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DRAFT PRELIMINARY SITE INVESTIGATION REPORT AND EXPANDED SITE INVESTIGATION/REMEDIAL FIELD INVESTIGATION WORK PLAN FOR TRUMBO POINT FUEL FARM AND PIERS D-1 AND D-3 NAS KEY WEST FL

9/1/1988

GERAGHTY AND MILLER INC

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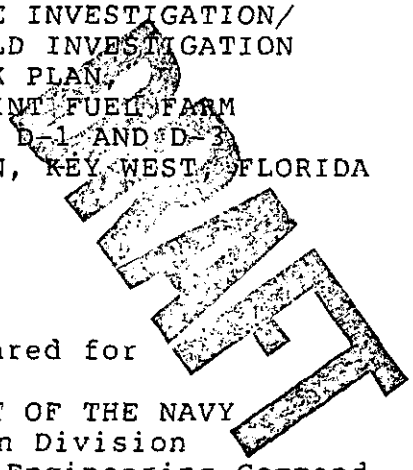
PRELIMINARY SITE INVESTIGATION REPORT
AND
EXPANDED SITE INVESTIGATION/
REMEDIAL FIELD INVESTIGATION
WORK PLAN,
TRUMBO POINT FUEL FARM
AND PIERS D-1 AND D-3
NAVAL AIR STATION, KEY WEST, FLORIDA



Prepared for

DEPARTMENT OF THE NAVY
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

Contract No. N62467-87-C-0026
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September 1988

Prepared by

GERAGHTY & MILLER, INC.
Ground-Water Consultants
3820 Northdale Boulevard, Suite 200-B
Tampa, Florida 33624

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INTRODUCTION

In January 1988, the Southern Division, Naval Facilities Engineering Command (Navy) retained Geraghty & Miller, Inc., (G&M) to provide architectural/engineering services at the Key West Naval Air Station (NAS), Florida (Figure 1). The area of study is located at the Trumbo Point Annex and includes the fuel farm, pier D-1, and pier D-3 (Figure 2). These sites at the Annex serve as a fuel depot for ships and aircraft.

Specifically, G&M was requested to conduct a Phase I - Preliminary Site Investigation (PSI) and prepare an Expanded Site Investigation/Remedial Field Investigation (ESI/RFI) Work Plan in accordance with the Naval Installation Restoration Program. The objective of the ESI/RFI Work Plan is to determine the extent of various fuels (petroleum hydrocarbons) or any other suspected contaminants within the soil and ground water underlying the study area.

The purpose of the PSI was to collect and review existing information concerning the study area to assist in the preparation of the ESI/RFI Work Plan. This work included a records search, interviews with persons associated with activities at the site, and an on-site reconnaissance (visual field inspection). The ESI/RFI Work Plan was developed to guide a field investigation to assess the horizontal and vertical extent of subsurface contaminant plumes, contaminant concentrations, contaminant pathways, the direction of contaminant movement, and to provide information to determine the type and extent of remedial actions that might be necessary. Included in the scope of the work plan, will be the collection of information necessary to address the Environmental Protection Agency's Hazardous Ranking System

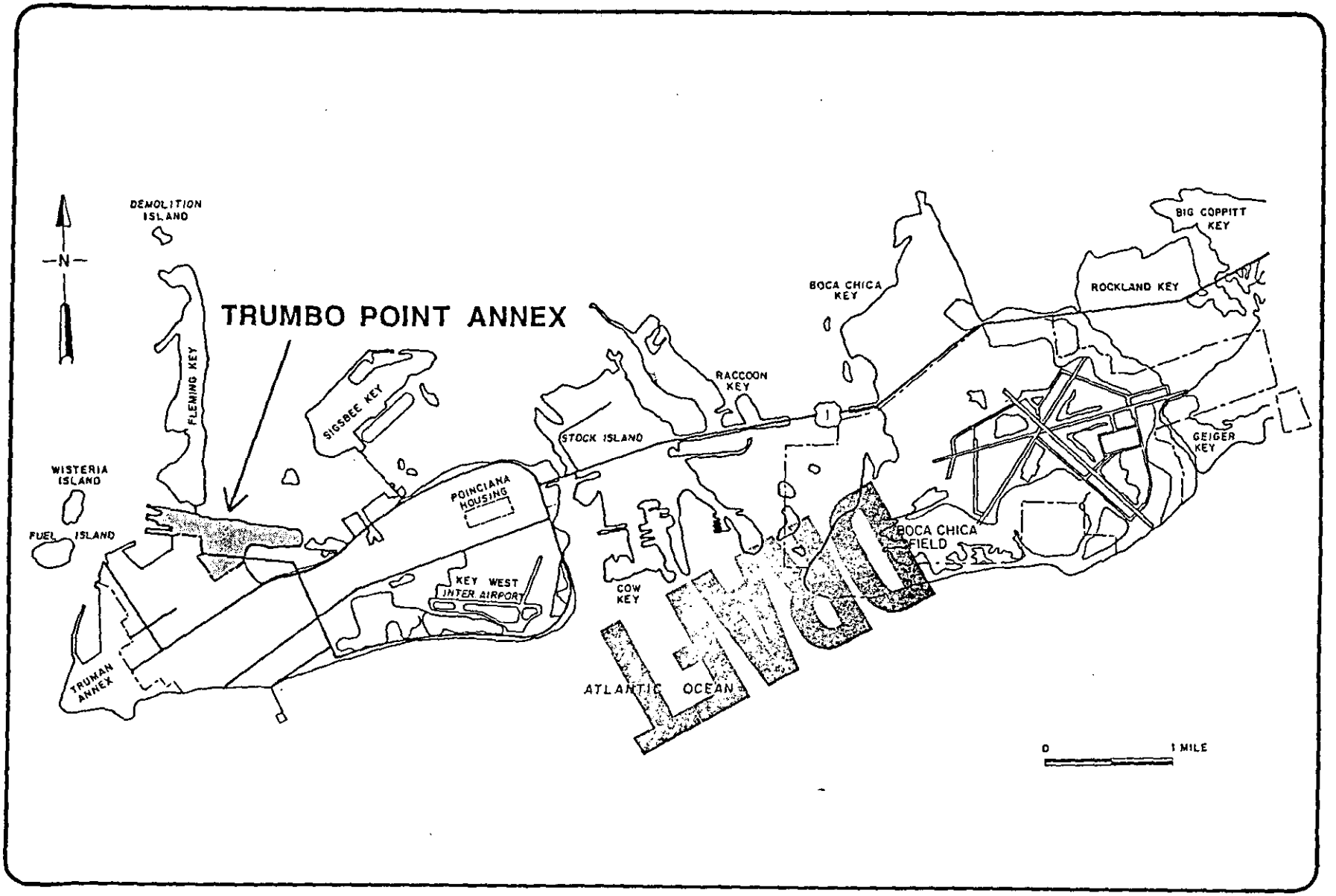

Figure 1.

Location of Trumbo Point Annex,
Key West, Florida.

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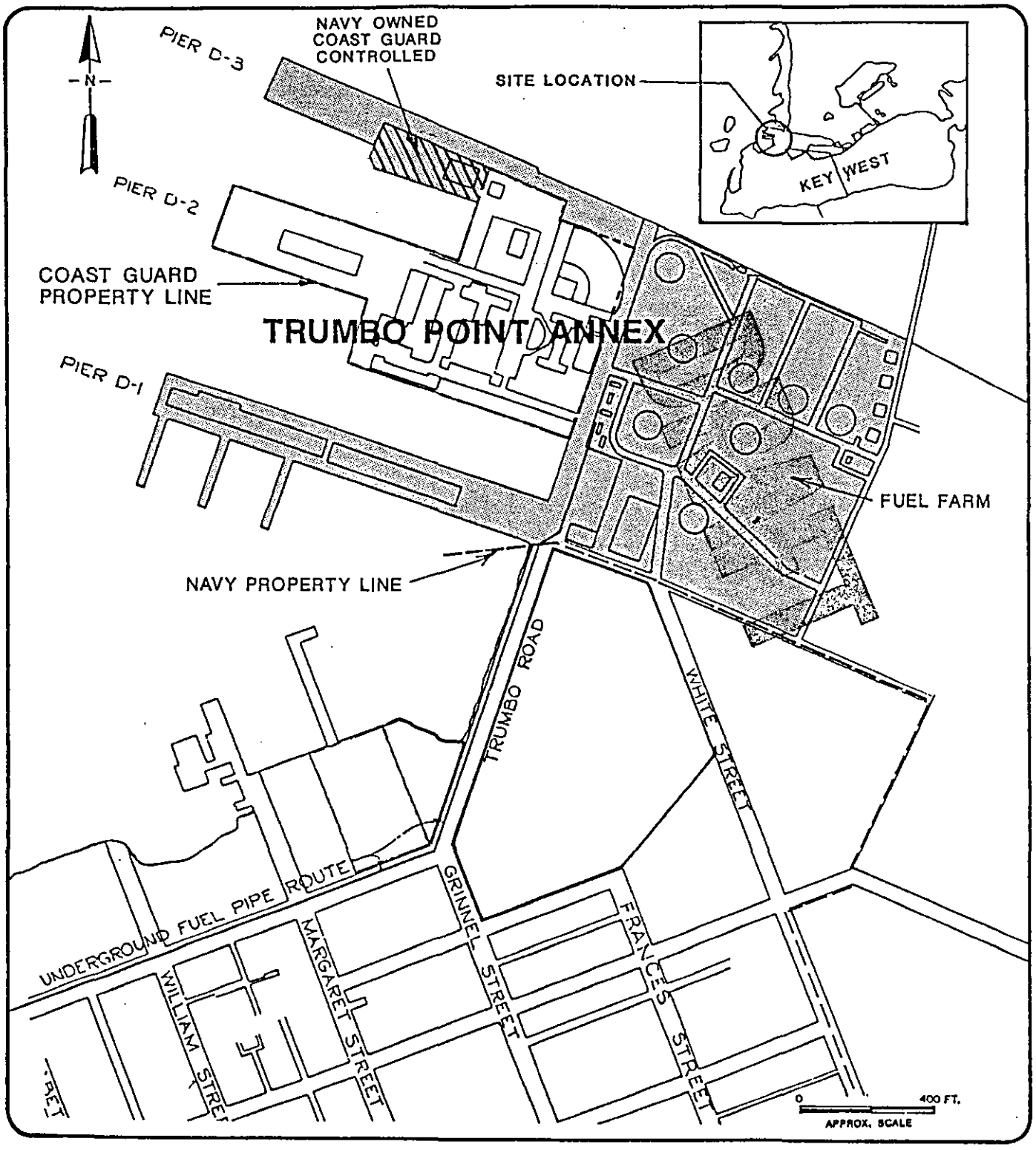

Figure 2.

Location of the Fuel Farm, Pier D-1 and Pier D-3 at Trumbo Point Annex.

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(HRS). Submitted concurrently with the following PSI report and the ESI/RFI Work Plan are the Quality Assurance/Quality Control Plan, Safety and Training Plan, Health Monitoring Plan, and the Site Management Plan.

The following report presents the background and a description of the project site, the findings of the PSI, and the proposed Work Plan for the ESI/RFI.

SITE DESCRIPTION AND PROJECT BACKGROUND

Trumbo Point Annex is located on the north side of Key West. The Annex was originally constructed using dredged materials for use as a seaplane base. Since 1942, the fuel farm (Figure 3), pier D-1 (Figure 4), and pier D-2 (Figure 5) have been used for on- and off-loading and storage of various types of petroleum products. Until about 1985, the fuel farm consisted of 28 tanks; currently, however, 15 tanks are still intact, of which 11 are actively used. Fuel for ships and aircraft at the NAS is received at the piers from tankers and barges, and then pumped via underground pipelines to the storage tanks at the fuel farm. From there, the fuel is conveyed via underground transmission lines to Truman Annex or NAS-Boca Chica or to ships docked at the piers. Fuels that have been stored in the past at this site have included No. 6 fuel oil, Bunker C oil, diesel oil, aviation gasoline, and both JP-4 and JP-5 jet fuels. Reportedly, the following petroleum products are stored at the site: diesel fuel, JP-5, MOGAS (Tanks D-1292 and D-1293), waste oil (Tank D-6), and waste Bunker C (AV-GAS tank in berms east of Tank 3) (see Figure 3).

