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NAS KEY WEST  
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CONTAMINATION ASSESSMENT REPORT PHMRON MAINTENANCE RAMP SITE TRUMAN  
ANNEX BUILDING 352 NAS KEY WEST FL  
2/1/1992  
ABB ENVIRONMENTAL SERVICES INC

**CONTAMINATION ASSESSMENT REPORT**

**PHMRON MAINTENANCE RAMP SITE**

**BUILDING 352**

**TRUMAN ANNEX  
NAVAL AIR STATION  
KEY WEST, FLORIDA**

**UIC NO.: N00213**

**CONTRACT NO. 62467-89-D-0317**

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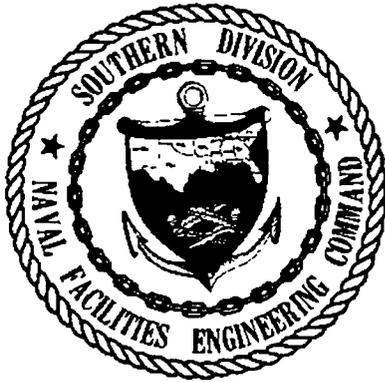
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**FEBRUARY 1992**

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## FOREWORD

Subtitle I of the Hazardous and Solid Waste Amendments (HSWA) of 1984 to the Solid Waste Disposal Act (SWDA) of 1965 established a national regulatory program for managing underground storage tanks (USTs) containing hazardous materials, primarily petroleum products. Prior to 1984, hazardous wastes stored in USTs were regulated under the Resource Conservation and Recovery Act (RCRA) of 1976, an earlier amendment to SWDA. Subtitle I requires the U.S. Environmental Protection Agency (USEPA) promulgate UST regulations. Accordingly, programs were designed by the USEPA to be administered by individual states, allowing each state the alternative to develop more stringent, but not less stringent standards for the management and regulation of USTs than the Federal regulations provided in Subtitle I. Local governments were also permitted to establish regulatory standards that were more stringent, but not less stringent than either State or Federal regulations. The USEPA UST regulations are found in the Code of Federal Regulations, Title 40, Part 280 (40 CFR 280), *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks* and 40 CFR 281, *Approval of State Underground Storage Tank Programs*. 40 CFR 280 was revised and published on September 23, 1988, and became effective December 22, 1988.

It is the policy of the Navy to comply with all Federal, State, and local regulations pertaining to USTs. This report was prepared to satisfy the requirements of the Florida Department of Environmental Regulation (FDER) Chapter 17-770, Florida Administrative Code (FAC), *State Underground Petroleum Environmental Response*, regarding regulations on petroleum contamination.

Questions regarding this report should be addressed to the Commanding Officer, Naval Air Station (NAS) Key West, Florida, or to Southern Division Naval Facilities Engineering Command (SOUTHNAVFAC), Code 18237, at 803-743-0528.

## EXECUTIVE SUMMARY

The PHMRON Maintenance Ramp is located in Truman Annex, Naval Air Station (NAS), Key West. During reconstruction activities in 1989, a 500 gallon underground storage tank (UST) containing diesel fuel was discovered beneath the ramp. Corrosion of the tank wall had occurred to such an extent that diesel fuel was released. The tank was subsequently removed from the site.

A contamination assessment (CA) was performed by ABB Environmental Services Inc. (ABB-ES) in July and August 1991. The objectives of the CA were to identify petroleum contaminants at the site, to assess the degree and extent of petroleum contamination in soils and in the surficial aquifer; and to recommend a feasible course of action, if necessary, to attain compliance within State regulatory constraints.

Four soil borings and three groundwater monitoring wells were installed at the site. Soil and groundwater samples were collected and analyzed for petroleum constituents of the kerosene analytical group. The attached figure shows the locations of the monitoring wells and the results of the laboratory analysis. A Contamination Assessment Report (CAR) was prepared and is attached herewith. The findings, conclusions, and recommendations of the CA are summarized below.

### FINDINGS

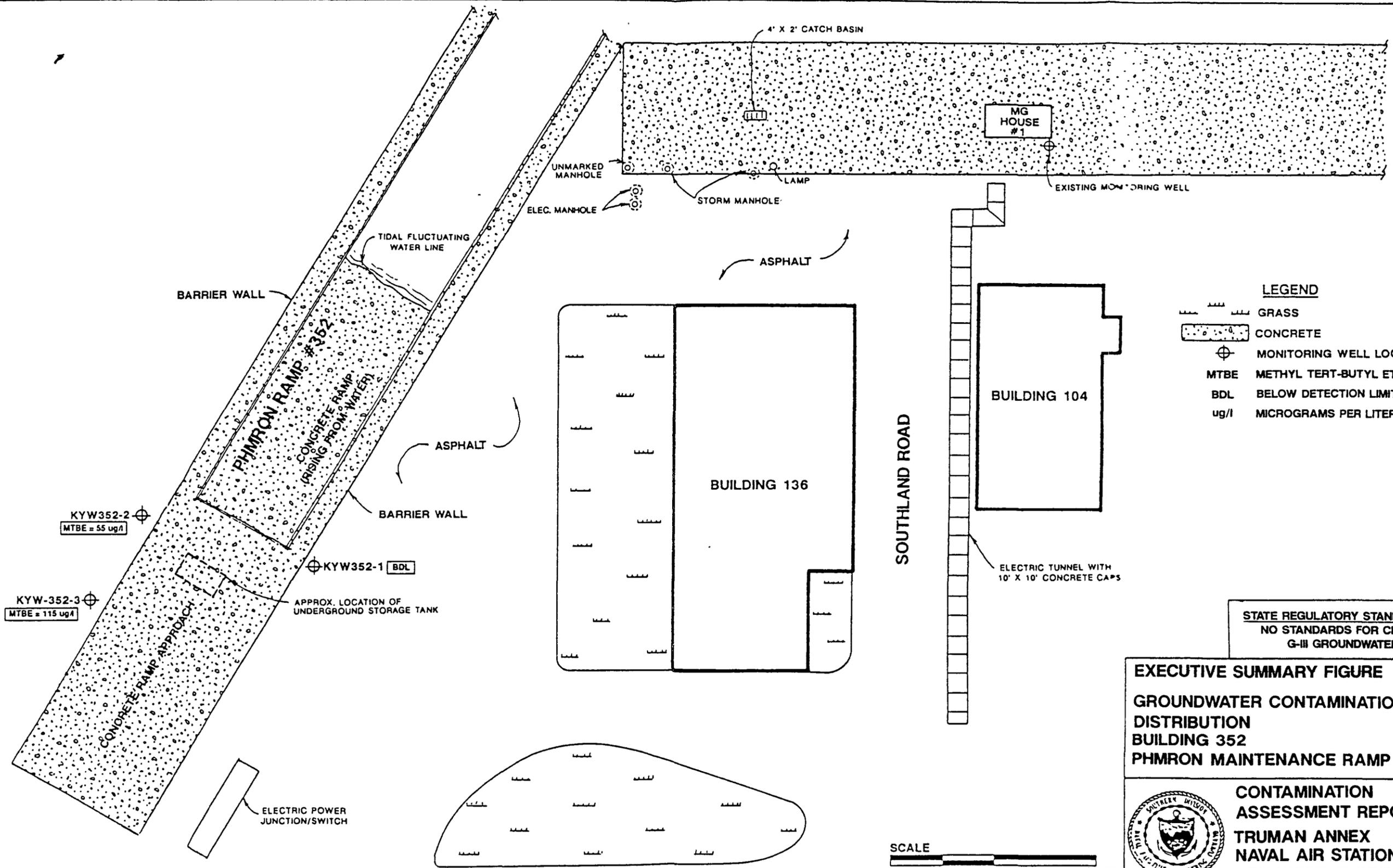
- The source of diesel fuel contamination has been abated. The UST was removed during reconstruction activities at the ramp.
- No excessively petroleum contaminated soils were identified by organic vapor analyzer (OVA) headspace analysis.
- No free product was found at the site.
- No official potable wells are present in the Key West area. Groundwater from the surficial aquifer has been designated as an unlikely source of potable water (McKenzie, 1990), and is designated as a Class G-III non-potable groundwater source.
- The groundwater contaminant methyl tert-butyl ether (MTBE) was detected in two of the monitoring wells. Samples KYW-352-2 and KYW-352-3 had MTBE concentrations of 55  $\mu\text{g}/\text{l}$  and 115  $\mu\text{g}/\text{l}$ , respectively. MTBE concentrations in the downgradient well, KYW-352-1, were below detection limits.
- MTBE is not a constituent of diesel fuel. The source of MTBE contamination is presently unidentified.
- The site area is presently covered with approximately 12 inches of concrete.

## CONCLUSIONS

- The predominant groundwater flow direction in the surficial aquifer is westerly toward the shoreline. The most likely chance for contaminant contact with potential receptors is through seaward migration of groundwater contaminants. The presence of two seawalls at the site will hinder seaward contaminant migration.
- There are no Class G-III regulatory standards that apply to the site.

## RECOMMENDATIONS

- Because the surficial aquifer is a Class G-III non-potable groundwater source and groundwater contamination levels are low, a **No Further Action Proposal (NFAP)** is recommended.

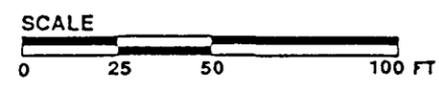


- LEGEND**
- GRASS
  - CONCRETE
  - MONITORING WELL LOCATION
  - MTBE METHYL TERT-BUTYL ETHER
  - BDL BELOW DETECTION LIMITS
  - ug/l MICROGRAMS PER LITER

**STATE REGULATORY STANDARDS**  
NO STANDARDS FOR CLASS G-III GROUNDWATER

**EXECUTIVE SUMMARY FIGURE**  
**GROUNDWATER CONTAMINATION DISTRIBUTION**  
**BUILDING 352**  
**PHMron MAINTENANCE RAMP**

**CONTAMINATION ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**



## ACKNOWLEDGEMENTS

In preparing this report, the Underground Storage Tank Section of the Comprehensive Long-Term Environmental Action Navy (CLEAN) Group at ABB-ES commends the support, assistance, and cooperation provided by the personnel at NAS Key West, Florida, and Southern Division, Naval Facilities Engineering Command. In particular, ABB-ES acknowledges the effort, dedication, and professionalism provided by the following people during the investigation and preparation of this report.

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## ACRONYMS, INITIALISMS, AND ABBREVIATIONS

The following list contains many of the acronyms, initialisms, abbreviations, and units of measure that may be used in this report.

