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]				35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	5.42	29.33
Surface Water Route Score (S_{sw})	15.44	238.41
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		267.74
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		16.36
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M$		9.45

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 2 - LANDFILL B

Location: NAVSTA MAYPORT - JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 2 IS A LANDFILL THAT WAS OPERATED FROM 1960 TO 1964 USING THE TRENCH AND FILL METHOD, AND FROM 1979 TO 1980 AS AN AREA LANDFILL. THE AREA IS PRESENTLY PAVED WITH ASPHALT AND USED FOR ORDNANCE STORAGE. THE LANDFILL IS APPROXIMATELY TWO ACRES IN SIZE. APPROXIMATELY 270,000 GALLONS OF LIQUID INDUSTRIAL WASTE WERE DISPOSED INTO THIS LANDFILL.

Scores: S_M = 10.14 (S_{gw} = 5.10 S_{sw} = 16.78 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 (1) 2 3	1	1	3	
Permeability of the Unsaturated Zone	0 1 2 (3)	1	3	3	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			13	15	
[3] Containment	0 1 2 (3)	1	3	3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 (7) 8	1	7	8	
Total Waste Characteristics Score			25	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			2,925	57,330	
[7] Divide line [6] by 57,330 and multiply by 100		S_{gw} = 5.10			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 (7) 8	1	7	8	
Total Waste Characteristics Score			25	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			10,800	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{SW} = 16.78		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	5.10	26.03
Surface Water Route Score (S_{sw})	16.78	281.68
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		307.71
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		17.54
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		10.14

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 4 - LANDFILL D

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 4 IS A THREE ACRE LANDFILL THAT OPERATED FROM 1963 UNTIL 1965. APPROXIMATELY 162,000 GALLONS OF LIQUID INDUSTRIAL WASTES WERE DISPOSED INTO THE LANDFILL. THE SITE PRESENTLY UNDERLIES THE DREDGE DISPOSAL AREA.

Scores: S_M = 9.87 (S_{gw} = 5.65 S_{sw} = 16.11 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 (6) 7 8	1	6	8	
Total Waste Characteristics Score			24	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			3,240	57,330	
[7] Divide line [6] by 57,330 and multiply by 100			S_{gw} = 5.65		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 (6) 7 8	1	6	8	
Total Waste Characteristics Score			24	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			10,368	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{SW} = 16.11		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	5.65	31.94
Surface Water Route Score (S_{sw})	16.11	259.59
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		291.53
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		17.07
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		9.87

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 5 - LANDFILL E

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 5 IS AN 11 ACRE LANDFILL THAT OPERATED FROM 1963 UNTIL 1966 EMPLOYING THE TRENCH AND FILL METHOD AND FROM 1974 TO 1980 USING THE AREA METHOD. APPROXIMATELY 600,000 GALLONS OF INDUSTRIAL WASTES WERE DISPOSED INTO THE LANDFILL DURING ITS PERIODS OF OPERATION.

Scores: S_M = 13.10 (S_{gw} = 6.12 S_{sw} = 21.82 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
3 Containment	0 1 2 3	1		3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			3510	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 6.12			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 (45)	1	45	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	0 1 2 3	1		3	
1-yr. 24-hr. Rainfall	0 1 2 3	1		3	
Distance to Nearest Surface Water	0 1 2 3	2		6	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
3 Containment	0 1 2 3	1		3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			14,040	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{SW} = 21.82		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet						
Rating Factor	Assigned Value (Circle One)		Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0)	45	1	0	45	5.1
Date and Location:						
Sampling Protocol:						
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].						
[2] Waste Characteristics						5.2
Reactivity and Incompatibility	0 1 2 3		1		3	
Toxicity	0 1 2 3		3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8		1		8	
	Total Waste Characteristics Score				20	
[3] Targets						5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30		1		30	
Distance to Sensitive Environment	0 1 2 3		2		6	
Land Use	0 1 2 3		1		3	
	Total Targets Score				39	
[4] Multiply [1] x [2] x [3]				0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100			S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	6.12	37.48
Surface Water Route Score (S_{sw})	21.82	476.03
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		513.51
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		22.66
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		13.10

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 6 - LANDFILL F

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 6 IS A 24 ACRE LANDFILL THAT OPERATED FROM 1966 UNTIL 1985. TRENCH AND FILL AND AREA FILL METHODS WERE EMPLOYED, RESPECTIVELY. APPROXIMATELY 200,000 GALLONS OF LIQUID INDUSTRIAL WASTES WERE DISPOSED INTO THE SITE. THE AREA IS PRESENTLY USED FOR AUTOMOBILE STORAGE.