G&M has previously performed two investigations at the fuel farm entitled "Subsurface Hydrocarbon Investigation at Trumbo Point Annex, NAS-Key West, June 1985;" and "Verification Study, Assessment of Potential Ground-Water Pollution at the Naval Air Station, Key West, Florida, March 1987." Based on the findings of these investigations, liquid-phase hydrocarbon was determined to be present floating on the ground-water table in the vicinity of tanks 2, D-3, and D-4. In addition to the above findings, NAS activity personnel reported that soil borings drilled in August 1988 at the area of former tank D-5 for foundation testing have determined the presence of liquid-phase hydrocarbons in the subsurface. Although no formal

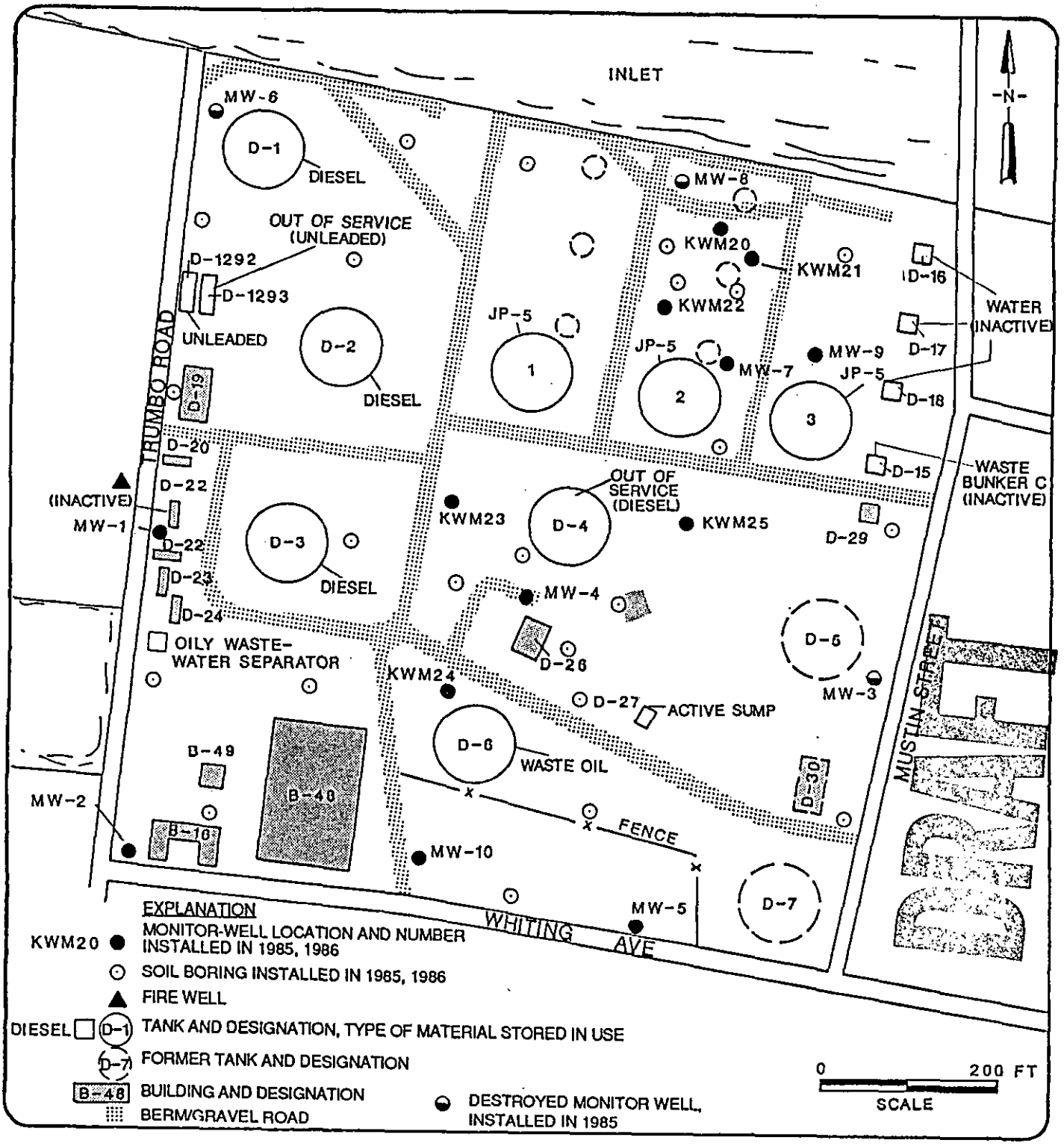

Figure 3.

Trumbo Point Fuel Farm.

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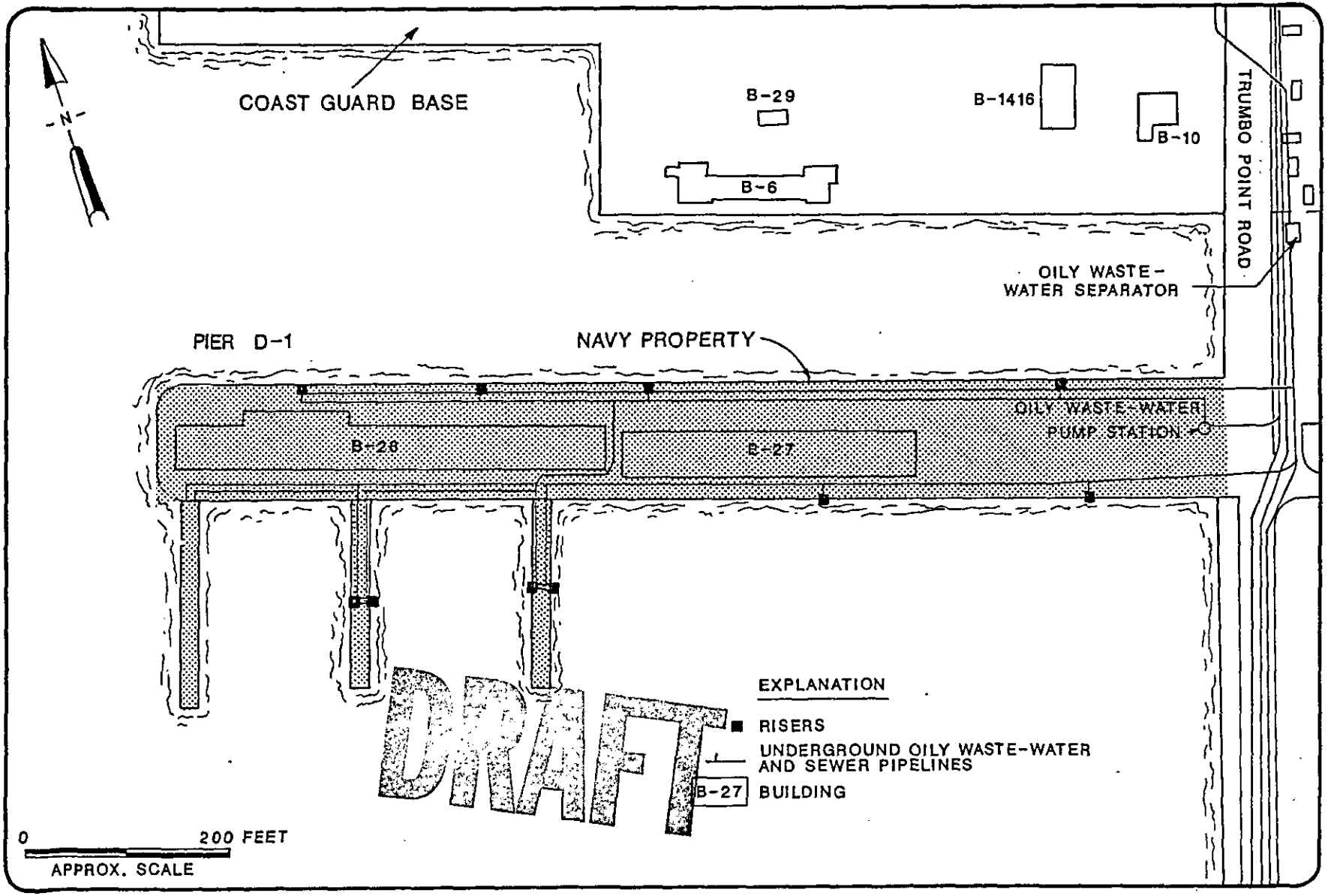

Figure 4.

Pier D-1.

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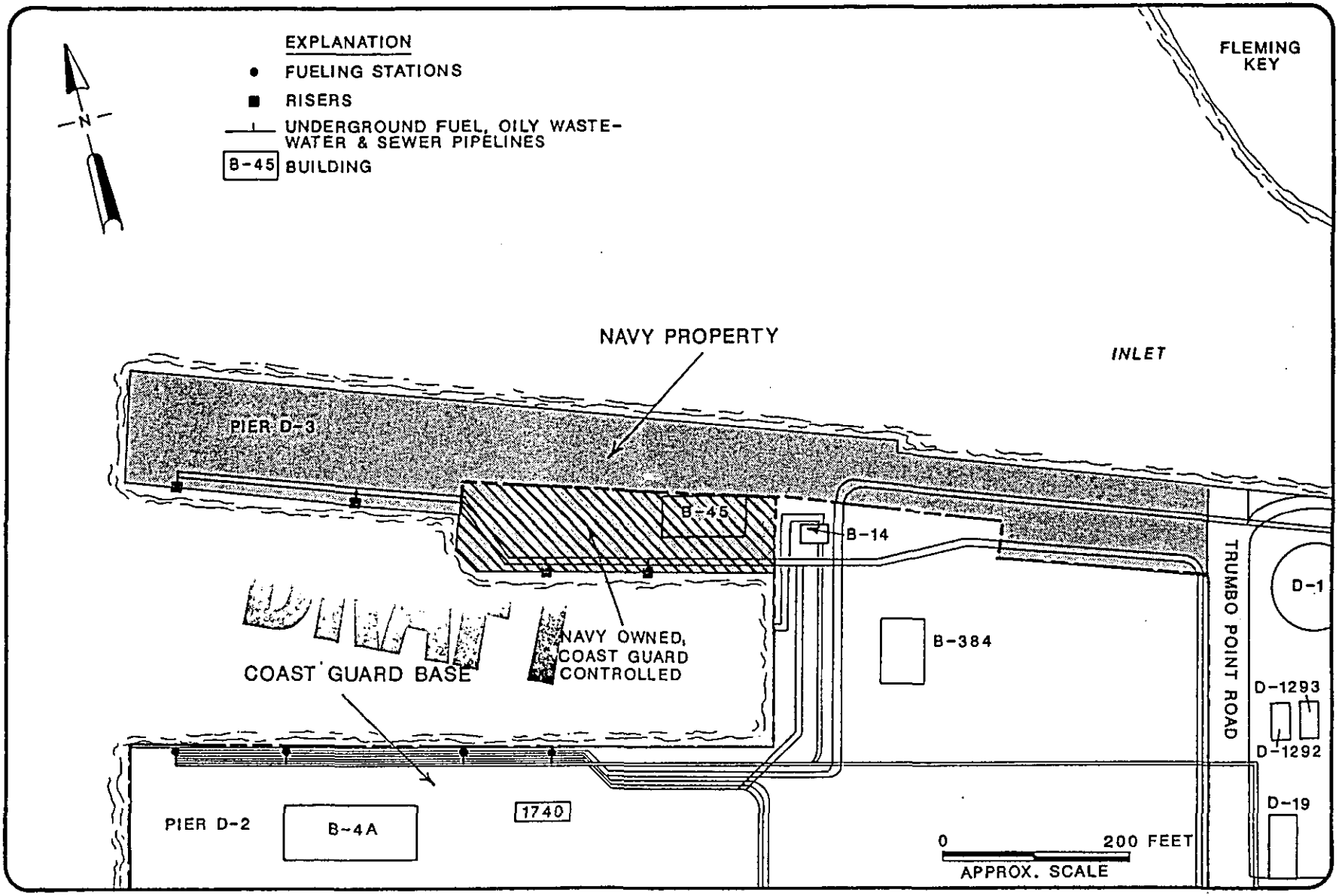

Figure 5.

Pier D-3.

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investigations have been conducted at pier D-1 or pier D-3, the Navy requested that more information be gathered about these areas due to past activities and observations of personnel working in these areas (see Warrant Officer Black and Lieutenant McCullough interviews, Appendix A).

The area surrounding tank D-4 and an area along the sea wall north of tank 2 and an associated recovery pit will be excluded from the ESI/RFI. These areas will be investigated during a separate study as requested by the Navy. Nevertheless, data acquired during the PSI for these areas is included.

PRELIMINARY SITE INVESTIGATION

The goal of the PSI was to acquire information concerning the location, type, and quantity of past discharges of fuels or other contaminants in the vicinity of pier D-1, pier D-3, and the fuel farm. To fulfill this objective, G&M representatives performed a visual field investigation of these areas and interviewed associated personnel from April 13-15, 1988 (Appendix A). Personnel working at the NAS for Public Works, Naval supply, and contractors associated with fueling or other operations at Trumbo Point Annex were interviewed about the general activities of these areas with regard to fuel or other contaminant spills, pipe leaks, overfills, and inventory losses (see Appendix A). Concurrently, a visual field investigation was performed at piers D-1 and D-3 and at the fuel farm, during which accessible manholes, piping, tanks, buildings, and other such structures were inspected to locate possible sources or accumulations of petroleum products or other contaminants. An interface probe was used to determine thicknesses of liquid-phase hydrocarbons in monitor wells previously installed at the fuel farm and in other structures such as sumps, manholes, or fire wells. This information has been assimilated and is present below in three sections according to location.

Pier D-1

The primary function of pier D-1 is to provide support to the hydrofoil ships that are docked here. These services include supplying the ships with electricity and fresh water, and pumping off the sewage from on-board holding tanks and oily wastewater from bilges. These operations occur at six points along the pier via structures referred to by the NAS as risers (Figure 4). Each riser consists of three separate pipes; one each for fresh water, sewage, and oily wastewater.

These pipes are connected to a pipeline system beneath the pier. The oily wastewater pipes empty into a common sump located at the east end of the pier. The liquid that accumulates in the sump is pumped with submersible pumps to an oil-water separator. The oil is drummed up, tested, and if determined to be nonhazardous, sent to the NAS at Boca Chica. The water is discharged into the city sanitary sewer system. The configuration of the pipeline system is shown in Figure 4 and was based on construction blueprints supplied to G&M by the Navy's Public Works Department. Because no as-built drawings are available, the accuracy of the pipeline layout cannot be ascertained.

During the visual field investigation, manhole covers protecting the riser, sewer, and oily wastewater pipeline clean-outs were inspected. A hydrocarbon odor was noticed coming from several of the oily wastewater pipeline clean-outs; two north of Building B-27 and one south of Building B-28. NAS personnel reported that the area inside the manholes surrounding the risers probably is not sealed, since oily water enters during high tides. NAS personnel also reported that during high tides and/or heavy rains, it appears that the oily waste-water pipeline coming from the risers discharges oily water into the sump even if no ships are pumping out their bilges. These observations might indicate that the pipelines connected to the risers have leaks along them which allow an exchange of oily wastewater and brackish ground water in and out of the pipeline.