ABB-ES	ABB Environmental Services Inc.
BDL	below detection limits
BTEX	benzene, toluene, ethylbenzene, and xylenes
bls	below land surface
CA	Contamination Assessment
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CFR	Code of Federal Regulations
CompQAPP	Comprehensive Quality Assurance Program Plan
CNO	Chief of Naval Operations
CTO	Contract Task Order
EDB	ethylene dibromide
FAC	Florida Administrative Code
FDER	Florida Department of Environmental Regulations
FID	flame ionization detector
ft/day	feet per day
ft <sup>2</sup> /day	feet squared per day
gpd/ft	gallons per day per foot
HSWA	Hazardous and Solid Waste Amendments of 1984
msl	mean sea level
MOP	Monitoring Only Plan
MTBE	methyl-tert-butyl ether
NAS	Naval Air Station
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOFAP	No Further Action Plan
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbons
POA	Plan of Action
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
SOUTHNAVFAC	Southern Division Naval Facilities Engineering Command
SPT	standard penetration test
SWDA	Solid Waste Disposal Act of 1965
TDS	total dissolved solids
TRPH	total recoverable petroleum hydrocarbons
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter
UIC	unit identification code
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
VOA	volatile organic aromatics
1,2-DCA	1,2- dichloroethane

## 1.0 INTRODUCTION

ABB Environmental Services Inc. (ABB-ES) was contracted by the Naval Facilities Engineering Command, Southern Division (SOUTHNAVFAC) to perform a contamination assessment (CA) and submit a Contamination Assessment Report (CAR) for the PHMRON maintenance ramp, Naval Air Station (NAS), Key West, Florida. During reconstruction of the ramp in 1989, a 500-gallon diesel fuel underground storage tank (UST) was discovered under the ramp approach. Corrosion of the tank had resulted in the discharge of diesel fuel. Although the UST was removed, an additional site investigation was required to identify petroleum contaminants present at the site and to assess the extent of contamination.

The scope of services provided by ABB-ES to SOUTHNAVFAC during the CA were defined by and performed under Contract Task Order (CTO) No. 007, the Plan of Action (POA), and the Contamination Assessment Plan (CAP), and included the following:

- installing soil borings and monitoring wells,
- analyzing groundwater and soil samples to assess the extent of soil and groundwater petroleum contamination (no deep monitoring well was installed because of the low levels of contamination and the Class G-III groundwater),
- collecting water level data,
- conducting an inventory of potable wells within a 1/4-mile radius of the site,
- performing slug tests on select wells to estimate aquifer characteristics, and
- reducing and analyzing data gathered during the CA to complete this CAR.

The assessment under this contract was conducted during August 1991. The following sections of the report present the background information, investigative methodologies, data compilation, results, conclusions, and recommendations of the CAR.

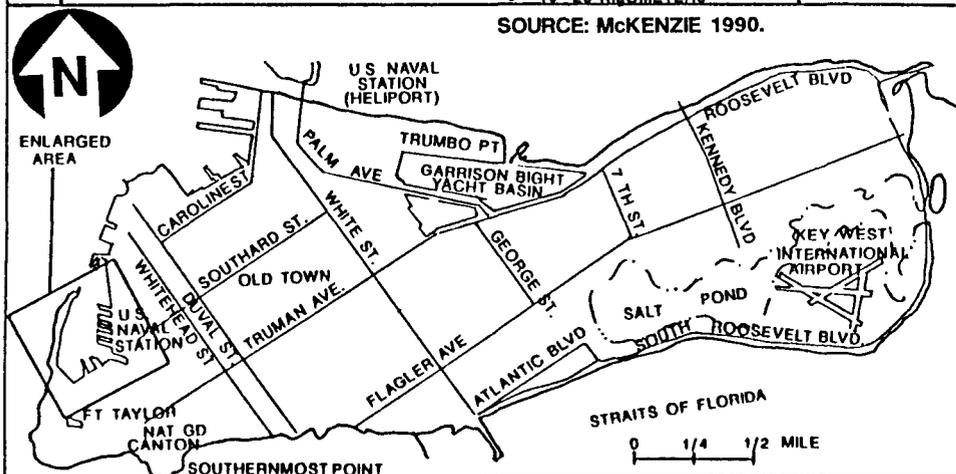
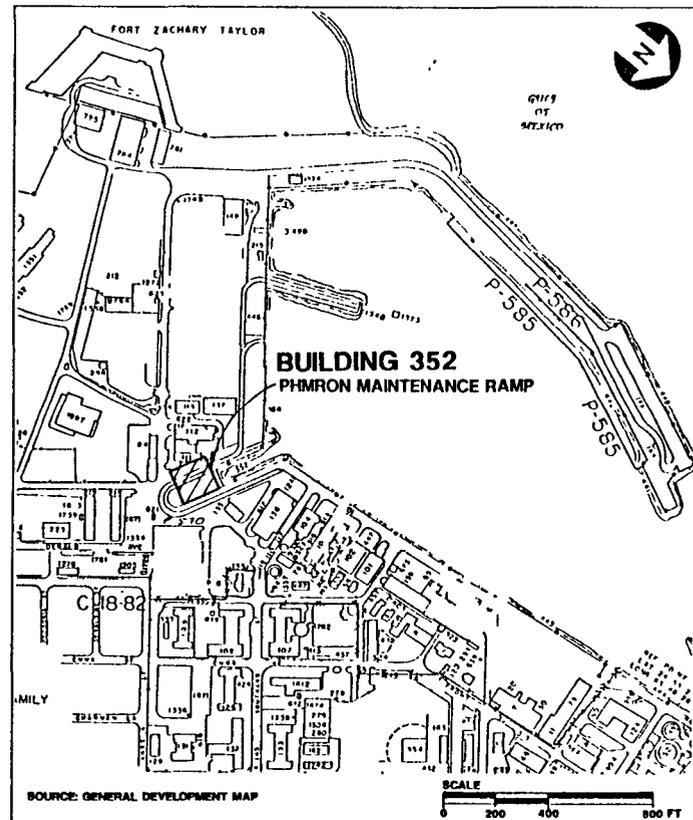
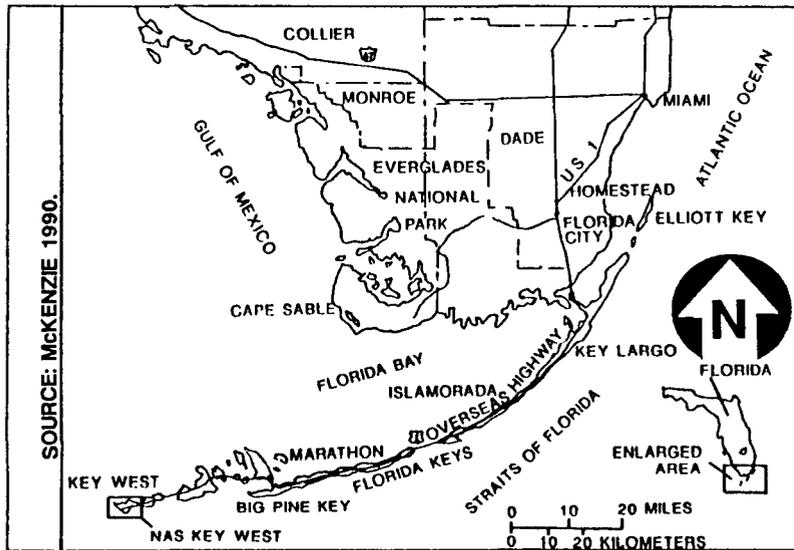
## 2.0 SITE BACKGROUND

### 2.1 SITE DESCRIPTION

Naval Air Station Key West (NAS Key West) is located approximately 150 miles southwest of Miami in Monroe County, Florida (Figure 2-1). NAS Key West, a complex of activities located in numerous areas of the Lower Florida Keys, encompasses approximately 5,000 acres. The majority of these activities are concentrated on Boca Chica Key and Key West. The mission of NAS Key West is to maintain and operate facilities and provide services and materials to support operations of aviation activities and units designated by the Chief of Naval Operations (CNO). The site is located on Key West at the PHMRON maintenance ramp south of Building 136 in Truman Annex (Figure 2-2). The former location of the UST is under the concrete approach of the maintenance ramp. The area surrounding the ramp is covered with asphalt.

### 2.2 SITE HISTORY

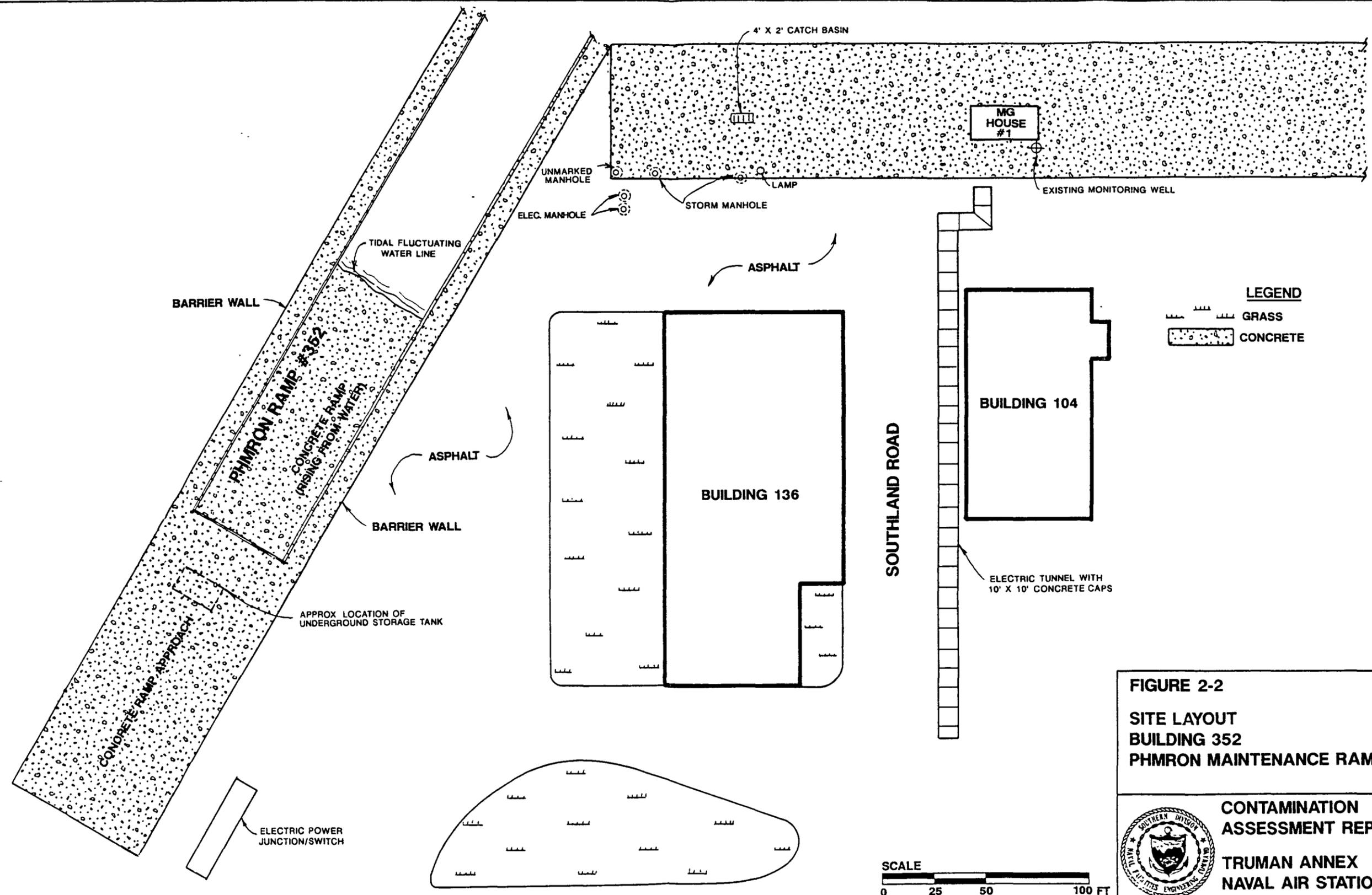
During reconstruction of the ramp in 1989, a diesel fuel UST was discovered at the site. The tank was removed from the site; however, corrosion of the tank was observed by workers to have resulted in the discharge of diesel into the soils and groundwater. The area above the former UST location was resurfaced with concrete.