Scores: S_M = 12.09 (S_{gw} = 5.65 S_{sw} = 20.14 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 (6) 7 8	1	6	8	
Total Waste Characteristics Score			24	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5]. If line [1] is 0, multiply [2] x [3] x [4] x [5]			3240	57,330	
[7] Divide line [6] by 57,330 and multiply by 100			S_{gw} = 5.65		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	4.1
If observed release is given a value of 45, proceed to line [4]. If observed release is given a value of 0, proceed to line [2].					
[2] Route Characteristics					4.2
Facility Slope and Intervening Terrain	0 1 2 3	1		3	
1-yr. 24-hr. Rainfall	0 1 2 3	1		3	
Distance to Nearest Surface Water	0 1 2 3	2		6	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	4.3
[4] Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 (6) 7 8	1	6	8	
Total Waste Characteristics Score			24	26	
[5] Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
[6] If line [1] is 45, multiply [1] x [4] x [5]. If line [1] is 0, multiply [2] x [3] x [4] x [5]			12,960	64,350	
[7] Divide line [6] by 64,350 and multiply by 100			S_{SW} = 20.14		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet						
Rating Factor	Assigned Value (Circle One)		Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0	45	1	0	45	5.1
Date and Location:						
Sampling Protocol:						
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].						
[2] Waste Characteristics						5.2
Reactivity and Incompatibility	0 1 2 3		1		3	
Toxicity	0 1 2 3		3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8		1		8	
	Total Waste Characteristics Score				20	
[3] Targets						5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30		1		30	
Distance to Sensitive Environment	0 1 2 3		2		6	
Land Use	0 1 2 3		1		3	
	Total Targets Score				39	
[4] Multiply [1] x [2] x [3]				0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100			S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	5.65	31.94
Surface Water Route Score (S_{sw})	20.14	405.61
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		437.55
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		20.92
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		12.09

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 8 - WASTE OIL PIT

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 8 IS A 0.2 ACRE PIT THAT WAS USED FROM 1973 TO 1978 FOR DISPOSAL OF WASTE OILY BILGE WATER. APPROXIMATELY 250,000 GALLONS OF LIQUIDS WERE DISPOSED INTO THIS PIT.

Scores: S_M = 6.73 (S_{gw} = 4.47 S_{sw} = 10.74 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 (12) 15 18	1	12	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 (7) 8	1	7	8	
Total Waste Characteristics Score			19	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			2,565	57,330	
[7] Divide line [6] by 57,330 and multiply by 100		S_{gw} = 4.47			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 (9) 12 15 18	1	9	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 (7) 8	1	7	8	
Total Waste Characteristics Score			16	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			6,912	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{sw} = 10.74			

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	4.47	19.98
Surface Water Route Score (S_{sw})	10.74	115.37
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		135.39
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		11.64
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		6.73

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 9 - FUEL SPILL AREA

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SOIL BORINGS INDICATE THAT PETROLEUM PRODUCTS HAVE LEAKED OR BEEN SPILLED ONTO THE GROUND WITHIN THE FUEL FARM AREA. LESS THAN 3,000 GALLONS ARE ESTIMATED TO HAVE BEEN SPILLED AT THIS SITE DURING THE PERIOD OF OPERATIONS (1942 TO PRESENT).

Scores: $S_M = 4.52$ ($S_{gw} = 2$ $S_{sw} = 7.38$ $S_a = 0$)

$S_{FE} =$

$S_{DC} =$

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	~~0~~ 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 (9) 12 15 18	1	9	18	
Hazardous Waste Quantity	0 1 (2) 3 4 5 6 7 8	1	2	8	
Total Waste Characteristics Score			11	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			1,485	57,330	
[7] Divide line [6] by 57,330 and multiply by 100			S_{gw} = 2.59		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 (9) 12 15 18	1	9	18	
Hazardous Waste Quantity	0 1 (2) 3 4 5 6 7 8	1	2	8	
Total Waste Characteristics Score			11	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			4,752	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 7.38		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a =	0		

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	2.59	6.71
Surface Water Route Score (S_{sw})	7.38	54.53
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		61.24
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		7.82
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		4.52

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 13 - OLD FIRE FIGHTING TRAINING AREA

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

SITE 13 WAS USED FOR FIRE FIGHTING TRAINING FROM 1973 TO 1982. DURING THIS 10 YEAR PERIOD, 48,000 GALLONS OF MIXED COMBUSTIBLES WERE USED DURING TRAINING. THE EXPECTED CONTAMINATION ROUTE WOULD BE THE DISCHARGE OF SHALLOW GROUNDWATER TO NEARBY TIDAL DITCHES WHICH DRAIN INTO SHERMAN CREEK.