Pier D-3

Pier D-3 (Figure 5) is the northernmost of the piers at Trumbo Point Annex and is located west of the fuel farm as shown in Figure 2. The pier was constructed on dredged material and has been topped with asphalt. Navy personnel reported that the pier was remodeled in 1983, and that fuel

was found in the ground at that time. Subsurface manways were installed as part of the remodeling so that underground utilities could be accessed. During the PSI, the metal plates covering the access points to these manways were removed and checked for signs of fuel; no signs of hydrocarbons were noticed.

Two risers were located on the pier for fuel dispensing. Construction blueprints provided by Public Works were used to prepare Figure 5, which shows the location of the risers and associated underground piping. As indicated by Figure 5, no structures exist on the pier other than those on U.S. Coast Guard controlled property.

Fuel Farm

The Trumbo Point Fuel Farm (Figure 3) is located immediately east of the piers at the Trumbo Point Annex, as shown in Figure 2. Fuel for ships and aircraft is received at this facility from tankers and barges and then distributed via buried transmission lines to either Truman Annex or NAS-Boca Chica.

G&M installed borings and monitor wells at the locations shown in Figure 3 during previous investigations that took place in 1985 and 1987. During the visual field investigation, water-level and product thickness measurements (Table 1 and Figure 6) were collected April 15, 1988, using an interface probe from each of these monitor wells and converted to elevations using survey data from the 1987 study. It was found that several of the monitor wells (MW-1, KWM-20, KWM-21, KWM-22, KWM-23, and KWM-24) contained layers of liquid-phase hydrocarbons. The water-level data measurements made in these monitor wells have been adjusted using the equation:

Table 1. Trumbo Point Fuel Farm
Water-Level Elevations and
Liquid-Phase Hydrocarbon Thicknesses
April 15, 1988

Monitor Well Designation	Measuring Point Elevation (ft msl)[1/]	Depth to Liquid-Phase Hydrocarbon (ft)[2/]	Depth to Water (ft)	Liquid-Phase Hydrocarbon Thickness (ft)	Water Table Elevation (ft msl)
MW-1	5.82	4.48	4.79 1.03	0.31	1.29 1.74
MW-2	6.11	--[3/]	5.44 0.67	--	0.67 2.8
MW-4	7.59	--	7.17 0.42	--	0.42 2.8
MW-5	6.79	--	5.55 1.24	--	1.24 2.05
MW-7	7.33	--	5.91 1.42	--	1.42 1.12
MW-9	6.99	--	5.52 1.47	--	1.47 1.10
MW-10	6.75	--	5.49 1.26	--	1.26 1.75
KWM-20	6.99	5.30	8.56 1.57	3.26	1.20 .98
KWM-21	7.64	6.26	6.96 0.68	0.70	1.28 .94
KWM-22	7.72	5.73	10.38 2.66	4.65	1.29 1.54
KWM-23	6.85	4.58	12.29 5.44	7.71	1.11 1.47
KWM-24	6.63	4.25	10.52 3.89	6.27	1.44 0.93
KWM-25	7.09	--	5.76 1.33	--	1.33 0.87
A[4/]		6.68	6.93	0.25	
B[4/]				<0.01[5/]	
C[4/]		5.66	5.70	0.04	
D[4/]					

1/ ft msl = feet above mean sea level.
2/ ft = feet
3/ -- = No liquid-phase hydrocarbon.
4/ Measurements collected from sumps, no elevation information has been determined.
5/ <0.01 = sheen of liquid-phase hydrocarbon.

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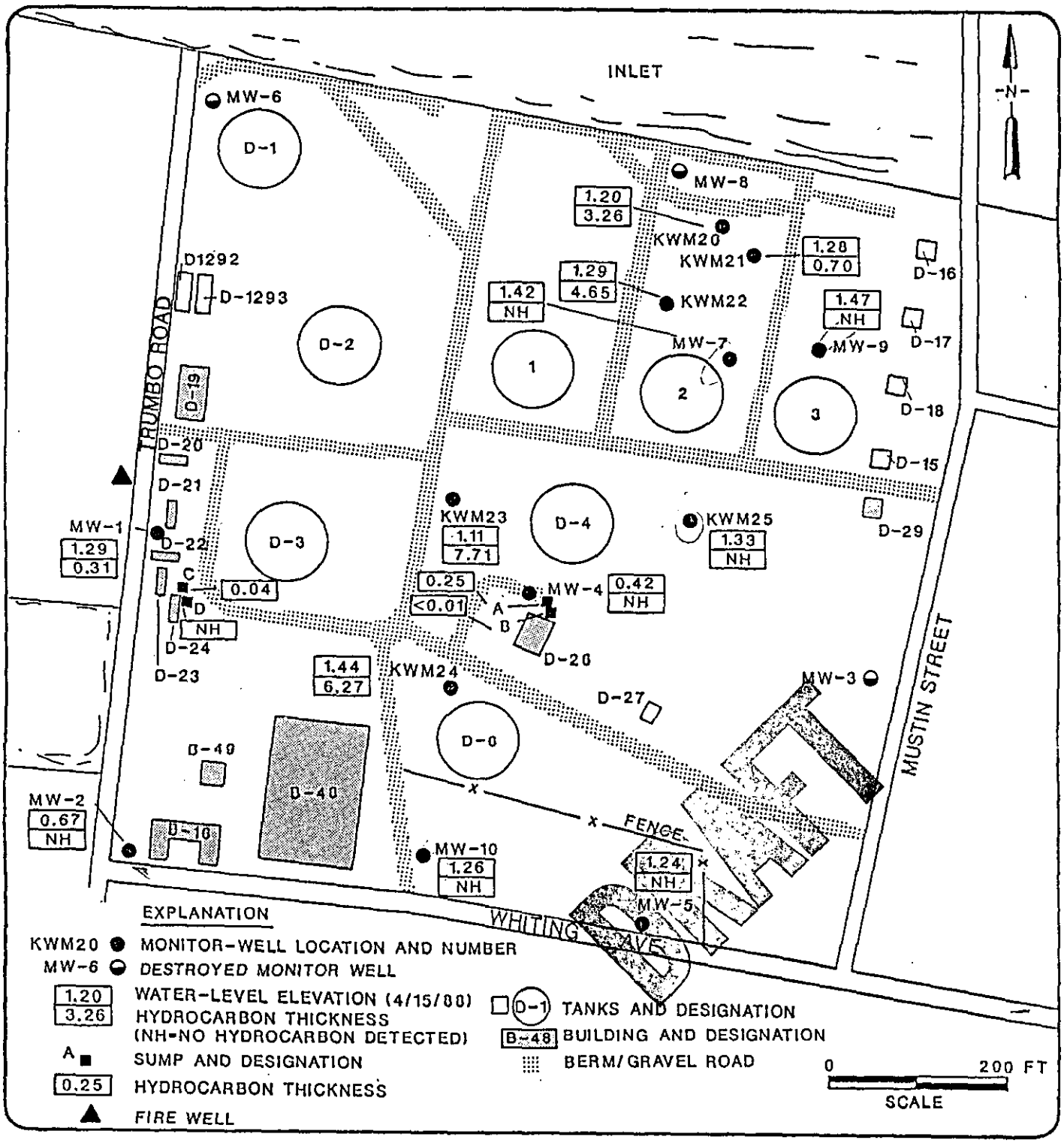

Figure 6.

Water-Level Elevations and Product Thicknesses in Monitor Wells and Other Structures at the Fuel Farm.

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Adjusted water-table elevation = the elevtion of the top of the well casing - [depth to water - (liquid-phase hydrocarbon thickness x 0.85)].

This calculation corrects the water-table elevation for the depression of the water table caused by the overlying liquid-phase hydrocarbons. These water-level data indicate that the water-level elevation at the fuel farm was about 1.5 feet (ft) above mean sea level on April 15, 1988. Additional water-level data would be necessary to determine the ground-water flow direction.

During the visual field investigation, other structures, including pump houses, sumps, and the fire well northwest of MW-1 (Figure 3), were inspected for the presence of liquid-phase hydrocarbons. The pump house (Building D-26) near tank D-4 was found to have heavily fuel-stained floors and a strong fuel odor was noted upon entering. Sumps A and C (Figure 6) also were found to have about 0.25 and 0.04 ft, respectively, of liquid-phase hydrocarbons floating on the water surface as measured by using the interface probe. Additionally, sump D (Figure 6) had a hydrocarbon odor when the metal plates covering it were removed, but no liquid-phase hydrocarbons were detected with the interface probe. Sump B had a sheen (<0.01 ft) of liquid-phase hydrocarbons, as detected with the probe. Liquid-phase hydrocarbons were not detected in the fire well. Figure 6 was prepared using this information and shows the location of liquid-phase hydrocarbons. This information indicates at least four plumes: (1) in the vicinity of MW-1, (2) surrounding KWM-24, (3) between KWM-23 and Building D-26, and (4) north of tank 2.

The fuel handling activities at the fuel farm have been contracted out by the Navy to two companies: Avantra

Corporation and Key West Pipeline, Inc. The contractors' activities are coordinated by the Navy Fuel Supply Office. During the PSI, personnel from each of these three organizations were interviewed and this information is included in Appendix A. The results of these interviews indicate that there may be two more areas, not previously investigated where hydrocarbon releases have occurred. These areas are north of tank D-2, and between tank D-4 and former tank D-5 (see David Bryant and Ralph Whaley interviews, Appendix A). Tank D-2 apparently had been overfilled, and the area between tank D-4 and former tank D-5 was trenched and then used for oily wastewater disposal in the past.

Personnel of Public Works, NAS-Key West have reported that an underground hazardous waste storage tank exists at Building D-21 and may contain solvents, waste oil, and possibly pesticides and polychlorinated biphenols. In addition, drums of wastes are stored near the oily wastewater separator (Figure 3).

CONCLUSIONS AND RECOMMENDATIONS

Based on the information gained during the PSI, several conclusions concerning subsurface conditions at pier D-1, pier D-3, and the fuel farm can be made:

- The oily wastewater system and sewer system at pier D-1 may be leaking into the subsurface.
- Information gained during personnel interviews indicated that the underground fuel pipeline at pier D-3 has leaked.
- Liquid-phase hydrocarbon exists in the subsurface in at least three general areas, and potentially two additional areas (Figure 6) of the fuel farm.
- Several unknown types of liquid-phase hydrocarbons may be present in the subsurface at Trumbo Point Annex.
- Because only construction drawings are available, the locations and condition of active and inactive underground pipelines are not certain. It is recommended that a tank and pipeline inspection and testing program be developed and implemented to determine whether continuing sources from these structures exist.
- The degree and overall extent of subsurface liquid-phase hydrocarbon contamination at Trumbo Point Annex have not been determined.

Because subsurface hydrocarbon contamination has been found or is suspected at pier D-1, pier D-3, and the fuel farm, G&M recommends that each of these sites be investigated further. The attached ESI/RFI Work Plan (Appendix B) outlines a proposed drilling and sampling program to better evaluate the degree and extent of contamination at each of the sites and a plan of action to determine the presence or absence of continuing sources.

APPENDIX A

PERSONNEL INTERVIEWS CONDUCTED APRIL 13-15, 1988

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Included below are the names of the individuals interviewed during the PSI, the organization with which they are affiliated, and the information they relayed to the G&M interviewer.

DAVID BRYANT - Key West Pipeline Company, located at Trumbo Point Fuel Farm Office

- Mr. Bryant began working for Key West Pipeline (KWP) Company in 1981, prior to which he was employed by Avantra.

- KWP owns above-ground tanks 1, 2, and 3 (Figure 3). Mr. Bryant said that the pipelines running to these tanks are cathodically protected and are vinyl-coated to help prevent corrosion. The lines were hydrostatically tested the week of April 11, 1988; the results of this test are not yet available.

- Pipelines associated with tanks that have been removed are still in the ground.

- KWP does not own the fuel in the tanks or pipes but they have a contract with the Defense Fuel Region to transport this fuel.

- Since Mr. Bryant has worked for KWP (1981), they have handled only JP-5; he believes that JP-4 and AVGAS were handled in the past.

- Mr. Bryant takes inventory of the fuel weekly by measuring the change in the height of the fuel in the tanks with a tape measure. He said that in windy weather he has difficulty

getting an accurate measurement because the top of the tank may move up and down as much as an inch. He also stated that in the 90-ft-diameter tanks, a 1/16-inch inaccuracy in thickness is equal to 247 gallons; in the 60-ft-diameter tanks, it is equal to 110 gallons.

Inventory records are sent to the Defense Fuel Region office at Tyndall Air Force Base, Florida.

- According to Mr. Bryant, the inventory records for the fuel farm have never been out of the 0.1% allowable tolerance, which would suggest an inventory discrepancy.

- Every six months, Mr. Leonard Chester, a Quality Surveillance representative with Tyndall Air Force Base Defense Fuel Supply Center, witnesses the gauging of the fuel delivery by the tankers at the fuel farm and reviews inventory records.

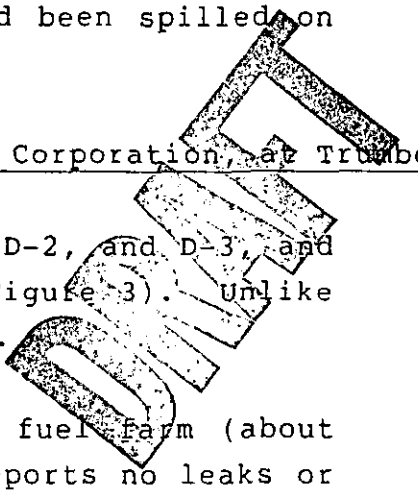
- There is another contractor (Avantra) responsible for fuels at the fuel farm. Unlike KWP, Avantra owns the fuel (diesel) that they handle, as well as the fuel tanks and pipelines. At various times, the tanks have contained gasoline, waste oil, and contaminated JP-5 fuel.