**FIGURE 2-1**  
**FACILITY LOCATION MAP**  
**BUILDING 352**  
**PHMRON MAINTENANCE RAMP**



**CONTAMINATION**  
**ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**



**LEGEND**  
 GRASS  
 CONCRETE

**FIGURE 2-2**  
**SITE LAYOUT**  
**BUILDING 352**  
**PHMRON MAINTENANCE RAMP**

**CONTAMINATION ASSESSMENT REPORT**  
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**SCALE**  
 0 25 50 100 FT

### 3.0 SITE CONDITIONS

#### 3.1 PHYSIOGRAPHY

Regional physiography is discussed in Appendix A. The site lies within the southern or distal geomorphic zone of Florida (White, 1970). Ground elevations at the Truman Annex site are approximately 10 feet above mean sea level.

#### 3.2 HYDROGEOLOGY

3.2.1 Regional. Regional hydrogeology is discussed in Appendix A.

3.2.2 Site Specific. Site-specific hydrogeologic characteristics were predominantly obtained from information gleaned during soil boring and monitoring well installation. The surficial aquifer is the only aquifer of concern in the Key West area. The surficial aquifer in the Key West area is unconfined. The water table is found at shallow depths at the site, occurring from 6 to 7 feet below land surface (bls) during this investigation. Groundwater flow direction in the surficial aquifer is predominantly to the west.

The site is underlain by light gray, silty, fossiliferous, weathered limestone. The limestone is present to the total depth of 14 feet penetrated by borings and monitoring wells at the site. Fill material, composed of coarse-grained, light gray sand, which contains some shell fragments, overlies the limestone in one site well. A geologic description and complete lithologic logs for all site monitoring wells are presented in Appendix B.

## 4.0 METHODOLOGIES AND EQUIPMENT

### 4.1 SOIL BORING PROGRAM

Soil borings were placed adjacent to the former location of the diesel UST. Because of the specialized concrete and special high load-bearing requirements for the ramp structure, the limits of the investigation were restricted by Naval personnel to the ramp edges. Four soil borings were drilled into the water table to assess the degree and extent of soil contamination, to identify the type of subsurface material, and to aid in placement of subsequent groundwater monitoring wells. Soil boring locations are shown in Figure 4-1 and are designated with the prefix "SB". Soil samples collected from each borehole were analyzed on an organic vapor analyzer (OVA) and screened with a field gas chromatograph (GC). The results of the soil boring program are discussed in Section 5.2 of this report.

### 4.2 MONITORING WELL INSTALLATION PROGRAM

Three, 2-inch-diameter monitoring wells were installed using a hollow-stem auger drill rig. Monitoring wells were drilled to a depth of 14 feet. Monitoring well locations are shown in Figure 4-1 and are designated with the prefix "KYW-352". Monitoring well construction methodologies and materials are discussed in Appendix C.

### 4.3 GROUNDWATER ELEVATION SURVEY

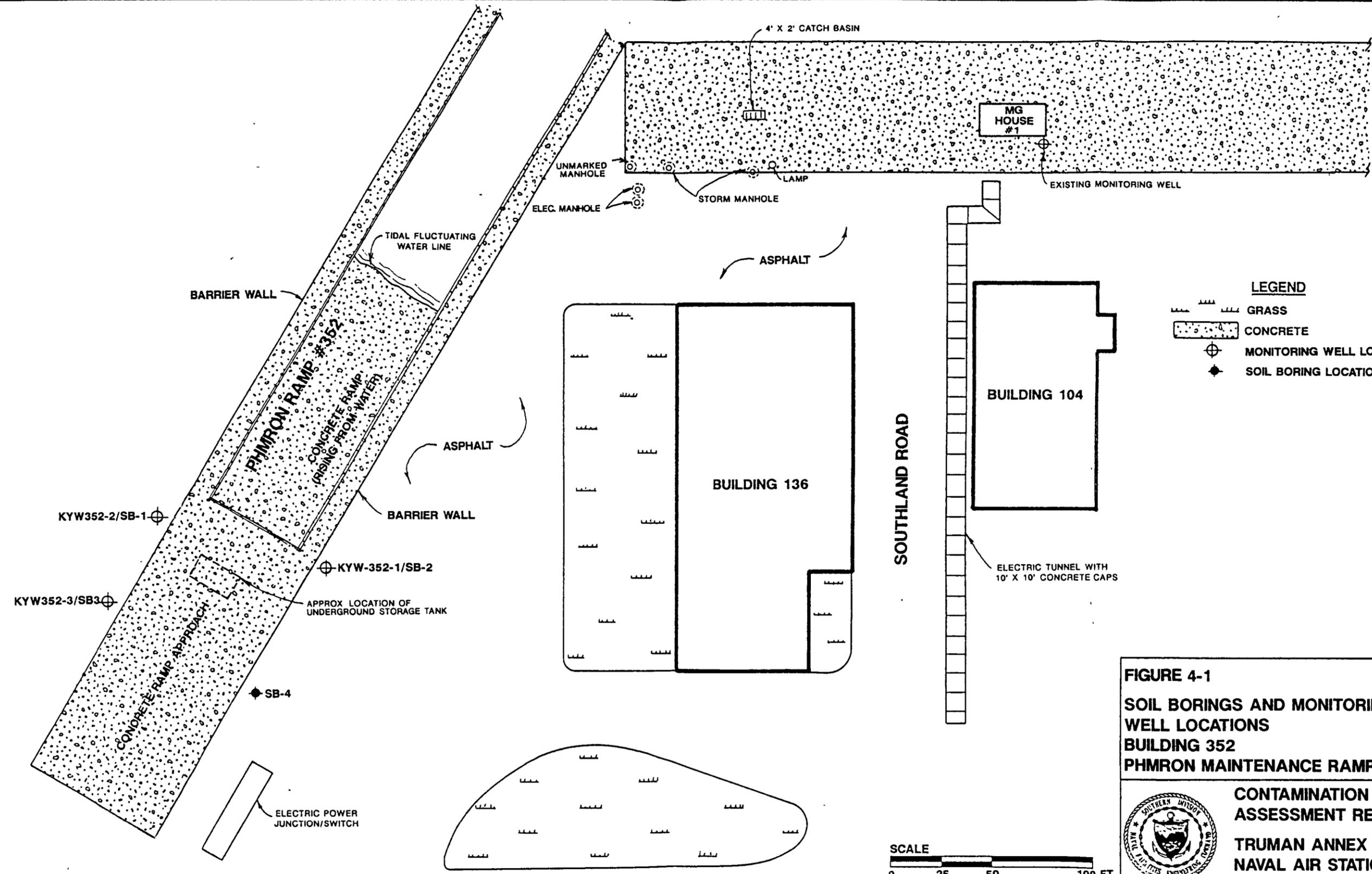
The elevation and slope of the water table were estimated by surveying the top of the well casing for each monitoring well to a common reference datum. No benchmark could be located in the area; therefore, an arbitrary reference elevation of 10.00 feet was established at the top-of-casing for monitoring well KYW-189-1. To assess the effects of tidal fluctuations, groundwater levels were measured over an 8-hour period on August 13, 1991. Procedures for groundwater level measurements are contained in Appendix C.

### 4.4 GROUNDWATER SAMPLING PROGRAM

Groundwater samples were collected from site monitoring wells on August 14, 1991. Sampling procedures followed the guidelines set forth in the Florida Department of Environmental Regulation (FDER) approved Comprehensive Quality Assurance Program Plan (CompQAPP) of ABB-ES. The appropriate number of field blanks, equipment blanks, and duplicates were collected. Samples were sent, under chain of custody, to Wadsworth/Alert Laboratories in Tampa, Florida. Procedures for collection of groundwater samples are presented in Appendix C.

### 4.5 AQUIFER SLUG TESTS

Aquifer slug tests were performed on monitoring wells KYW-352-1 and KYW-352-3 to assess the hydraulic conductivity of the surficial aquifer. Slug test procedures are discussed in Appendix C.



**LEGEND**

	GRASS
	CONCRETE
	MONITORING WELL LOCATION
	SOIL BORING LOCATION

**FIGURE 4-1**  
**SOIL BORINGS AND MONITORING**  
**WELL LOCATIONS**  
**BUILDING 352**  
**PHMIRON MAINTENANCE RAMP**

**CONTAMINATION**  
**ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**



## 5.0 CONTAMINATION ASSESSMENT RESULTS

### 5.1 AQUIFER CHARACTERISTICS AND HYDROGEOLOGIC PARAMETERS

The slug test analyses indicate an average horizontal hydraulic conductivity of 10 feet per day (ft/day) and 7.6 ft/day for wells KYW-352-1 and KYW-352-3, respectively. The average hydraulic conductivity for the two slug test results is 8.8 ft/day. This value correlates with the hydraulic conductivity of a silty sand to clean sand (Freeze and Cherry, 1979).

Hydraulic gradients were assessed for both low tide and high tide periods. The calculated hydraulic gradients vary from  $1.0 \times 10^{-3}$  at low tide to  $2 \times 10^{-3}$  at high tide. The average hydraulic gradient for the high and low tide measurements is  $1.5 \times 10^{-3}$  or approximately 8 feet per mile (ft/mile). The calculated hydraulic gradients are significantly higher than the hydraulic gradients reported by McKenzie (1990) for the Key West area, which ranged from 1 to 4 ft/mile.

Calculated average pore water velocity in the surficial aquifer varies from  $5.2 \times 10^{-2}$  ft/day to  $6.8 \times 10^{-2}$  ft/day. Transmissivity varies from  $5.5 \times 10^1$  feet squared per day ( $\text{ft}^2/\text{day}$ ) to  $7.2 \times 10^1$   $\text{ft}^2/\text{day}$ .

Presented in Appendix D are the slug test results and aquifer calculations.