Scores: S_M = 9.05 S_{gw} = 5.18 S_{sw} = 14.77 S_a = 0)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line [4]. If observed release is given a score of 0, proceed to line [2].					
[2] Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
[3] Containment	0 1 2 3	1		3	3.3
[4] Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 (4) 5 6 7 8	1	4	8	
Total Waste Characteristics Score			22	26	
[5] Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
[6] If line [1] is 45, multiply [1] x [4] x [5] If line [1] is 0, multiply [2] x [3] x [4] x [5]			2,970	57,330	
[7] Divide line [6] by 57,330 and multiply by 100			S_{gw} = 5.18		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	4	8	
Total Waste Characteristics Score			22	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5. If line 1 is 0, multiply 2 x 3 x 4 x 5			9,504	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{SW} = 14.77			

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5-6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	5.18	26.84
Surface Water Route Score (S_{sw})	14.77	218.13
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		244.97
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		15.65
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		9.05

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 14 - MERCURY/OILY WASTE SPILL SITE

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

DRUMS CONTAINING MERCURIC NITRATE WASTE HAVE RUSTED THROUGH AND LEAKED ONTO SURROUNDING SOILS. LESS THAN 200 GALLONS ARE ESTIMATED TO HAVE LEAKED SINCE 1977. ADDITIONALLY, AN OIL/WATER SEPARATOR HAS MAL-FUNCTIONED AT TIMES, LEAKING APPROXIMATELY 4,000 GALLONS TO SURROUNDING SOILS. THE SHALLOW GROUNDWATER DISCHARGES TO THE ST. JOHNS RIVER, ABOUT 200 FEET AWAY.

Scores: $S_M = 8.22$ ($S_{gw} = 4.71$ $S_{sw} = 13.43$ $S_a = 0$)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
3 Containment	0 1 2 3	1		3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 (2) 3 4 5 6 7 8	1	2	8	
Total Waste Characteristics Score			20	26	
5 Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			2,700	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 4.71			

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			12	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 (2) 3 4 5 6 7 8	1	2	8	
Total Waste Characteristics Score			20	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			8640	64,350	
7 Divide line 6 by 64,350 and multiply by 100		S_{SW} =	13.43		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a =	0		

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	4.71	22.18
Surface Water Route Score (S_{sw})	13.43	180.27
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		202.45
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		14.23
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		8.22

FIGURE 10
WORKSHEET FOR COMPUTING S_M

Facility name: SITE 16 - TRANSFORMER STORAGE YARD

Location: NAVSTA MAYPORT, JACKSONVILLE, FLORIDA

EPA Region: IV

Person(s) in charge of the facility:

Name of Reviewer: Date:

General description of the facility:
(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

FROM 1981 UNTIL 1986 SITE 16 WAS USED FOR STORAGE OF TRANSFORMERS, SOME OF WHICH MAY HAVE CONTAINED PCBs. LESS THAN 50 GALLONS OF TRANSFORMER OIL IS ESTIMATED TO HAVE LEAKED AT THE SITE. ALTHOUGH SOIL SAMPLES DID NOT CONTAIN DETECTABLE LEVELS OF PCBs, MEASUREABLE LEVELS OF DDT, DDE, AND DDD PESTICIDES WERE PRESENT. ADDITIONALLY, A DOWNGRADIENT MONITOR WELL CONTAINED DETECTABLE LEVELS OF DDE.

Scores: $S_M = 8.98$ ($S_{gw} = 4.47$ $S_{sw} = 14.88$ $S_a = 0$)

S_{FE} =

S_{DC} =

FIGURE 1
HRS COVER SHEET

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	0 (45)	1	45	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 3	2		6	
Net Precipitation	0 1 2 3	1		3	
Permeability of the Unsaturated Zone	0 1 2 3	1		3	
Physical State	0 1 2 3	1		3	
Total Route Characteristics Score				15	
3 Containment	0 1 2 3	1		3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 (1) 2 3 4 5 6 7 8	1	1	8	
Total Waste Characteristics Score			19	26	
5 Targets					3.5
Ground Water Use	0 (1) 2 3	3	3	9	
Distance to Nearest Well/Population Served	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			3	49	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			2,565	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 4.47		

FIGURE 2
GROUND WATER ROUTE WORK SHEET

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	0 1 (2) 3	1	2	3	
1-yr. 24-hr. Rainfall	0 1 2 (3)	1	3	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 1 2 (3)	1	3	3	
Total Route Characteristics Score			14	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 (1) 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score			19	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	0 1 2 (3)	2	6	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			12	55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			9,576	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{SW} = 14.88		

FIGURE 7
SURFACE WATER ROUTE WORK SHEET

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location:					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

FIGURE 9
AIR ROUTE WORK SHEET

	S	S^2
Groundwater Route Score (S_{gw})	4.47	20.02
Surface Water Route Score (S_{sw})	14.88	221.45
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		241.46
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		15.54
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} \,/\, 1.73 = S_M =$		8.98

FIGURE 10
WORKSHEET FOR COMPUTING S_M