- One of Avantra's diesel tanks, D-4 (according to Navy personnel, this tank is owned by NAS-Key West), had a leak some time in 1982 or 1983. A trench was dug in the vicinity of the

leak and about 20,000 gallons of diesel fuel were recovered.

- While walking around the fuel farm, G&M personnel noticed that the ground around tank JP D-1 was orange-colored and that the grass was sparse and/or dead. Mr. Bryant speculated because there is an anti-icing agent in the fuel in this tank, that when the water condensate is drained out of the bottom of the tank onto the ground, the grass is killed.

- Mr. Bryant reported that tank JP D-2 possibly had been overfilled and fuel had been spilled on the north side of the tank.



MR. JERRY "BUFFALO" MATTHEWS - Avantra Corporation, at Trumbo Point Fuel Farm office

- Avantra operates tanks D-1, D-2, and D-3, and the Mogas (gasoline) tank (Figure 3). Unlike KWP, Avantra owns their fuel.

- Since he has worked at the fuel farm (about the past three years), he reports no leaks or spills from their tanks. After it rains, fuel seeps into the pump house D-26 (Figure 3). After this fuel is cleaned up, more product seeps in. Mr. Matthews has heard that there was a leak in the pipeline connecting tank D-4 to pump house D-26; he thinks this may account for the fuel in the pump house.

MR. RALPH WHALEY - former Avantra Corporation employee

- Mr. Whaley said that he knew a Mr. Joe Johnson that was in charge of heavy equipment

operations from NAS-Boca Chica. Mr. Johnson operated the backhoe that was used to dig trenches for emptying the oily wastewater bilges. He implied that these trenches were located between tanks D-4 and D-5. He was unclear as to when this occurred.

- Mr. Whaley said he used to pump out fuel that would accumulate in manholes adjacent to D-4 and empty it into tank D-5.

WARRANT OFFICER BLACK - Navy Chief of Supply for Mobile Logistics Support Group for the Hydrofoils, located on Pier D-1, Trumbo Point Annex

- The primary role of activities on pier D-1 is to provide support for the hydrofoil ships docked here. As part of this support, [illegible] risers (see Figure 4) were installed on the pier so that on-board sewage holding tanks and oily wastes from the bilge could be pumped off, and fresh water could be pumped on board the hydrofoils. There are underground pipes connected to the risers that run the length of the pier. The oily waste-water pipelines empty into a common sump (see Figure 4). The liquid that accumulates in the sump is then pumped with submersible pumps to an oil-water separator located across the street (Figure 4). The oil is drummed and sent to the Naval Air Station at Boca Chica, and the water goes into the city sanitary sewer system.

- Mr. Black said that during very high tides and/or heavy rains, the pipes coming from the risers discharge oily water into the sump even

when no ships are pumping into them. Mr. Black speculated that the pipelines from the risers might have cracks in them which allow tidal or rain water to infiltrate into the pipes along with oily wastewater that has exfiltrated into the ground during lower tides.

- The Coast Guard Station on pier D-2 has a similar system which is also connected to the sump on pier D-1 by underground lines. When testing the D-1 system, the check valves on the pier D-2 line located beneath Trumbo Road were determined to be leaking.

- The "vans" (trailer-like mobile compartments used for office and work space) located on the pier have sewer hook-ups to them which tie into the city sanitary sewer system. Also located on the pier is a mess hall and laundry (no dry cleaning is done there).

MR. MICHAEL RICHARDSON - Navy, Deputy Supply Officer, located at the NAS on Boca Chica

- The duties of Mr. Richardson's group include arranging the supply of fuels to all planes, ships, and vehicles operating out of the base. His group coordinates with KWP and Avantra to supply this fuel.

- Prior to 1975, KWP handled JP-4 and AVGAS; since 1975, they have handled JP-5.

MR. ED ADKINS - Navy, Fuel Supply Office, works with Mr. Richardson, located at the NAS on Boca Chica

- Mr. Adkins and Mr. Miller (Navy escort) accompanied G&M on a tour of pier D-1. While on the pier, the "risers," described by Warrant Officer Black in the previous interview, were pointed out to G&M along with several 8-inch-diameter manholes with "Oil C.O." inscribed on the lids. Inside these manholes are 4-inch-diameter PVC pipes set vertically into the ground; a hydrocarbon odor was noted when the manhole covers were opened. The sewer clean-outs were pointed out to G&M by Mr. Miller. When opened, a hydrocarbon odor was also noted in several of the clean-outs.

- Mr. Adkins said that he worked at the fuel farm from 1964-1974, prior to working for the Navy Fuel Supply Office. During this time, he said trenches were not dug for fuel disposal, as mentioned by Mr. Whaley; however, he was not sure whether this could have happened before or since he was there.

- The suction line running to tank D-4 leaked between 1980 and 1983. The exact duration of the leak was uncertain but the fuel was diesel. The leaking line was repaired but never put back in service because there was some question as to the integrity of the other lines associated with the tank.

- A JP-5 leak occurred near above-ground tank 3, but Mr. Adkins was unsure of the dates.

- Tanks D-5, D-6, and D-7 all contained "Navy special" fuel oil and he had no information as to whether or not these tanks had ever leaked.

MR. ROBERT YOUNG - Public Works, located at NAS Boca Chica

- Mr. Young supplied G&M with construction blueprints for pier D-1, pier D-2, and the fuel farm. These diagrams show the proposed locations of above- and below-ground structures. However, no as-built drawings were available so any changes made during construction are unknown.

LIEUTENANT MCCULLOUGH - U.S. Coast Guard, located on Pier D-2, Trumbo Point Annex

- When pier D-3 was remodeled (about 1983), fuel was found in the ground.

- Some time later, men working in underground utilities trenches, installed during the pier remodeling, were overcome by fumes.

APPENDIX B

EXPANDED SITE INVESTIGATION/ REMEDIAL FIELD INVESTIGATION WORK PLAN

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EXPANDED SITE INVESTIGATION/ REMEDIAL FIELD INVESTIGATION WORK PLAN, TRUMBO POINT FUEL FARM AND PIERS D-1 AND D-3 NAVAL AIR STATION, KEY WEST, FLORIDA

Prepared for

DEPARTMENT OF THE NAVY
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

Contract No. N62467-87-C-0026
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GERAGHTY & MILLER, INC.
Ground-Water Consultants
3820 Northdale Boulevard, Suite 200-B
Tampa, Florida 33624

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FIGURES

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INTRODUCTION

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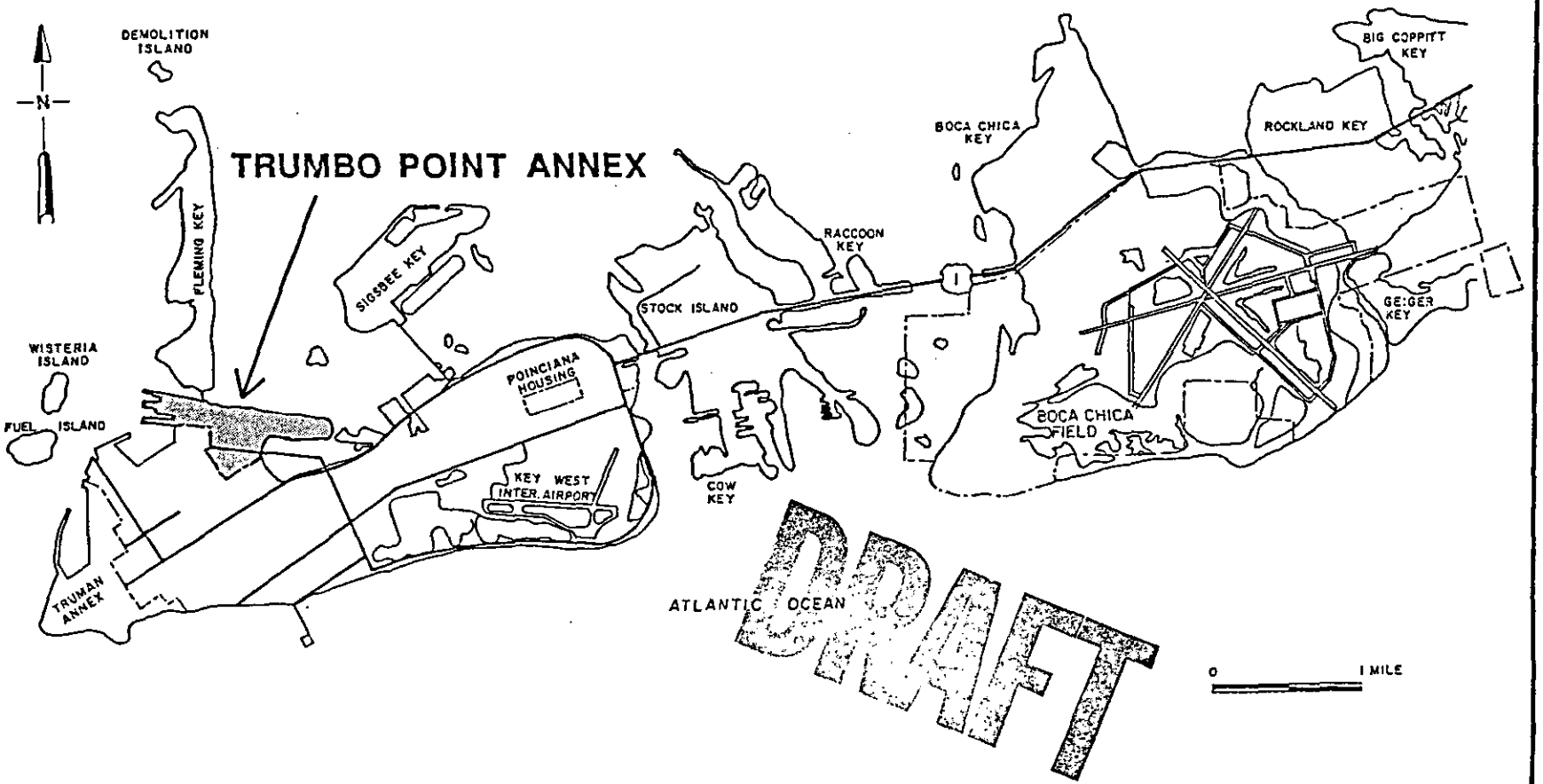

Figure 1.

Location of Trumbo Point Annex,
Key West, Florida.

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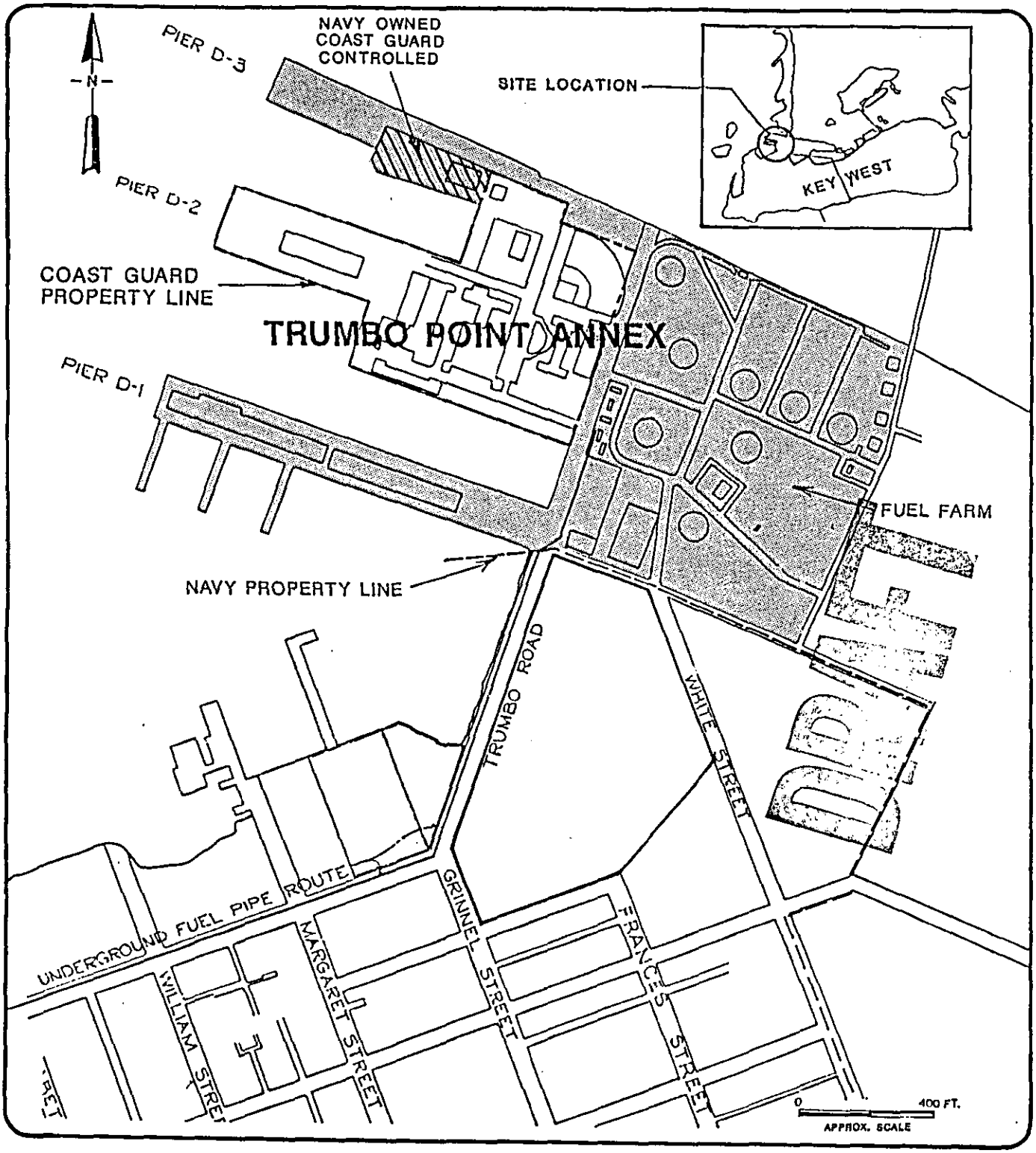

Figure 2.