### 5.2 CONTAMINATION ASSESSMENT AND CHARACTERIZATION

**5.2.1 Soil Assessment.** Soil samples collected with a split-spoon sampler from soil borings and monitoring well borings underwent OVA headspace analysis. Samples were collected immediately above the soil groundwater interface. For kerosene analytical group constituents, excessively contaminated soils are defined in Chapter 17-770, FAC as those having OVA detected concentrations in excess of 50 parts per million (ppm) and must be remediated. Soils having OVA concentrations between 10 ppm and 50 ppm may require remediation, and soils with OVA concentrations below 10 ppm do not require remediation (FDER, 1991). No petroleum contaminated soils (>50 ppm) were identified by OVA headspace analysis.

**5.2.2 Groundwater Assessment.** Water quality field parameters were measured for each monitoring well installed during the field investigation. In summary, the pH ranged from 7.19 to 7.45 standard units and the specific conductance ranged from 2,210 to 2,830  $\mu\text{mhos}/\text{cm}$ .

Pursuant to FDER Chapter 17-770, Florida Administrative Code (FAC), groundwater samples were analyzed for United States Environmental Protection Agency (USEPA) Methods 418.1, 601, 602, 610 (reported on laboratory sheets as Method 625), ethylene dibromide, and lead. Groundwater analytical results are attached in Appendix E.

Table 5-1 summarizes groundwater analytical results. No free product was found in any monitoring well. Methyl tert-butyl ether (MTBE) was the only contaminant detected in the groundwater. MTBE concentrations were 55 ppm and 115 ppm in samples collected from wells KYW-352-2 and KYW-352-3, respectively. MTBE was not

**TABLE 5-1**  
**SUMMARY OF GROUNDWATER ANALYTICAL RESULTS, AUGUST 14, 1991, SAMPLING EVENT**  
**PHMRON MAINTENANCE RAMP, BUILDING 352, TRUMAN ANNEX**

COMPOUND	MONITORING WELL IDENTIFICATION					
	KYW-352-1	KYW-352-2	KYW-352-3	EQUIPMENT BLANK	TRIP BLANK	FIELD BLANK
Laboratory Designation:	PRMW-1	PRMW-2	PRMW-3			
<b>PURGABLE AROMATICS, ug/L</b>						
Methylene chloride	BDL	BDL	BDL	1	BDL	8
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	27
Methyl tert-butyl ether (MTBE)	BDL	55	115	BDL	BDL	BDL

**Notes**

BDL = Below Detection Limit

ug/L = micrograms per liter

State regulatory standards do not apply to Class III groundwater

Laboratory data sheets are included in Appendix A

detected in well KYW-352-1. Figure 5-1 shows MTBE groundwater contamination levels at the site. Since MTBE is not a constituent of diesel fuel, the source of contamination is presently unidentified.

**5.2.3 Tidal Influence Study.** On August 13, 1991, an 8-hour tidal influence study was conducted at the site. The purpose of the study was to observe water level fluctuations over a higher high water and lower low water tidal event and to determine the impact of the fluctuations on groundwater flow directions. Over the course of the study, water level measurements were obtained from each monitoring well. Table 5-2 summarizes groundwater elevation data collected from onsite monitoring wells during the study. In summary, water level elevations and flow directions were shown to be affected by tidal fluctuations. Figures 5-2, 5-3, 5-4, and 5-5 show the change in configuration of the surficial aquifer and the resulting changes in the direction of groundwater flow. At low tide, the direction of groundwater flow is to the northeast. At high tide, the direction of groundwater flow is to the southwest.

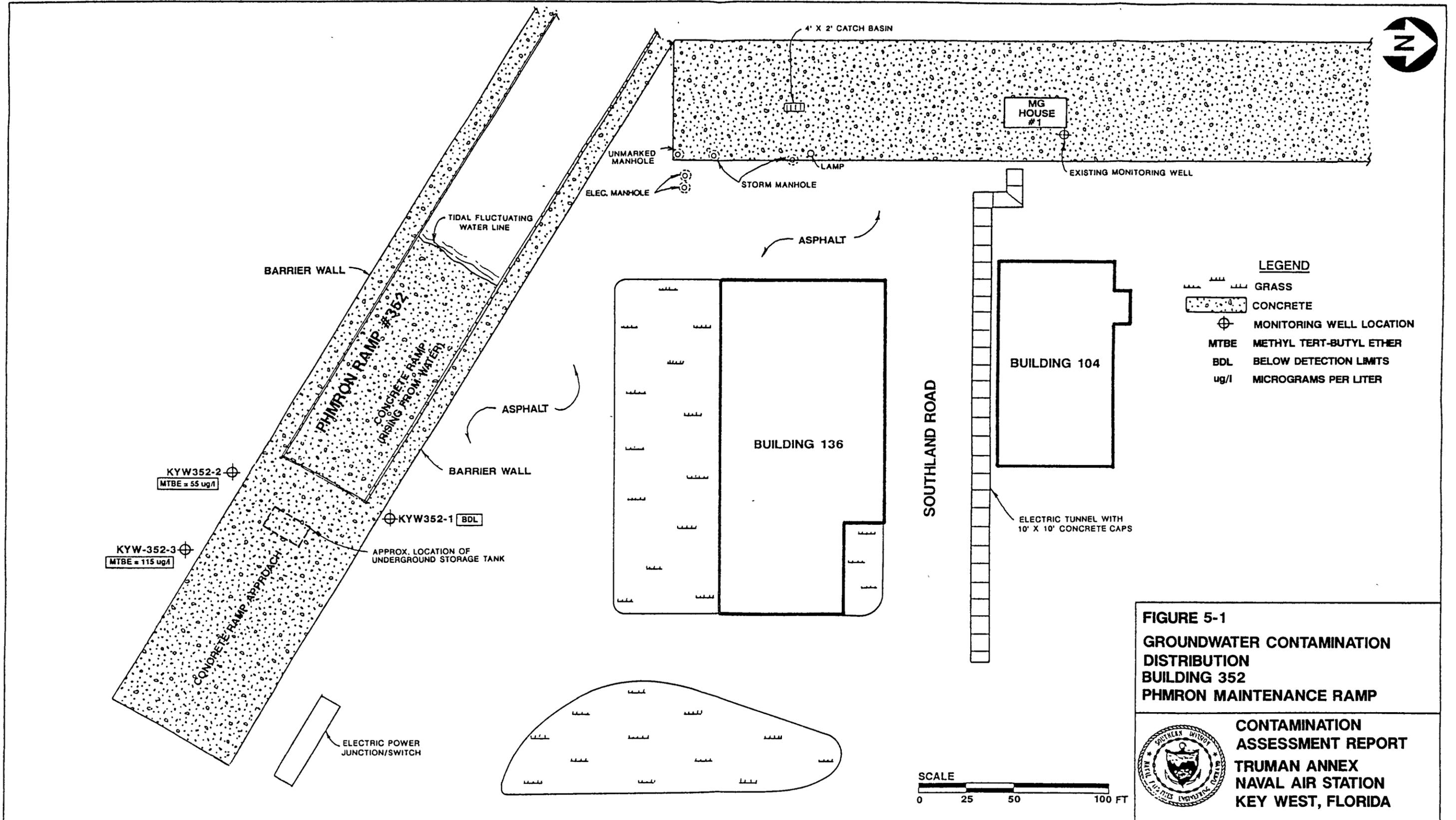
Graphs of water level elevations versus time for each well monitored during the study are in Appendix F. The predicted high and low tides based on information from tide table published by the U.S. Commerce National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (1990) are shown on each graph.

### 5.3 POTABLE WELL SURVEY AND GROUNDWATER CLASSIFICATION

There are no official potable wells in the Key West area. Potable water in the area is imported from mainland Florida through the Florida Keys Aqueduct. The volume of fresh groundwater in the Key West area is limited. Small lenses of fresh groundwater exist in the Key West area, but these lenses are subject to saltwater intrusion (Black, Crow, and Eidness, 1977).

Groundwater in the Key West area is classified as G-III groundwater for the following reasons.

- There are no official potable wells in the Key West area.
- Water quality data indicate that the surficial aquifer is an unlikely potable water source (McKenzie, 1990).
- Total dissolved solid concentrations (TDS) in the water table aquifer are often in excess of 10,000 parts per million (ppm) (McKenzie, 1990).



KYW352-2  
MTBE = 55 ug/l

KYW-352-3  
MTBE = 115 ug/l

KYW352-1 BDL

APPROX. LOCATION OF UNDERGROUND STORAGE TANK

SOUTHLAND ROAD

BUILDING 104

BUILDING 136

MG HOUSE #1

BARRIER WALL

BARRIER WALL

ASPHALT

ASPHALT

PHMRON RAMP #352  
CONCRETE RAMP  
(RISING FROM WATER)

CONCRETE RAMP APPROACH

TIDAL FLUCTUATING WATER LINE

UNMARKED MANHOLE  
ELEC. MANHOLE

STORM MANHOLE

4' X 2' CATCH BASIN

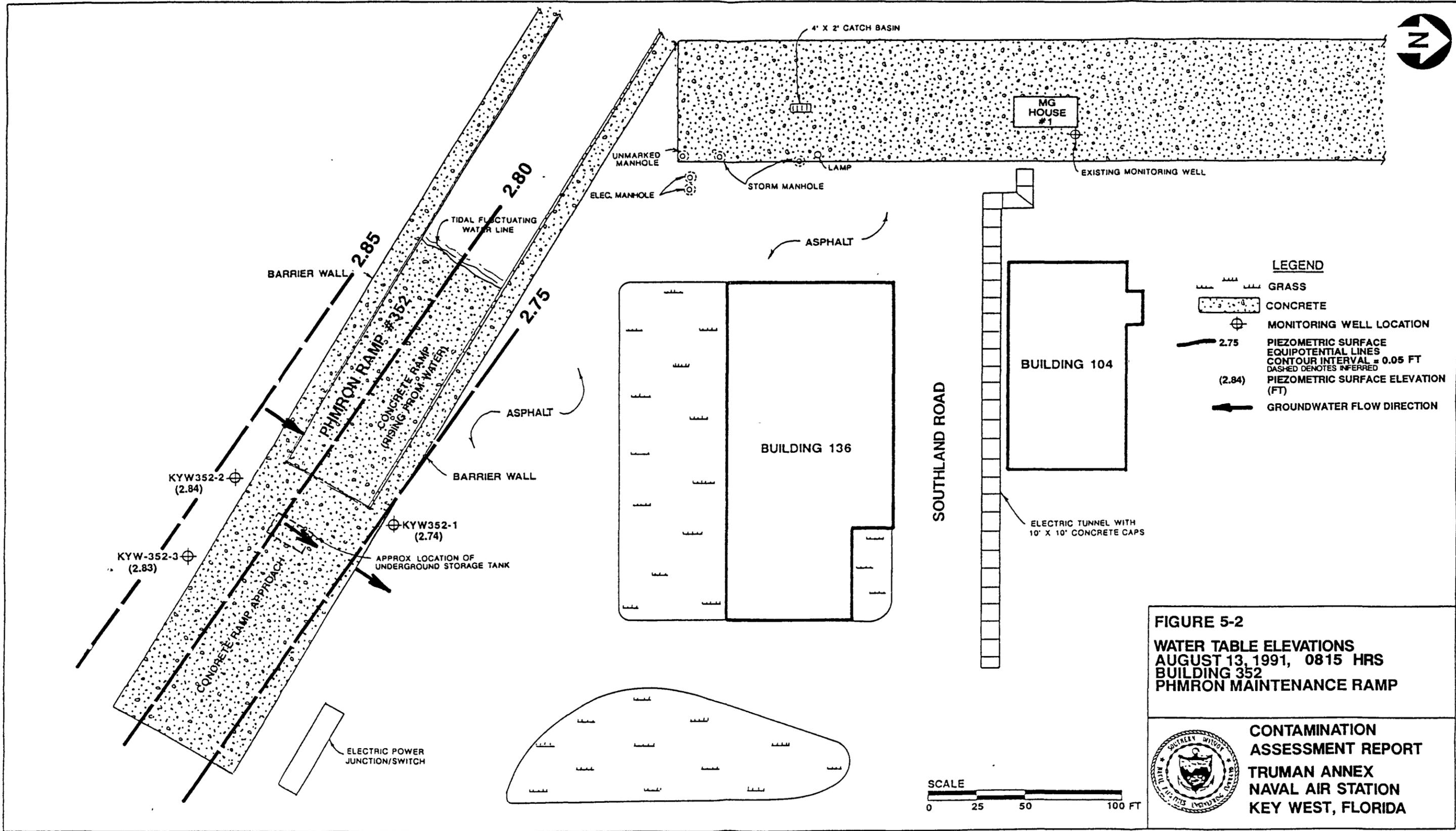
LAMP

EXISTING MONITORING WELL

ELECTRIC TUNNEL WITH 10' X 10' CONCRETE CAPS

ELECTRIC POWER JUNCTION/SWITCH

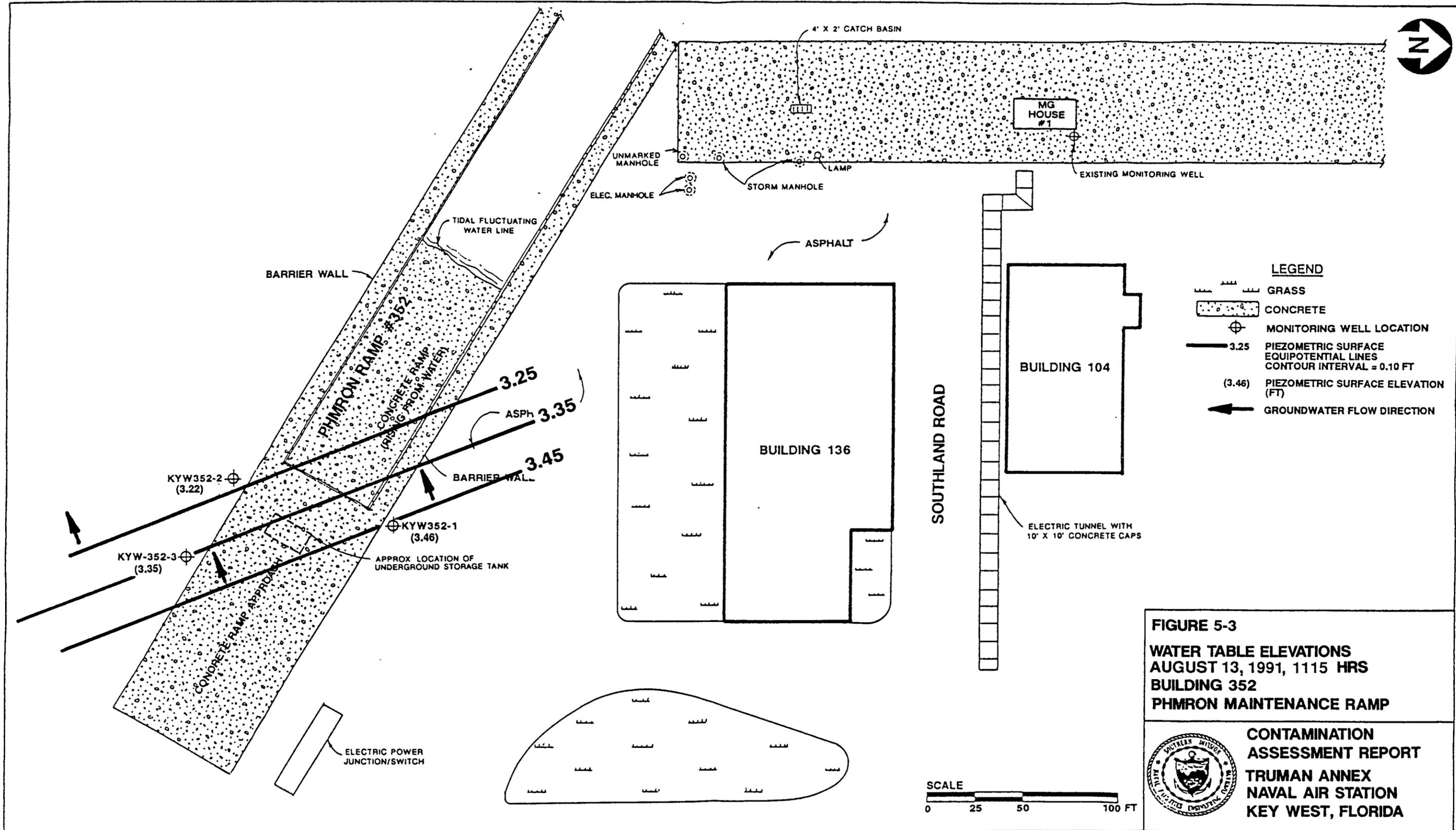




**FIGURE 5-2**  
**WATER TABLE ELEVATIONS**  
**AUGUST 13, 1991, 0815 HRS**  
**BUILDING 352**  
**PHMRON MAINTENANCE RAMP**

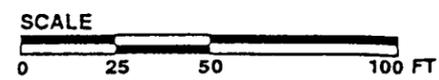
**CONTAMINATION**  
**ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**

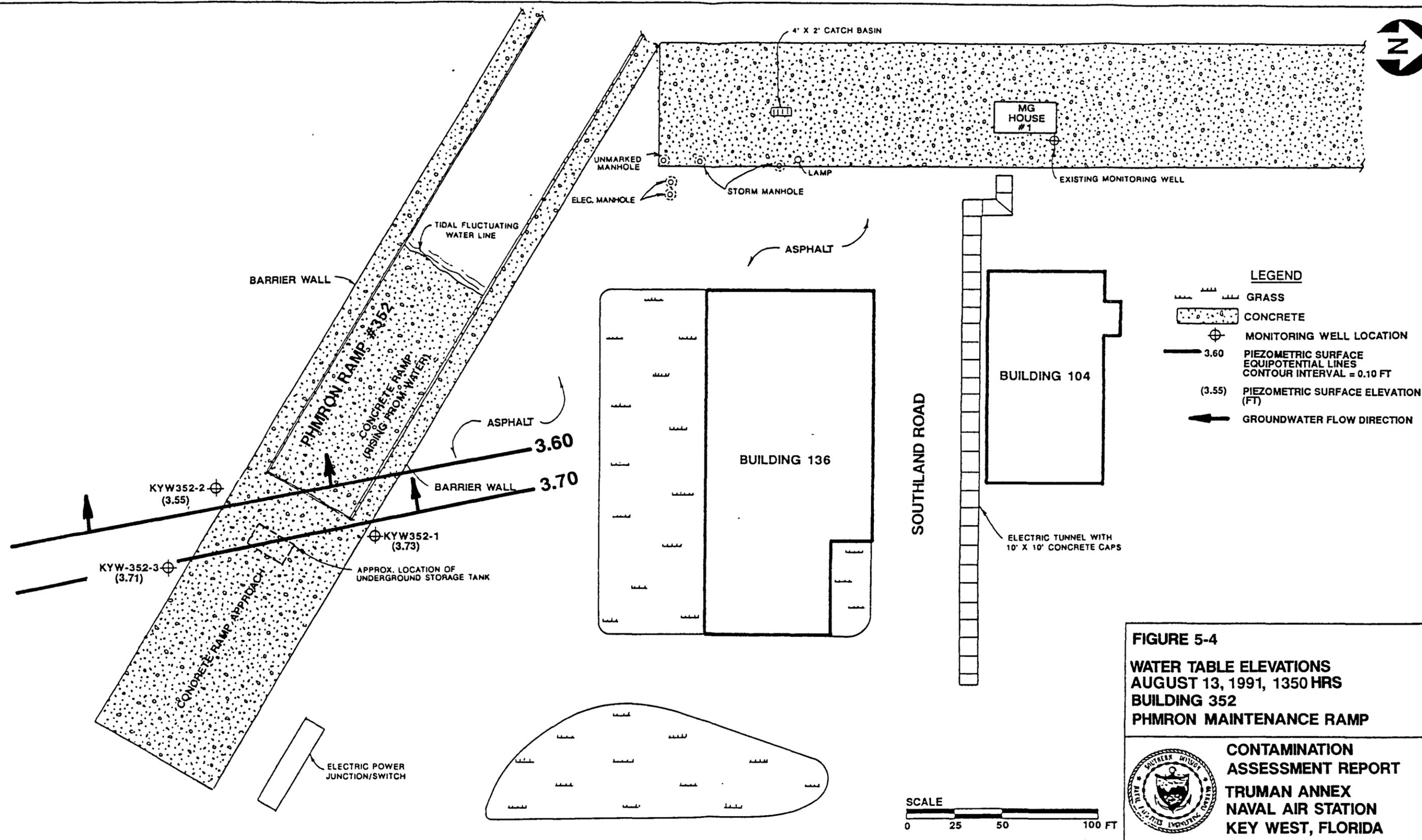




**FIGURE 5-3**  
**WATER TABLE ELEVATIONS**  
**AUGUST 13, 1991, 1115 HRS**  
**BUILDING 352**  
**PHMRON MAINTENANCE RAMP**

**CONTAMINATION**  
**ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**





**FIGURE 5-4**  
**WATER TABLE ELEVATIONS**  
**AUGUST 13, 1991, 1350 HRS**  
**BUILDING 352**  
**PHMron MAINTENANCE RAMP**

**CONTAMINATION**  
**ASSESSMENT REPORT**  
**TRUMAN ANNEX**  
**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**





**TABLE 5-2**  
**TOP OF CASING ELEVATIONS, DEPTH TO GROUNDWATER, AND GROUNDWATER ELEVATIONS**  
**FROM TIDAL INFLUENCE STUDY OF AUGUST 13, 1991, 8-HOUR PERIOD**  
**PHMRON MAINTENANCE RAMP, TRUMAN ANNEX BUILDING 352**

WELL I.D.	24-HOUR TIME:	0815		0915		1000		1115	
	TOC ELEV.	DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.
KYW-352-1	9.59	6.85	2.74	6.64	2.95	6.43	3.16	6.13	3.46
KYW-352-2	9.27	6.43	2.84	6.37	2.90	6.28	2.99	6.05	3.22
KYW-352-3	9.63	6.80	2.83	6.66	2.97	6.50	3.13	6.28	3.35

WELL I.D.	24-HOUR TIME:	1350		1545		1645	
	TOC ELEV.	DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.	DEPTH TO WATER	WATER ELEV.
KYW-352-1	9.59	5.86	3.73	6.13	3.46	6.41	3.18
KYW-352-2	9.27	5.72	3.55	5.78	3.49	5.93	3.34
KYW-352-3	9.63	5.92	3.71	6.13	3.50	6.35	3.28

TOC = Top of Casing  
 Elev. = Elevation  
 High Tide: 1301 hours  
 Low Tides: 0630 and 1844 hours

**ALL MEASUREMENTS IN FEET.**

## 6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### 6.1 SUMMARY

Based on the results of the field investigations and the laboratory analytical results collected during the CA, the following is a summary of conditions at the site.