Location of the Fuel Farm, Pier D-1, and Pier D-3 at Trumbo Point Annex.

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following ESI/RFI Work Plan are the Quality Assurance/Quality Control Plan, Safety and Training Plan, Health Monitoring Plan, and the Site Management Plan.

The following report presents the background and a description of the project site, and the proposed Work Plan for the ESI/RFI.

SITE DESCRIPTION AND PROJECT BACKGROUND

Trumbo Point Annex is located on the north side of Key West. The Annex was originally constructed using dredged materials for use as a seaplane base. Since 1942, the fuel farm (Figure 3), pier D-1 (Figure 4), and pier D-2 (Figure 5) have been used for on- and off-loading and storage of various types of petroleum products. Until about 1985, the fuel farm consisted of 28 tanks; currently, however, only 15 tanks are still intact, of which 11 are actively used. Fuel for ships and aircraft at the NAS is received at the piers from tankers and barges, and then pumped via underground pipelines to the storage tanks at the fuel farm. From there, the fuel is conveyed via underground transmission lines to Truman Annex or NAS-Boca Chica or to ships docked at the piers. Fuels that have been stored in the past at this site have included No. 6 fuel oil, Bunker C oil, diesel oil, aviation gasoline, and both JP-4 and JP-5 jet fuels. Reportedly, the following petroleum products are stored at the site: diesel fuel, JP-5, MOGAS (Tanks D-1292 and D-1293), waste oil (Tank D-6), and waste Bunker C (AV-GAS tank in berms east of Tank 3) (see Figure 3).

G&M has previously performed two investigations at the fuel farm entitled "Subsurface Hydrocarbon Investigation at Trumbo Point Annex, NAS-Key West, June 1985;" and "Verification Study, Assessment of Potential Ground-Water Pollution at the Naval Air Station, Key West, Florida, March 1987." Based on the findings of these investigations, liquid-phase hydrocarbon was determined to be present floating on the ground-water table in the vicinity of tanks 2, D-3, and D-4. In addition to the above findings, NAS activity personnel reported that soil borings drilled in August 1986 at the area of former tank D-5 for foundation testing determined the presence of liquid-phase hydrocarbons in the subsurface. Although no formal investigations have

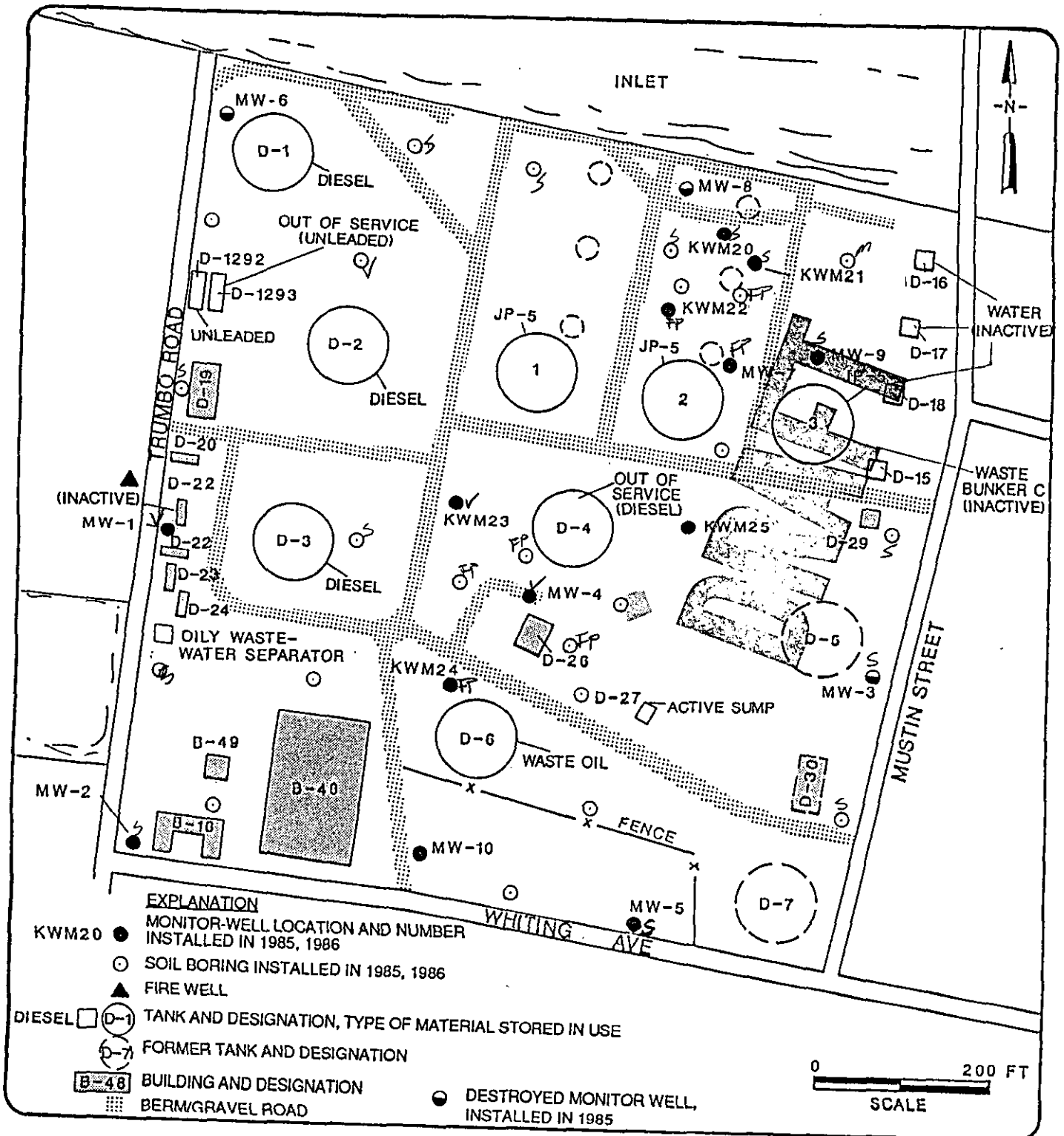

Figure 3.

Trumbo Point Fuel Farm.

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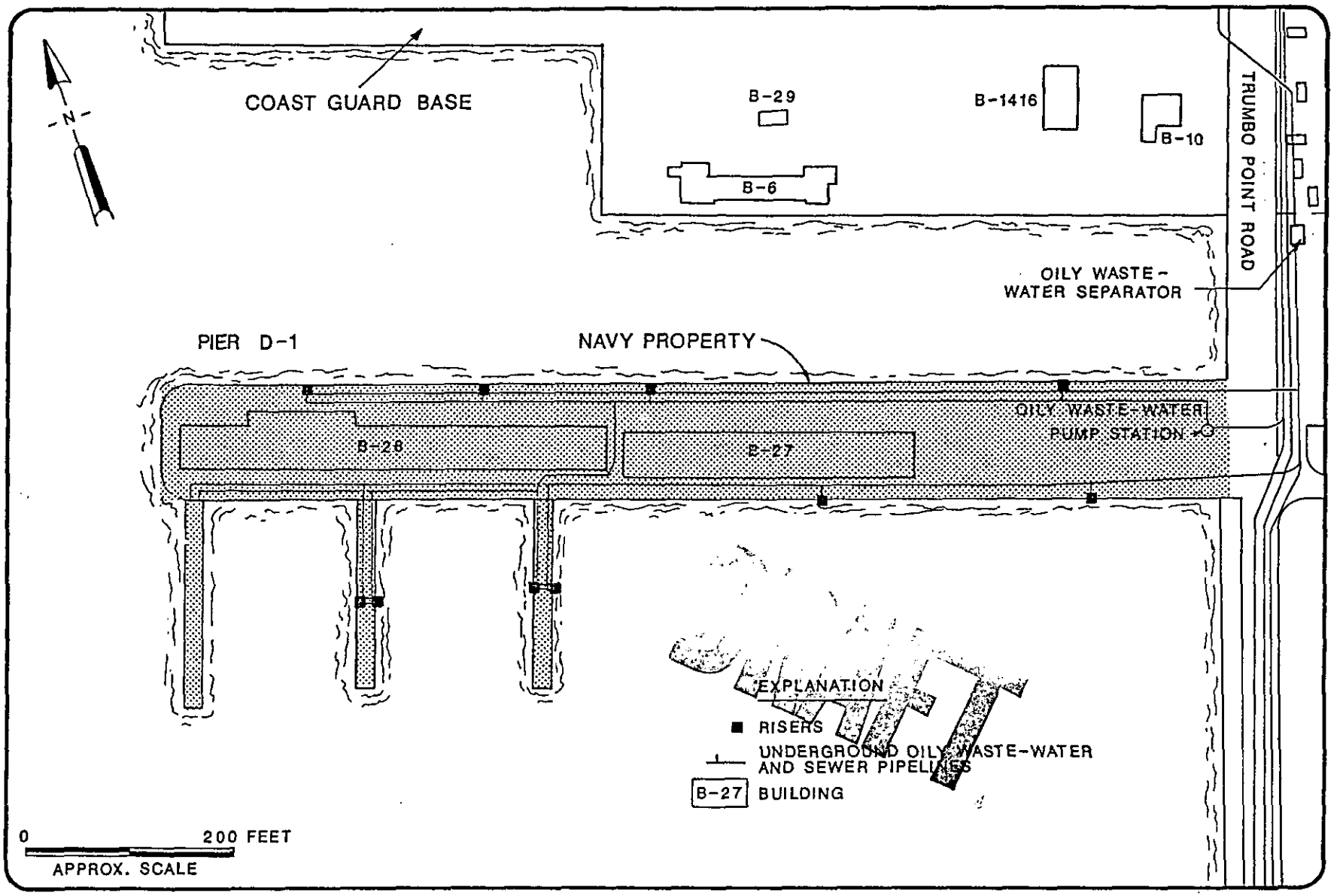

Figure 4.

Pier D-1.

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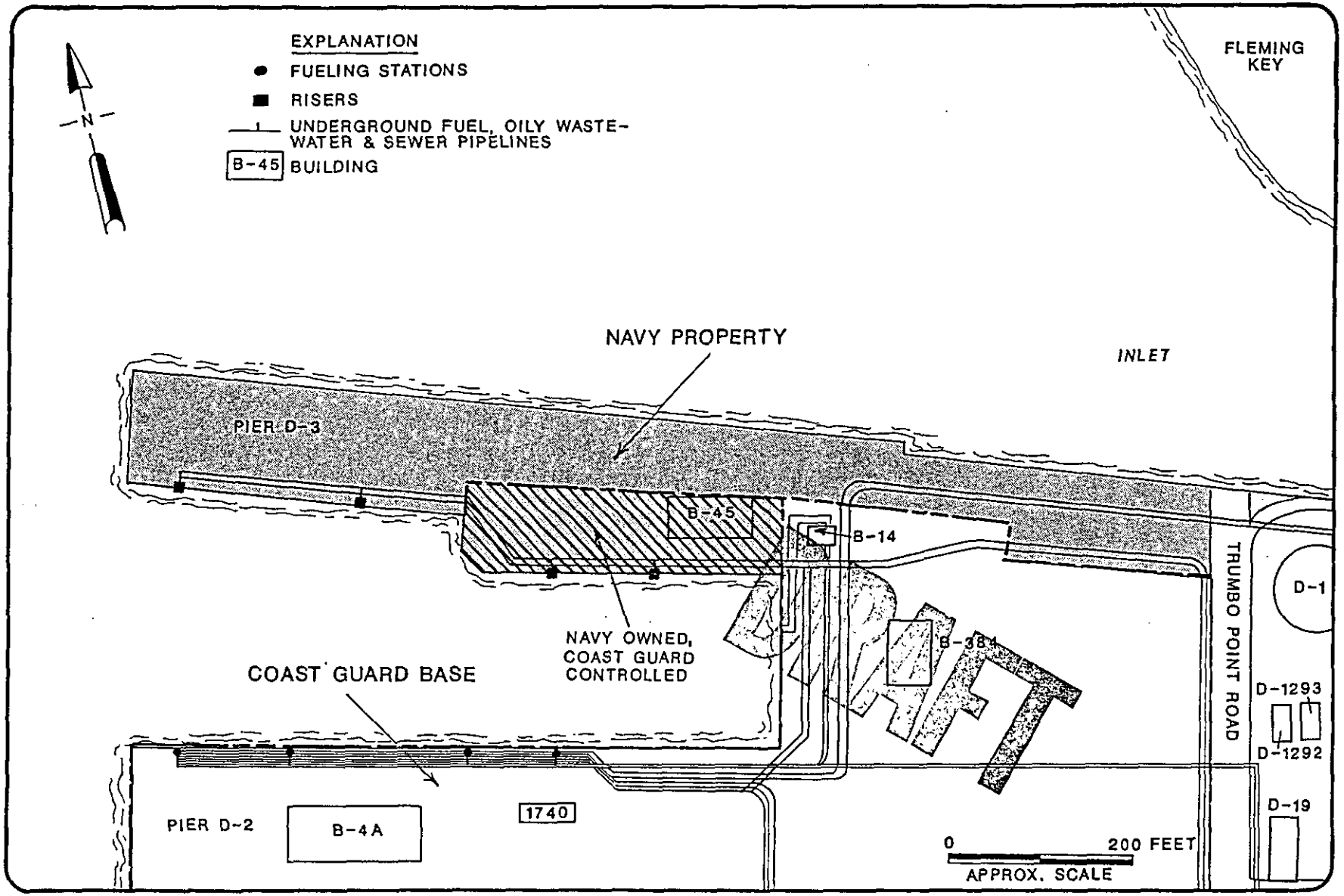

Figure 5.