- The surficial aquifer in the Key West area is classified as a Class G-III groundwater source. There are no official potable wells in the Key West area. Groundwater from the surficial aquifer has been designated as an unlikely source of potable water (McKenzie, 1990).
- Surficial sediments are composed of fill material. This is underlain by a weathered limestone.
- Groundwater was found at depths of 6 to 7 feet bls.
- The direction of groundwater flow in the surficial aquifer is tidally influenced with the flow to the northeast during low tide events, and to the southwest during high tide events.
- The calculated hydraulic conductivity in the surficial aquifer varies from 7.6 ft/day to 10.0 ft/day.
- The average of the high and low tide hydraulic gradient is approximately  $1.5 \times 10^{-3}$ .
- No free product was found at the site.
- No petroleum contaminated soils were identified in the OVA headspace survey.
- MTBE concentrations were detected in monitoring wells KYW-352-2 and KYW-352-3 at 55  $\mu\text{g}/\text{l}$  and 115  $\mu\text{g}/\text{l}$ , respectively. MTBE was not detected in well KYW-352-1.

### 6.2 CONCLUSIONS

- The source of petroleum contamination has been abated. No diesel fuel constituents were found during this assessment.
- MTBE, the only contaminant identified during the investigation, is not a constituent of diesel fuel. The source of MTBE contamination was not identified in this assessment.
- The presence of two seawalls at the site is expected to hinder seaward contaminant migration.

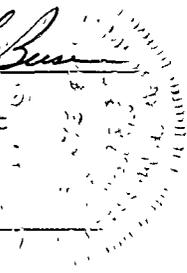
### 6.3 RECOMMENDATIONS

Based on the findings and interpretations of the CAR, a *No Further Action Proposal (NFAP)* is recommended for this site.

7.0 PROFESSIONAL REVIEW CERTIFICATION

The CA contained in this report was prepared using sound hydrogeologic principles and judgment. This assessment is based on the geologic investigation and associated information detailed in the text and appended to this report. If conditions are revealed that differ from those described, the undersigned geologist should be notified to evaluate the effects of any additional information on the assessment described in this report. This CAR was developed for the NAS, Key West site near Building 352 at the PHMRON maintenance ramp, Truman Annex, and should not be construed to apply to any other site.

  
\_\_\_\_\_  
Kenneth L. Busen  
Professional Geologist  
P.G. No. 0000191

  
\_\_\_\_\_  
Date 2/25/92

## 8.0 REFERENCES

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APPENDIX A  
SITE CONDITIONS

Physiography

The State of Florida is divided into three geomorphic zones: the northern or proximal zone, the central or mid-peninsular zone, and the southern or distal zone (White, 1970). The Key West area is part of the Lower Keys and is located entirely within the southern or distal zone. This area is characterized by a sparse veneer of residual soil and surface vegetation overlying eroded limestone. The topography of the Lower Keys is generally smooth and flat in the center of the key and slopes gently downward toward the shoreline (White, 1970). Ground elevations at the site are approximately 10 feet above mean sea level.

Regional Hydrogeology

The Lower Keys are overlain by an oolitic member of the Pleistocene Miami Limestone. The Key Largo coral reef limestone underlies the Miami Limestone. Hoffmeister (1974) reported that the Miami Limestone is 27 feet thick and the Key Largo Limestone is greater than 270 feet thick in the western part of Key West. The Key Largo Limestone is generally more porous than the Miami Limestone. Surficial and shallow subsurface features in the area have often been altered by imported fill material.

The surficial aquifer in the Key West area is unconfined. The water table is found at shallow depths in the area, generally occurring from less than 1 foot to 10 feet below land surface. Water table elevations can be influenced by local rainfall and tidal fluctuations (McKenzie, 1990). The surficial aquifer is contained within the Miami Limestone, the underlying Key Largo Limestone, and surficial fill materials. The limestones generally contain brackish or saline water. Recharge to the aquifer is directly from precipitation, and infiltration rates are rapid. Groundwater flow discharge is to surrounding surface waters.

The surficial aquifer contains a small freshwater lens that floats on the saline groundwater. The lens, which is very thin (from less than 1 foot near the edge to an average of 5 feet near the center), is located below the center of the western half (Old Town) of the island. The lens contains about 20 million gallons of freshwater during the dry season and about 30 million gallons during the wet season.

The water table fluctuates and the configuration of the lens constantly changes, largely as a result of tidal action. On the average the lens is approximately 8,000 feet in length by 4,000 feet in width. Water quality data indicate that the lens is an unlikely source of potable water (McKenzie, 1990).

APPENDIX B  
LITHOLOGIC LOGS

TRU352DF CAR  
02.92 (CLEAN.01)

TITLE: NAS Key West, Truman Annex		LOG of WELL: KYW-352-1	BORING NO.
CLIENT: SOUTHNAVFACENCOM			PROJECT NO: 7519-30
CONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 8/8/91	COMPLTD: 8/8/91
METHOD: HSA	CASE SIZE: 2 inch	SCREEN INT: 3' to 13'	PROTECTION LEVEL: D
TOC ELEV.: 9.59	MONITOR INST.: OVA	TOT DPTH: 14FT.	DPTH TO $\nabla$ 8.85 FT.
LOGGED BY: A. DeSandro	WELL DEVELOPMENT DATE: 8/8/91		SITE: PHMRON Ramp

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5				Limestone: Light gray, weathered, silty. Some shell fragments.	[Brick pattern symbol]			[Well diagram]
10				Limestone: Weathered, silty.				
15								

<b>TITLE:</b> NAS Key West, Truman Annex		<b>LOG of WELL:</b> KYW-352-2	<b>BORING NO.</b>
<b>CLIENT:</b> SOUTHNAVFACENGCOM			<b>PROJECT NO:</b> 7518-30
<b>CONTRACTOR:</b> Groundwater Protection Inc.		<b>DATE STARTED:</b> 8/8/81	<b>COMPLTD:</b> 8/8/81
<b>METHOD:</b> HSA	<b>CASE SIZE:</b> 2 Inch	<b>SCREEN INT.:</b> 3' to 13'	<b>PROTECTION LEVEL:</b> D
<b>TOC ELEV.:</b> 8.27 FT.	<b>MONITOR INST.:</b> OVA	<b>TOT DPTH:</b> 14FT.	<b>DPTH TO ∇:</b> 6.43 FT.
<b>LOGGED BY:</b> A. DeSandro	<b>WELL DEVELOPMENT DATE:</b> 8/8/81		<b>SITE:</b> PHMRON Ramp

DEPTH FT.	LABORATORY SAMPLE ID.	RECOVERY SAMPLE	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/8-IN	WELL DATA
5				Limestone: Light gray, weathered, silty. Some shell fragments.	[Brick pattern symbol]			[Well diagram]
10				Limestone: Weathered, silty.				
15								



## APPENDIX C

### INVESTIGATIVE METHODOLOGIES AND PROCEDURES

#### Soil borings

Soil borings were used to assess the degree of soil contamination at the site and to aid in the placement of subsequent monitoring wells. Soil borings were advanced into the water table using rotary drilling and hollow-stem augers. For each boring, a soil sample was collected immediately above the soil-groundwater interface. Samples were collected with a standard penetration test (SPT) split-spoon sampler. Samples were placed in 16-ounce glass jars, and headspace analysis was performed with an organic vapor analyzer (OVA) equipped with a flame ionization detector (FID).

#### Monitoring well construction

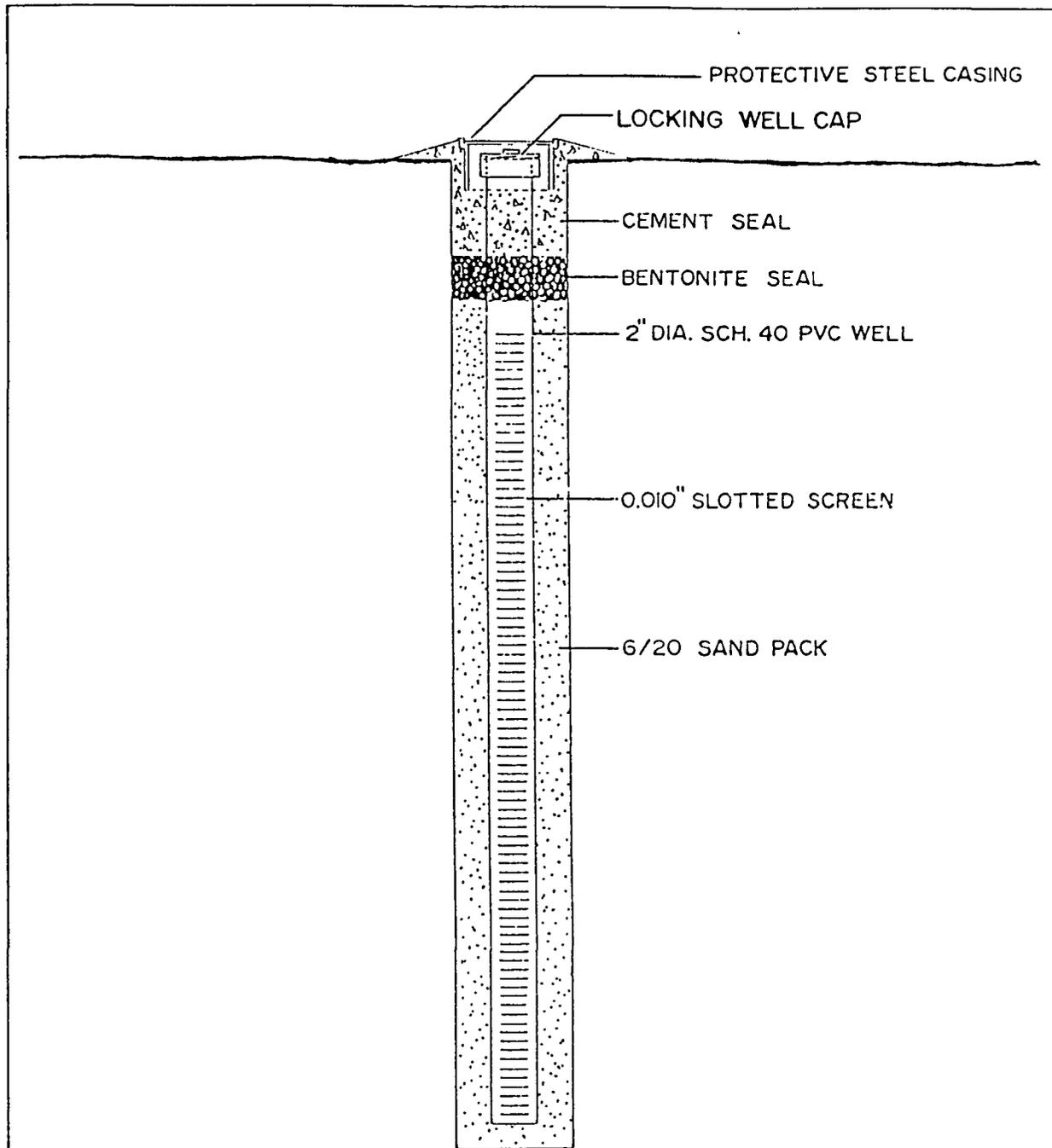
All monitoring wells were constructed of 2-inch diameter, schedule 40, polyvinyl chloride (PVC) casing. The bottom 10 feet of each well was screened with 2-inch diameter, 0.010-inch slotted, PVC well screen. The shallow water table conditions necessitated limiting the thickness of the sand filter pack, bentonite seal, and grout above the screened interval. A 6/20 grade silica sand filter pack was placed in the annular space around each well to approximately 7 inches above the top of the screen. A 4-inch thick bentonite seal was then placed on top of the filter pack. The remaining annular space was grouted to the surface with neat cement. A protective traffic-bearing vault was installed to complete each well. Each monitoring well was equipped with a locking well cap. Typical monitoring well construction details are presented in Figure C-1.