Pier D-3.

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been conducted at pier D-1 or pier D-3, the Navy requested that more information be gathered about these areas due to past activities and observations of personnel working in these areas (see Warrent Officer Black and Lieutenant McCullogh interviews, Appendix A).

The area surrounding tank D-4 and an area along the sea wall north of tank 2 and an associated recovery pit will be excluded from the ESI/RFI. These areas will be investigated during separate studies as requested by the Navy. Nevertheless, data acquired during the PSI for these areas is included.

EXPANDED SITE INVESTIGATION/REMEDIAL FIELD INVESTIGATION WORK PLAN

Based on the information obtained during the PSI, the following ESI/RFI work plan was prepared. The purpose of the ESI/RFI will be to acquire the data needed to assess the overall vertical and horizontal extent, migration potential of contamination in the subsurface, and to attempt to identify individual plumes and/or sources of contamination. In addition, the investigation will determine the need for any remedial actions.

Components of the investigation will include fuel storage tank and pipeline integrity testing as requested by the Navy; the installation of soil borings; the installation of shallow and deeper monitor wells; surveying to establish horizontal and vertical locations of monitor wells; and sample collection and analysis of ground water, soil, and liquid-phase hydrocarbons recovered from the subsurface. Testing of the shallow aquifer will also be performed to determine hydraulic parameters. Details of this investigation are discussed below.

Fuel Storage Tank and Pipeline Testing

Contamination of ground water by petroleum liquids normally cannot be stopped until the source of the hydrocarbons is found. In order to ascertain whether or not fuel tanks and pipelines owned by the Navy might be continuing sources of contamination at the fuel farm and pier areas, G&M proposes to develop a tank and pipeline integrity/leak testing program using acceptable techniques and procedures. The testing program will be developed in accordance with the criteria set forth in Title 40 CFR Parts 280 and 281, Underground Storage Tanks and Chapter 17-61 FAC, Stationary Tanks. Both regulatory rules stated above include

guidance established by the National Fire Protection Association's publication "Recommended Practice No. 329 Underground Leakage of Flammable and Combustible Liquids 1985." Both sets of regulations recognize "precision tests" (tightness tests) as acceptable practices for such structures as closed tanks and pipelines. In the case of open-top tanks, inventory reconciliation may be the only practical means for release detection.

Because of the absence of as-built drawings of the fuel system's conduits and associated appurtenances, a two-stepped approach will be employed to accomplish this program. This will allow details and the costs of the program to be developed in an accurate manner before actual testing commences, and ensure an end product of meaningful results. The first step would involve a preliminary field reconnaissance and survey of the tanks and pipelines and development of the testing program logistics. The second step will consist of the actual testing program of the structures with recommendations for corrective actions.

The following is a description of the approach:

During Step 1, an on-site detailed inventory and survey of the tanks and pipelines will be conducted by a qualified firm specializing in this type of work. At the request of the Navy, examples of qualified firms that could conduct the varied release detection testing at the fuel farm are:

- Pan Am Environmental, Inc.; Cape Canaveral, Florida
- AMF Tuboscope, Inc.; Houston, Texas
- Tracer Research, Inc.; Tuscon, Arizona

A comprehensive review of all pertinent information relating to the fuel conveyance system will be performed, and interviews will be conducted with personnel directly responsible for the transport and storage of petroleum products at the site. Based on the PSI, it seems that personal local knowledge of the fuel system's components might be the most useful information to be obtained. Any past or recent testing of tanks and pipes and the methods used will be reviewed and documented to determine whether particular segments of the fuel system might be eliminated from the proposed testing program. Basic information on tanks and pipes to be collected will include type of material, diameter of pipes, type of tanks, type of product in tanks, dimensions of tanks and their fill technique. Upon collecting this information, a "working" map will be prepared with a convenient scale showing tanks and underground conduits and associated fittings such as valves. Next, an attempt will be made to field verify the locations of particular structures in question. Field verification may include metal detection devices, physical probing, or possibly excavation. Based on G&M's investigation of this matter, it is possible that testing of some types of tanks with "floating lids" might not be feasible. Emptying of the product and physical examination or inventory reconcilation may be the only practical means of ascertaining the integrity of some tanks. A key element of this effort will be an assessment of the feasibility, practically, and the accessibility of the pipes to determine whether test(s) can actually be conducted.

Upon collection and review of the information, the commercially-available test methods with standard and proven techniques will be investigated to select the appropriate method. In addition, the mechanics and logistics of the tank and pipe testing program will be developed. Techniques to be considered (but not limited to) will include ultrasonic,

tracer, hydrostatic, acoustical, electronic, and physical examination. Criteria to be used for the selection of a testing method(s) are:

- o economical and reliable;
- o applicability to the majority of the pipelines found at Trumbo Point;
- o testing procedures that will have minimum impact to the normal operation of the pipeline; and
- o equipment that can be easily utilized in the field in the presence of grounding cables and other utilities.

A report of findings with a recommended testing program work plan and schedule will be submited to the Navy for their review. Upon finalization and acceptance of the plan, a subcontractor will be employed to implement the testing.

Step 2 will consist of the implementation of this program. Because of the importance of coordinating the testing with Navy and civilian personnel involved with fuel supply at NAS-Key West, it is anticipated that at least two meetings will be necessary; one meeting will be held after the first draft of the testing program work plan is completed, and another meeting should be scheduled just prior to commencing the test program.

Soil Boring/Monitor-Well Installation

A total of 36 soil borings will be installed at the three sites; 23 borings at the Fuel Farm (Figure 6); 6 borings at pier D-1 (Figure 7); and 7 borings at pier D-3 (Figure 8). The locations of the soil borings were proposed in areas previously identified as having liquid-phase or dissolved petroleum hydrocarbons in the subsurface; in areas

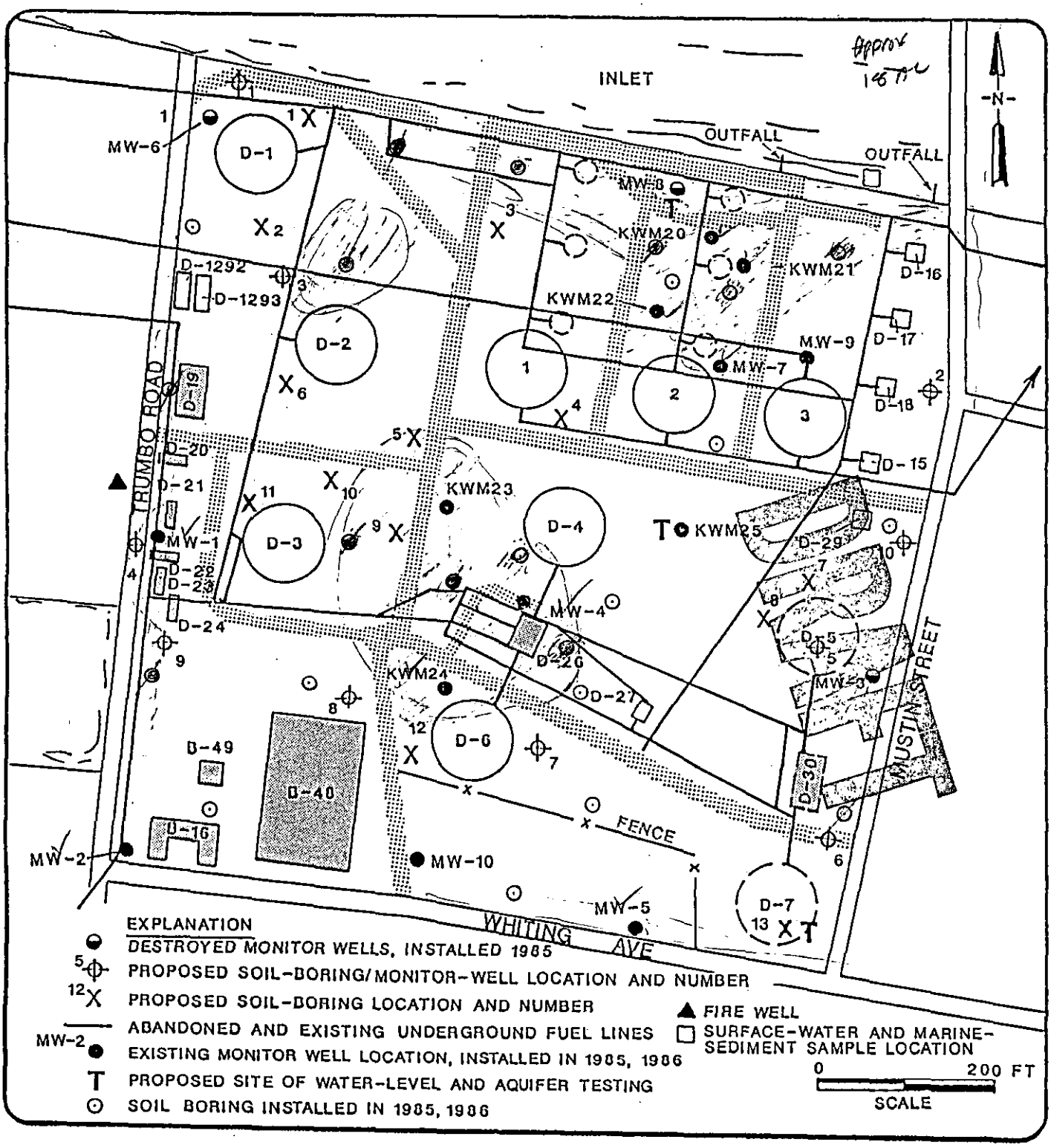

Figure 6.

Proposed Soil Boring/Monitor-Well Locations at the Fuel Farm.

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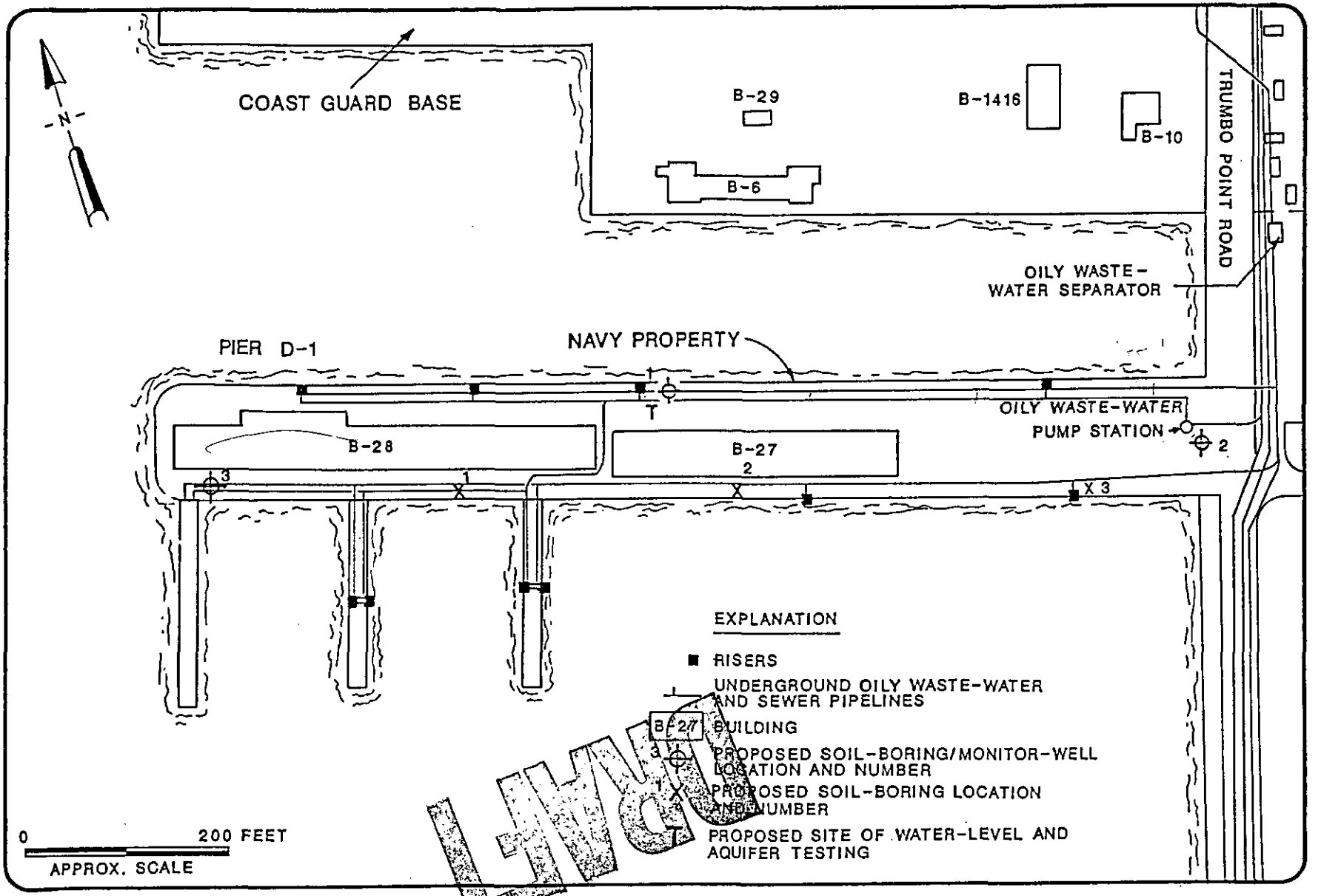

Figue 7.

Proposed Soil Boring/Monitor-Well Locations at Pier D-1.

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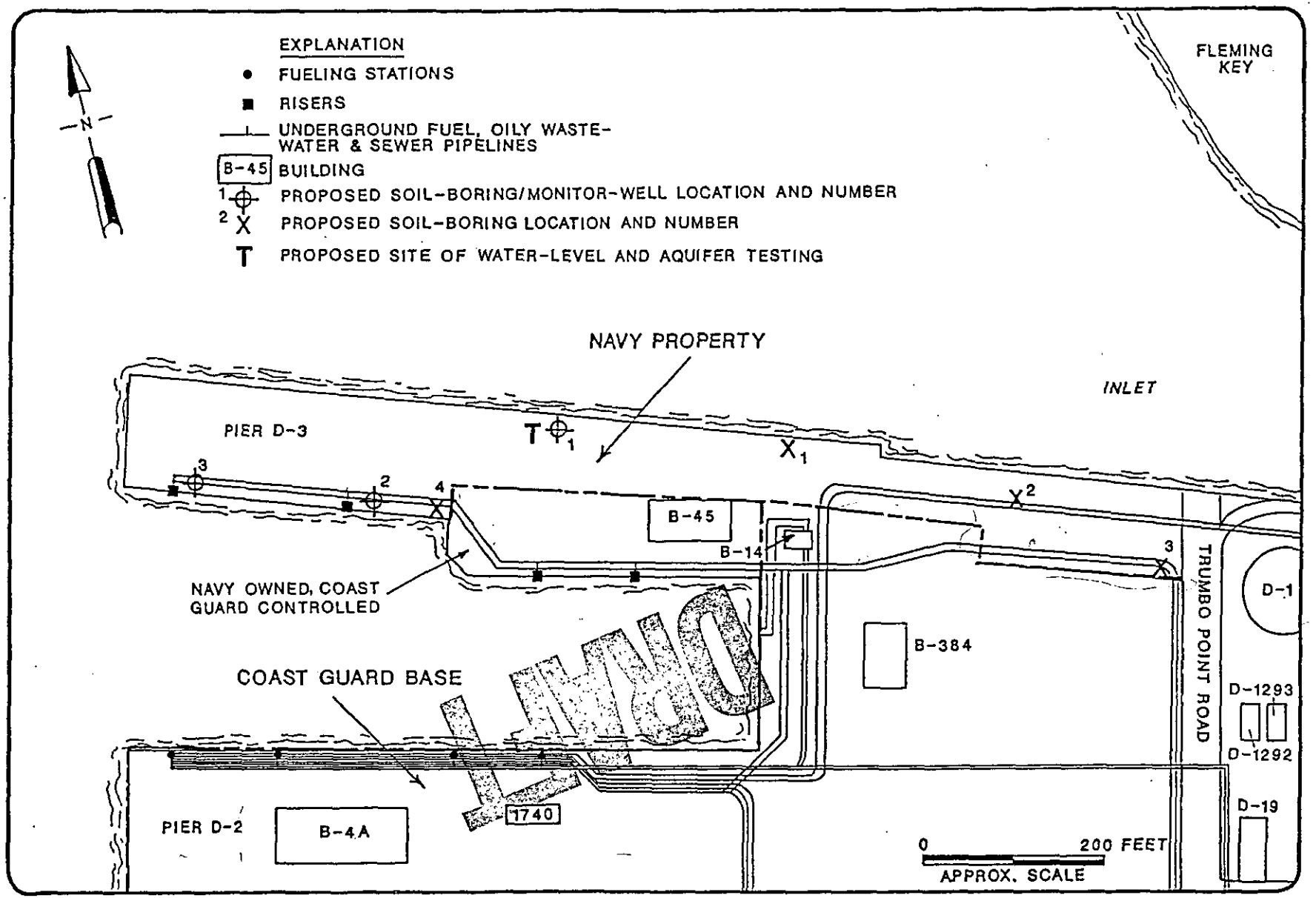

Figure 8.

Proposed Soil Boring/Monitor-Well Locations at Pier D-3.

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adjacent to active, abandoned, or removed pipelines and tanks (according to plans provided to G&M by the Navy); based on results of measurements of hydrocarbon thicknesses during the PSI; on information acquired during the interviewing process of the PSI; and on constraints presented by the physical setting (accessibility by a drill rig) of the project area. Prior to installation of any borings, excavation permits will be obtained from Public Works, NAS-Key West to ensure that underground utilities and structures are not encountered. Table 1 lists the placement rationale for the soil borings and monitor wells shown in Figures 6, 7, and 8. The boring and well numbers in these figures correlate with those listed in Table 1.

The soil borings will be installed by the hollow-stem auger method of drilling. About 32 of the soil borings will be installed to a depth of 18 ft below land surface (bls); the remaining 4 will be installed to about 35 ft bls to determine the lithology of the aquifer at greater depths at each site. Continuous split-spoon samples will be collected during drilling and examined on-site by a geologist to determine the general lithologic characteristics of the soil. All equipment used during drilling and sampling will be steam-cleaned between boreholes to prevent cross-contamination. The presence or absence of hydrocarbons in each sample will be evaluated visually with an Organic Vapor Analyzer, with a TIP (Total Ionizable Pollutants) meter, or with a combustible gas explosimeter so that the degree of contamination at each boring can be estimated. The results of this evaluation will be reported to the Navy. It is planned that 16 of the soil borings will be converted to monitor wells (12 monitor wells to 18 ft bls and 4 monitor wells to 35 ft bls) at the locations shown in Figures 6, 7, and 8. However, selection of the final locations of the monitor wells will be determined based on data collected from the soil borings. The remaining soil borings will be plugged

Table 1. Soil Boring and Monitor-Well Placement Rationale

Soil Boring No.	Monitor Well No.	Placement Rationale
		Fuel Farm (see Figure 6)
1, 2	1	Evaluate water quality adjacent to D-1 and associated pipelines.
3, 4		Evaluate water quality adjacent to tank 1 and associated pipelines.
	2	Evaluate water quality adjacent to tanks and pipelines.
6	3	Evaluate reported release at D-2.
	4	Evaluate extent of liquid-phase hydrocarbon plume at MW-1.
11		Evaluate water quality adjacent to D-3 and associated pipelines.
5, 9, 10		Evaluate extent of liquid-phase hydrocarbon plume at KWM-23 and determine whether it is adjacent to tank D-3.
12	8, 7	Evaluate extent of liquid-phase hydrocarbon plume at KWM-24.
	9	Evaluate water quality in adjacent sumps.
	10	Evaluate water quality adjacent to the pump-house in this area.

Table 1. Continued

Soil Boring No.	Monitor Well No.	Placement Rationale
7, 8, 13	5, 6	Evaluate water quality surrounding the former tanks D-5, D-7, and Building D-30.
		Pier D-1 (see Figure 7)
1, 2, 3	1, 3	Evaluate water quality adjacent to risers and pipelines.
	2	Evaluate water quality adjacent to the sump.
		Pier D-3 (see Figure 8)
1, 2, 3, 4	1, 2, 3	Evaluate water quality conditions adjacent to risers and pipelines and along the sea-wall.

Note: The actual location of the borings and monitor wells may need to be adjusted due to conditions encountered in the field.

and abandoned by filling the borehole with a neat cement grout from the bottom of the hole to land surface. Any soils or drilling fluids produced during well installation will be properly containerized. Composite samples of soils or fluids produced during well installation will be analyzed for ignitability, total recoverable petroleum hydrocarbons, and for selected parameters by the Toxicity Characteristic Leaching Procedure (TCLP) method for volatiles, semi-volatiles, and metals. Analyses for pesticides and poly-chlorinated biphenols (PCB) (TCLP method) will be included for samples of soils and fluids produced during drilling of proposed monitor well no. 4 in the area of building D-21. The results of these analyses will be used to determine the proper method of disposal to be used by NAS-Key West personnel.

During drilling, at least two undisturbed soil samples will be collected from each site (Pier D-1, Pier D-3, and the Fuel Farm) for grain-size analyses and laboratory hydraulic conductivity tests using the "falling head" method. Results of these analyses will provide information about the hydraulic properties of the aquifer at each site.

The shallow monitor wells will be constructed by installing into the borehole a 0.01-inch slot, 2-inch-diameter PVC (15.5-ft-long) screen attached to 2-inch-diameter blank PVC (2.5-ft-long). A graded (20/30 sieve size) silica sand will be emplaced into the annular space between the well casing and borehole to about 2 ft above the top of the well screen. A fine sand cap (0.2-ft thick) will be installed on top of the sand pack. The remaining annular space will be filled with a neat cement grout to about 0.3 ft bls. The monitor well will be fitted with a water-tight cap and a locking manhole cover will be installed into a concrete pad around the top of the well, flush with land surface, to protect the well from vehicular

traffic and vandalism. Construction details for these wells are given in Figure 9.

The deeper monitor wells will be installed adjacent to the shallow wells so that the vertical extent of contamination in the aquifer can be determined. The deeper monitor wells will be constructed using hollow-stem augers to a depth of 35 ft, with a surface casing depth from land surface to 18 ft. The purpose of the surface casing is to prevent potential downward migration of liquid-phase or dissolved hydrocarbons into lower portions of the aquifer during drilling. The surface casing will be installed by drilling a 10-inch-diameter borehole to 18 ft and installing a 17.5-ft-long, 8-inch-diameter, Schedule 40 PVC casing into the borehole. The annular space outside the casing will be filled with a neat cement grout and allowed to set overnight.

Another borehole (6-inch-diameter) then will be drilled through the surface casing to a depth of 35 ft. The monitor well will be constructed inside the surface casing by installing 5 ft of 2-inch-diameter well screen (0.01 inch slot) with 30 ft of 2-inch-diameter, Schedule 40 PVC riser attached at the top into the borehole. The annular space will be filled with a uniformly-graded silica sand (20/30 sieve size) to about 3 ft above the screen. The remaining annular space will be filled with a neat cement grout to about 0.5 ft bls. The monitor well will be fitted with a water-tight cap and a locking manhole cover will be installed into a concrete pad over the top of the well, flush with land surface, to protect the well from vehicular traffic and vandalism. Construction details for these wells are given in Figure 10.

After installation, each monitor well will be properly developed by surging and pumping or air-lifting methods until a sediment-free discharge is obtained. The deeper monitor

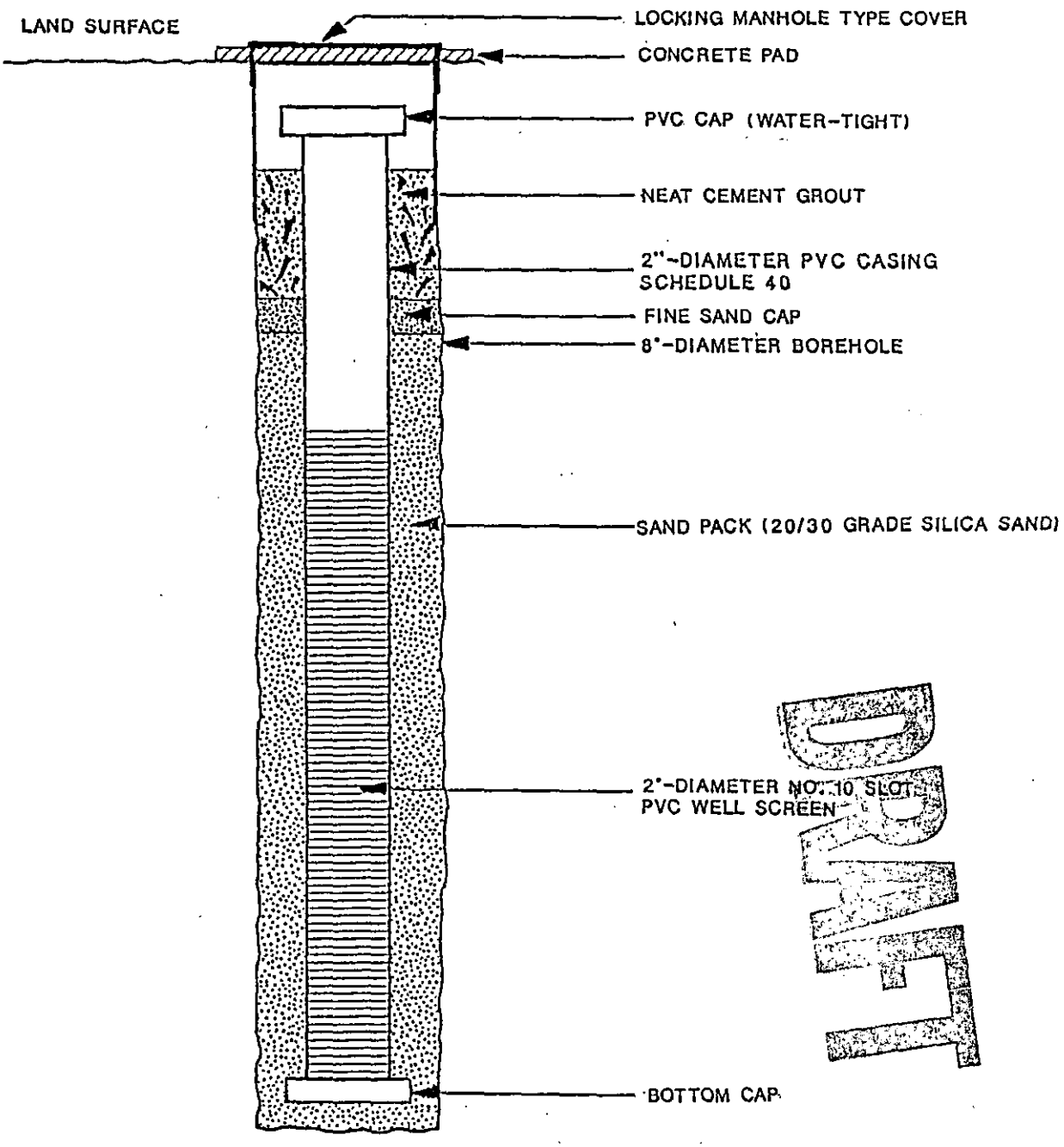

Figure 9.