#### Groundwater elevation measurements and tidal influence study

The elevation of the water table was estimated by surveying the top of the well casing of each monitoring well to a common reference datum. No benchmark was located in the area; therefore, an arbitrary reference elevation of 10.00 feet was established. Groundwater levels were measured using an electronic water level indicator. Water level elevations were calculated by subtracting the measured depth to groundwater from the elevation at the top of the well casing. To assess the effect of tidal fluctuations on water level elevations, water elevations were measured over an 8 hour period.

#### Groundwater sampling

Groundwater samples were collected from site monitoring wells on August 14, 1991. The groundwater samples were collected in accordance with ABB-ES' FDER approved CompQAPP. Before sampling, monitoring wells were properly developed and purged with Teflon™ bailers. Purging continued until a minimum of five well volumes had been removed. Groundwater samples were then collected, and the samples were placed into appropriate containers. The containers were labeled, placed on ice, and shipped under chain of custody to Wadsworth/Alert Laboratories in Tampa,



**FIGURE C-1**  
**TYPICAL MONITORING WELL**  
**CONSTRUCTION DIAGRAM**



**CONTAMINATION**  
**ASSESSMENT REPORT**

**NAVAL AIR STATION**  
**KEY WEST, FLORIDA**

Florida, for analyses. Pursuant to FDER Chapter 17-770, FAC, groundwater samples collected from monitoring wells underwent analyses for USEPA Methods 418.1, 601, 602, 610, ethylene dibromide (EDB), and lead. Field blanks, trip blanks, and equipment blanks were also analyzed.

### Slug Tests

Aquifer slug tests were performed on monitoring wells KYW-352-1 and KYW-352-3 to assess the hydraulic conductivity of the surficial aquifer. The slug was constructed of 1-inch outside diameter PVC pipe, 5 feet in length. The slug was filled with sand and capped watertight at both ends. Water level changes in the monitoring wells were recorded with a data logger and pressure transducer.

The pressure transducer was suspended less than 6 inches above the bottom of the well and the initial water level was recorded prior to beginning the test. The slug was then lowered into the well until it was totally submerged beneath the water table. Following recovery, the slug was quickly removed, and water level measurements were recorded until the water level recovered. Three rising head tests were conducted for each well in order to obtain an average recovery response. Slug test results are attached in Appendix G.

Hydraulic conductivities were calculated from slug test data based on the analytical method of Bouwer and Rice (1976) for partially penetrating wells screened in an unconfined aquifer. The computer program, AQTESOLV™ (Geraghty and Miller, 1989) was used to calculate a hydraulic conductivity (K) value based on linear regression of the data gathered during the slug test.

APPENDIX D

AQUIFER SLUG TEST RESULTS AND CALCULATIONS

## AQUIFER SLUG TEST CALCULATIONS

### Average Pore Water Velocity Calculations

Estimates of average pore water velocity were obtained using the following formula:

$$v = (KI_{av})/n$$

where

v = average pore water velocity (ft/day),  
K = hydraulic conductivity (ft/day),  
 $I_{av}$  = average hydraulic gradient across site =  $8.5 \times 10^{-3}$  ft/ft, and  
n = estimated porosity.

Using an estimated porosity of 22 percent (Davis and DeWiest, 1966), the average hydraulic gradient across the site ( $I_{av}$ ) and the hydraulic conductivity from well KYW-352-1 ( $K = 1.0 \times 10^1$  ft/day), the calculated average pore water velocity is:

$$v = (1.0 \times 10^1 \text{ ft/day})(1.5 \times 10^{-3})/0.22$$

$$v = 6.8 \times 10^{-2} \text{ ft/day.}$$

Likewise, using the hydraulic conductivity calculated from well KYW-352-3 ( $K = 7.6$  ft/day), the calculated average pore water velocity is:

$$v = (7.6 \text{ ft/day})(1.5 \times 10^{-3} \text{ ft/ft})/0.22$$

$$v = 5.2 \times 10^{-2} \text{ ft/day.}$$

Based on the above calculations, average pore water velocity at the site varies from  $5.2 \times 10^{-2}$  to  $6.8 \times 10^{-2}$  ft/day.

### Transmissivity

Transmissivity, T, for the surficial aquifer, was estimated by using the following formula:

$$T = K*b$$

where

T = transmissivity (ft<sup>2</sup>/day),  
K = hydraulic conductivity (ft/day), and  
b = aquifer test interval or thickness (ft).

For monitoring well KYW-352-1, using a K value of  $1.0 \times 10^1$  ft/day and a b value of 7.15 ft, the calculated transmissivity is as follows:

$$T = 1.0 \times 10^1 \text{ ft/day} \times 7.15 \text{ ft}$$

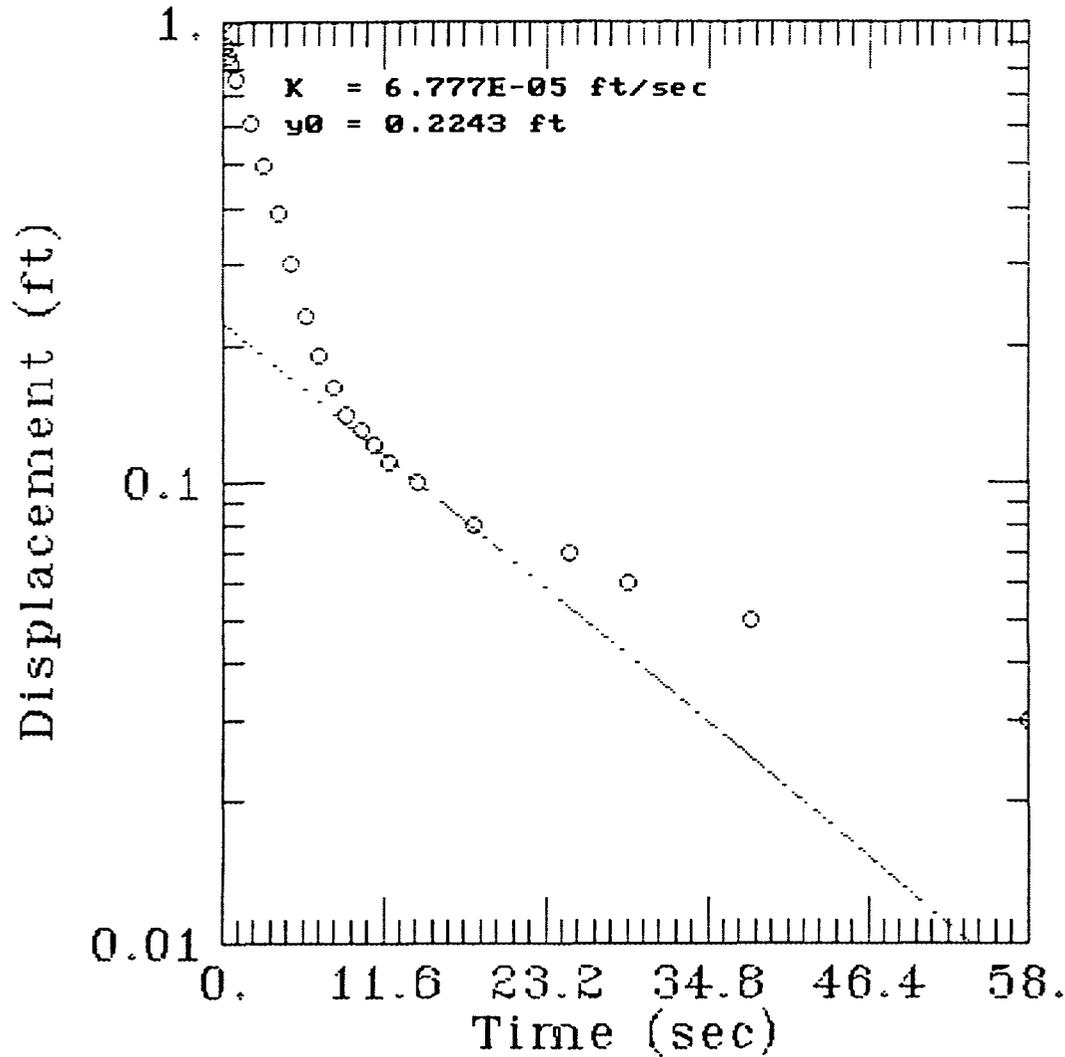
$$T = 7.15 \times 10^1 \text{ ft}^2/\text{day}.$$