Construction Diagram of a Typical Shallow Monitor Well.

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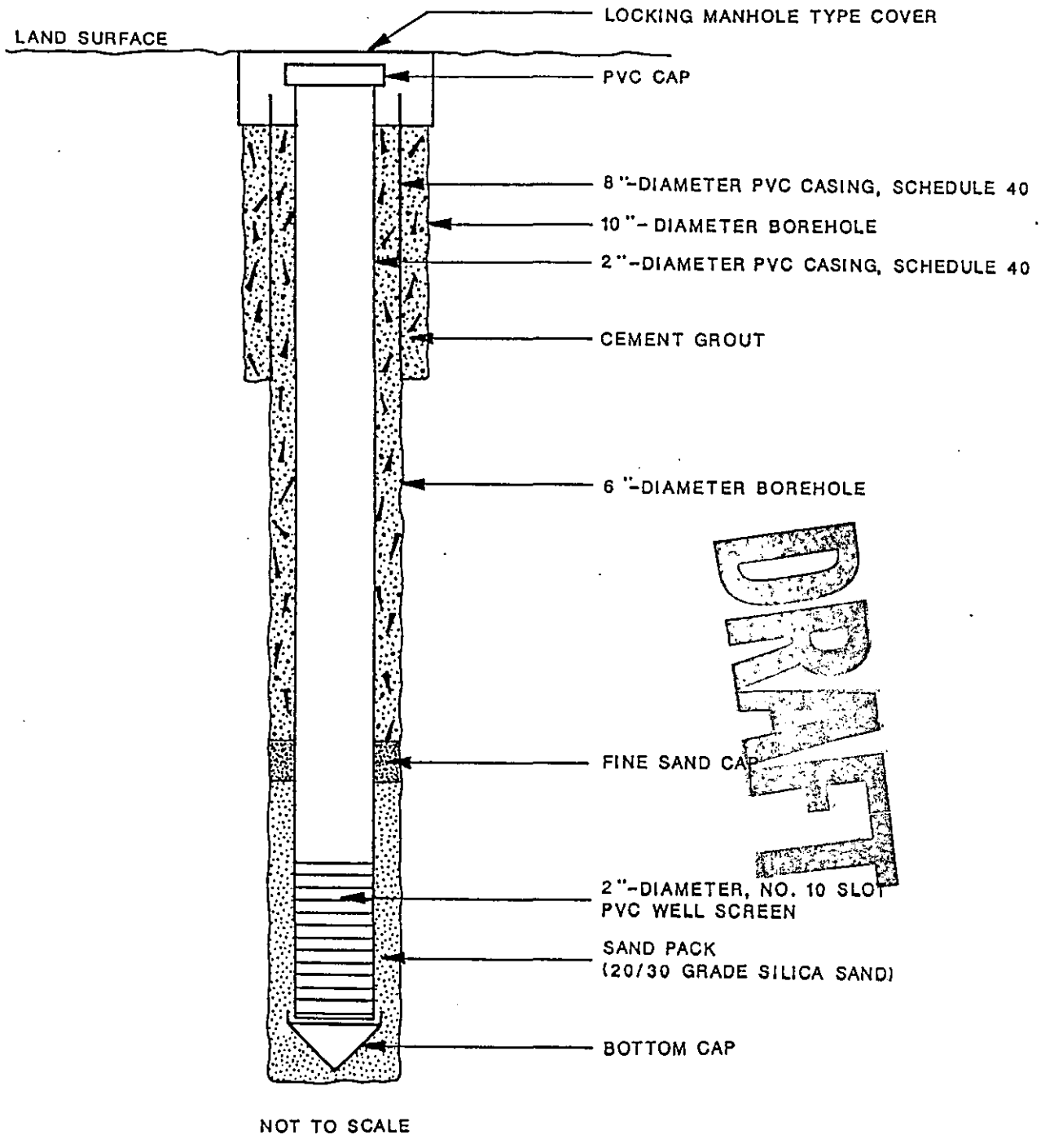

Figure 10.

Construction Diagram of a Typical Deep Monitor Well.

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wells will be pumped at a low rate to avoid pulling down potential contamination from the upper part of the aquifer. Any fluids produced by development will be containerized, and samples will be analyzed by for the same constituents as described for the drilling cuttings and fluids. The results of these analyses will be used to determine the proper method of disposal to be used by NAS-Key West personnel.

Water-Level Measurements and Surveying

A measuring point (top of well casing) will be established on each monitor well and referenced to the vertical datum used by the Navy at NAS-Key West (U.S. Coast and Geodetic survey markers) by a Florida registered professional land surveyor. Ground-water level measurements will be measured in each well on at least two occasions and converted to water-table elevations using this datum in order to determine the direction of shallow ground-water flow. Because past investigations indicated that tidal fluctuations seem to affect ground-water levels at the fuel farm (G&M, June 1985), it is proposed that ground-water levels be continuously monitored in selected wells over at least a one-month period. This will be accomplished by placing a continuously recording transducer in at least three monitor wells at the fuel farm (see Figure 6) and one monitor well at each of the piers (see Figures 7 and 8). The monitor wells that have been proposed for testing were chosen in locations assumed to be representative of the hydrogeologic conditions at each area. However, the wells ultimately chosen for monitoring will be selected subsequent to installation and based on geologic information acquired at that time. An interface probe, capable of detecting both liquid-phase hydrocarbons and water levels, will be used to determine the thickness of any product. The monitor wells also will be surveyed to establish the relative horizontal location of each well using the U.S. Coast and Geodetic survey markers as

a datum. This information will then be used to construct a base map.

As requested by the Navy, G&M will contract a Florida registered professional land surveyor to conduct a topographic survey to establish topographic control and locate significant above-ground structures at Piers D-1, D-3, and at the fuel farm. These data will be used to construct a map (using U.S. Coast and Geodetic Survey markers as datum) that will be used to estimate drainage patterns at the fuel farm. In addition, this information may be used in the design of recovery systems, if required.

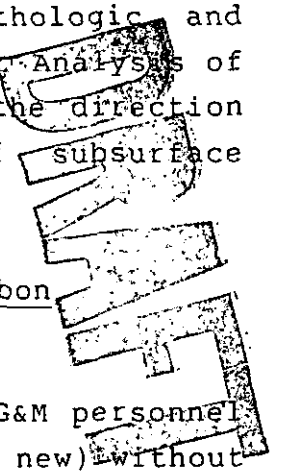
Aquifer Testing

In order to better define the hydraulic characteristics of the aquifer beneath each site, approximately six "slug tests" and one 2-day pumping test will be performed on monitor wells without liquid-phase hydrocarbons. Slug tests will be used to determine in-situ hydraulic conductivity values. These tests will be conducted in individual wells and will be initiated by causing an instantaneous change in the water level in the well through the sudden introduction or removal of a solid cylinder (slug) of known volume. Recovery of the water level with time will then be observed and the data recorded. These data will then be analyzed using the Bouwer and Rice (1976) method and adjusted to compensate for tidal effects.

In addition to the "slug tests", a two-day pumping test will be performed at one of the monitor wells at the fuel farm. The well selected for testing will be pumped at a constant rate over approximately a two-day period. The change in water levels with respect to time (drawdown) in the pumped well and monitor wells in close proximity will be continuously recorded. The data will be analyzed and

adjusted to compensate for tidal effects so that the transmissivity and storativity of the aquifer in this area can be approximated. This test will provide information regarding the response of water levels in the aquifer under long-term pumping conditions. An attempt will be made to choose a well without dissolved or liquid-phase hydrocarbons; however, water produced during pumping will be discharged to the oil/water separator east of Pier D-1 so that it will not have to be containerized for disposal.

The monitor wells proposed for aquifer testing have been designated in Figures 6, 7, and 8. These wells were selected in locations assumed to be representative of a variety of conditions at the sites. However, the final monitor well selection will be made after obtaining lithologic and water-quality data gathered during installation. Analysis of these tests will be used to better understand the direction and migration potential and flow rate of subsurface contamination at each site.



Ground-Water and Liquid-Phase Hydrocarbon Sampling and Analysis

Ground-water samples will be collected by G&M personnel from all of the monitor wells (both existing and new) without liquid-phase hydrocarbon. All appropriate sampling procedures and protocol will be exercised according to the Quality Assurance Project Plan (QAPP). Ground-water samples will be collected with a Teflon[R] bailer and poured into the appropriate containers for shipping to the laboratory. After the sample containers are filled, they will be placed on ice and shipped to an independent laboratory for analysis of volatile organic compounds (purgeable halocarbons and purgeable aromatics) (EPA Methods 601 and 602) and polynuclear aromatic hydrocarbons by EPA Method 610 with confirmation by 625, for total lead (EPA Method 239.2), and

total dissolved solids (EPA Method 160.1). Ground-water samples collected from proposed monitor well no. 4 also will be analyzed for pesticides and PCB (EPA Methods 608 with confirmation by 625). Measurements of temperature, pH, and specific conductance of the water samples will be recorded in the field.

Approximately four liquid-phase hydrocarbon samples will be collected from monitor wells in each suspected plume area for a gas chromatograph/mass spectrometer "finger-printing" analysis to determine the type of petroleum hydrocarbon. This information will assist in determining the possible source(s) of the subsurface contaminants and when compared to the water-quality analyses will help delineate and distinguish between different subsurface plumes.

Analyze Data and Prepare ESI/RFI Report

The data obtained during the ESI/RFI will be compiled and evaluated into a written report. Included in the report will be a discussion of the work performed in the field including the results of ground water and soil analyses, an interpretation of aquifer test data, survey results, contaminant plume delineation, an interpretation of lithologic data, the direction and rate of ground-water movement, and other findings of the investigation. Figures and tables will be used to illustrate these findings. In addition, the results of the Hazardous Ranking System, if deemed necessary by the Navy, will be included.

A health-based risk assessment (RA) will be prepared concurrently with the ESI/RFI report. The objective of the RA is to quantify the public health and environmental risks posed by exposure (dermal contact, ingestion, inhalation) to contaminants in the environmental media (soil, air, ground water, surface water, and marine sediments) surrounding and

within the site. The RA will be based on the analytical results obtained from soil, air, ground water, surface water, and marine sediment samples. These data will be used to derive the public health risk (dose) by calculating the average daily lifetime exposure (for carcinogens) and the chronic daily intake (for noncarcinogens). The evaluation of environmental risks will be made by comparing surface water data to federal water quality criteria (marine chronic and acute toxicity).

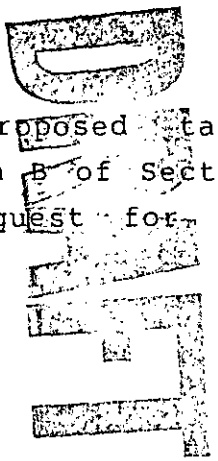
Ground water and soil data collected during the course of the ESI/RFI will be used in the RA; however, these data do not represent all the environmental media necesary to quantify health risks and will require that marine sediment, surface water, and air samples be collected. Approximately five marine sediment and five surface-water samples will be collected from locations best suited to evaluate the worst-case contaminant conditions (Figures 6, 7, and 8). One surface-water sample and one marine sediment sample will be obtained adjacent to the fuel farm near the stormwater outfalls (Figure 6). The remaining surface-water and marine sediment samples will be collected adjacent to risers used to refuel Naval ships at piers D-1 and D-3 (Figures 7 and 8).

All appropriate sampling procedures and protocol will be exercised according to the QAPP. The marine sediment samples will be collected next to the sea walls using a bottom sampling dredge device. The sediment samples will be put in containers, placed on ice, and sent to the laboratory for analysis of volatile organic compounds (EPA Methods 8010, 8020, and polynuclear aromatics by 8270) and for total lead (EPA Method 239.2). Surface-water samples will be obtained using a Teflon^{R} bailer. Water samples will be collected next to the sea-wall in an attempt to obtain a sample representative of the ground water discharged from the facility to the adjacent surface waters. After collection, the samples will

be poured into the appropriate containers and placed on ice for shipping to the laboratory. The samples will be analyzed for volatile organic compounds (purgeable halocarbons and purgeable aromatic hydrocarbons) (EPA Methods 601 and 602) and polynuclear aromatic hydrocarbons by EPA Method 610 with confirmation by EPA Method 625, total lead by EPA Method 239.2, and total dissolved solids by EPA Method 160.1. Temperature, pH, specific conductance, and salinity measurements on the surface-water samples will be immediately obtained and recorded in a field log notebook.

An air sampling program will be conducted around the perimeter of the fuel farm and piers D-1 and D-3 to evaluate air-quality conditions entering and leaving each area. To accomplish this, stations will be set up at approximately 100-ft intervals along the boundary of each area, and air quality will be analyzed using a Photovac portable gas chromatograph. During air sampling, wind direction, approximate velocity and air temperature will be noted. The results of the ESI/RFI and RA reports will determine the neccessity of remedial actions at the site and evaluate the target end points for completing remediation, if required.

PROJECT SCHEDULE



The schedules for completing the proposed tasks described herein will be consistent with Item B of Section III - Submittals and Schedules of the Request for Fee Proposal for Amendment No. 3.

REFERENCE

Bouwer, Herman, and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells: Water Resources Research 12: 423-428.