Likewise, for monitoring well KYW-352-3, using a K value of 7.6 ft/day and a b value of 7.2 ft, the calculated transmissivity is as follows:

$$T = 7.6 \text{ ft/day} \times 7.2 \text{ ft}$$

$$T = 5.5 \times 10^1 \text{ ft}^2/\text{day}.$$

# NAS KEY WEST KYW-352-1 RUN NO. 1

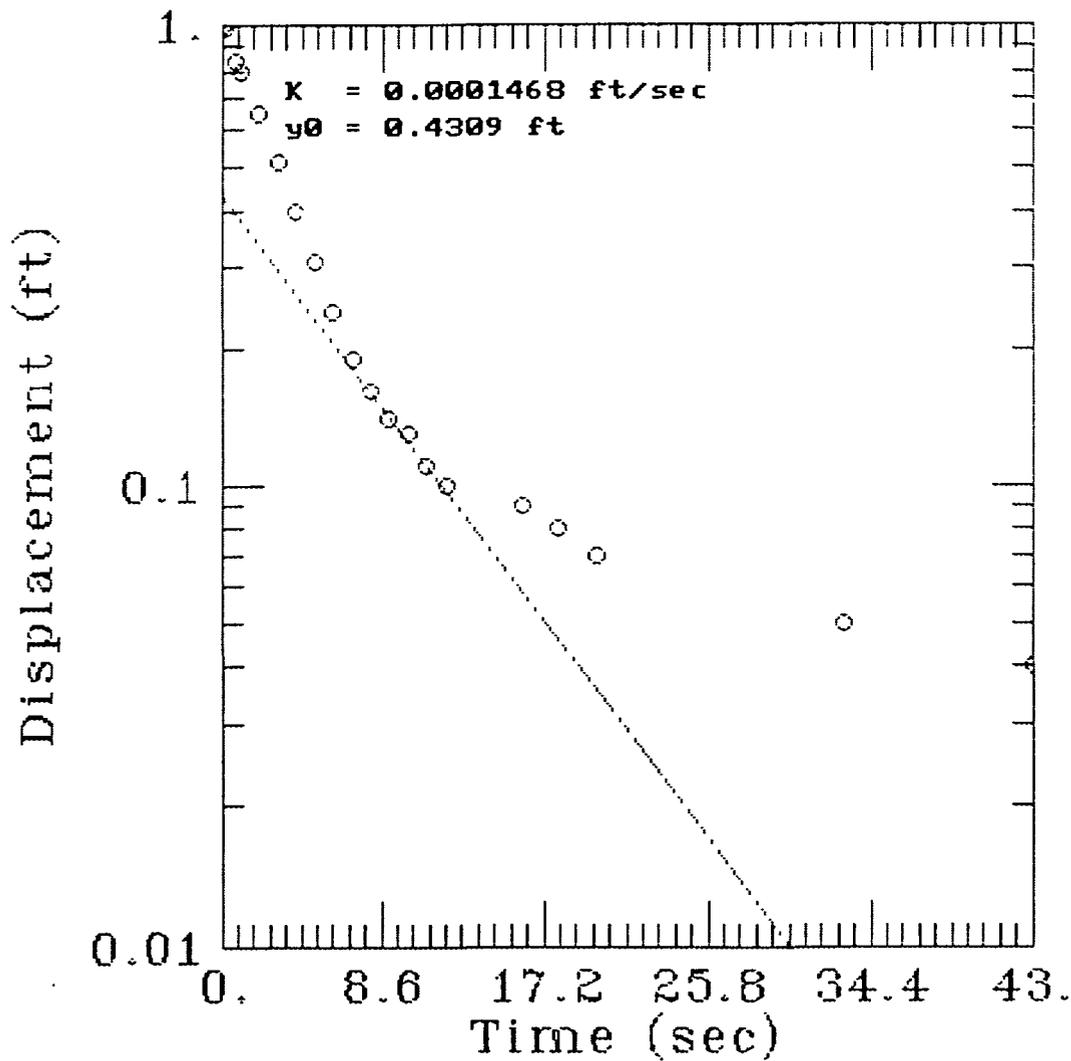


AQTESOLV



Modeling Group

# NAS KEY WEST KYW-352-1 RUN NO. 2



AQTESOLV

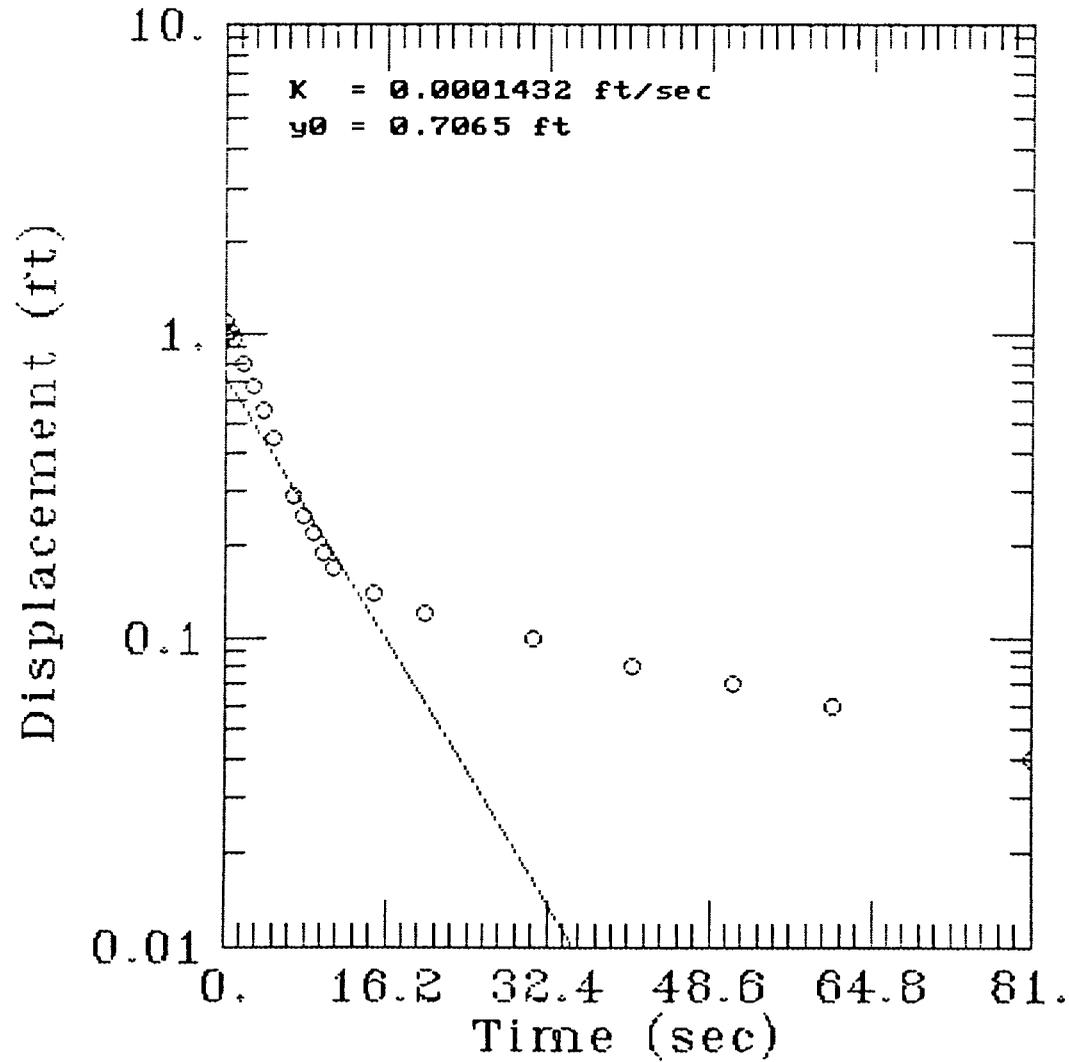


GERAGHTY  
& MILLER, INC.



Modeling Group

NAS KEY WEST KYW-352-1 RUN NO. 3

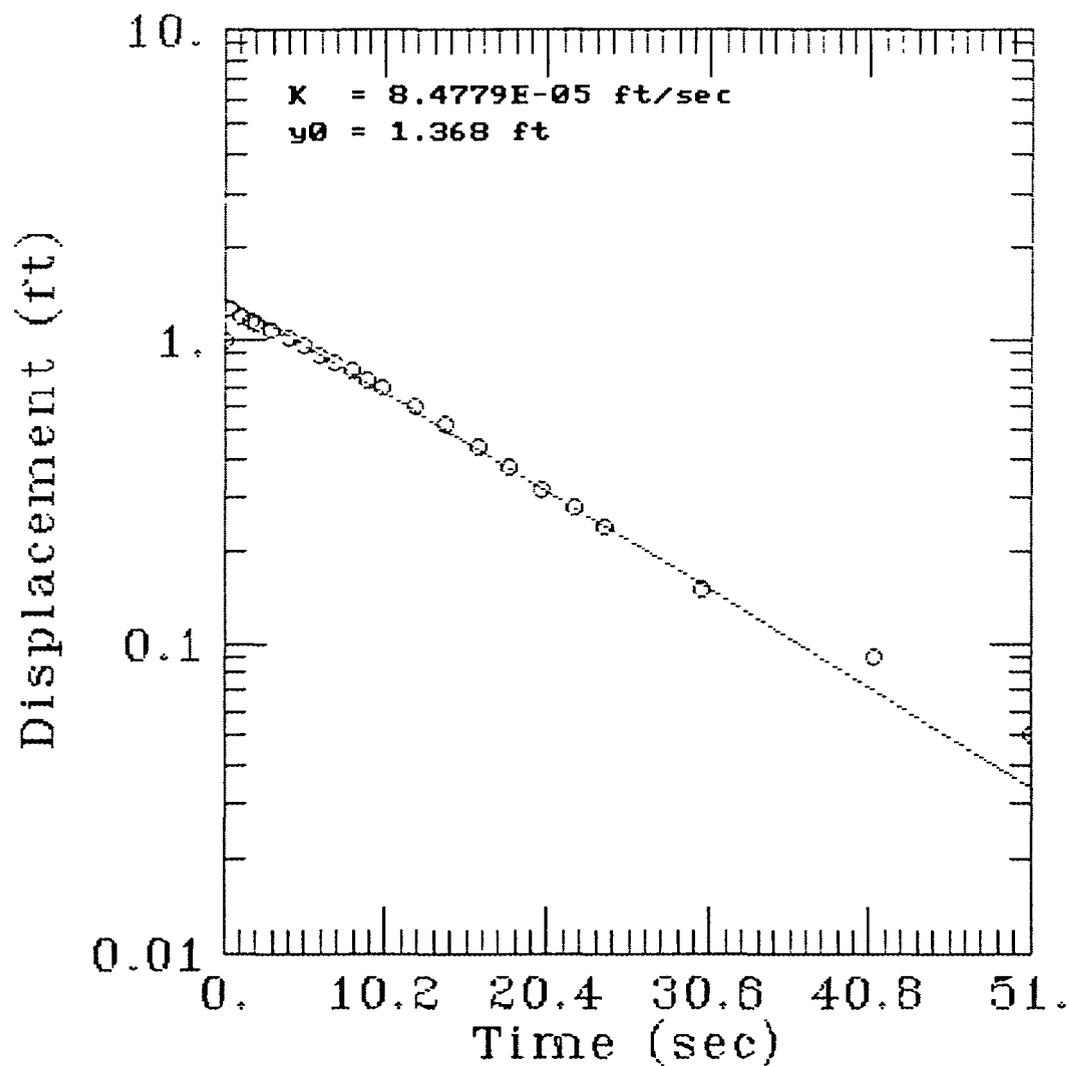


AQTESOLV

 GERAGHTY  
& MILLER, INC.

 Modeling Group

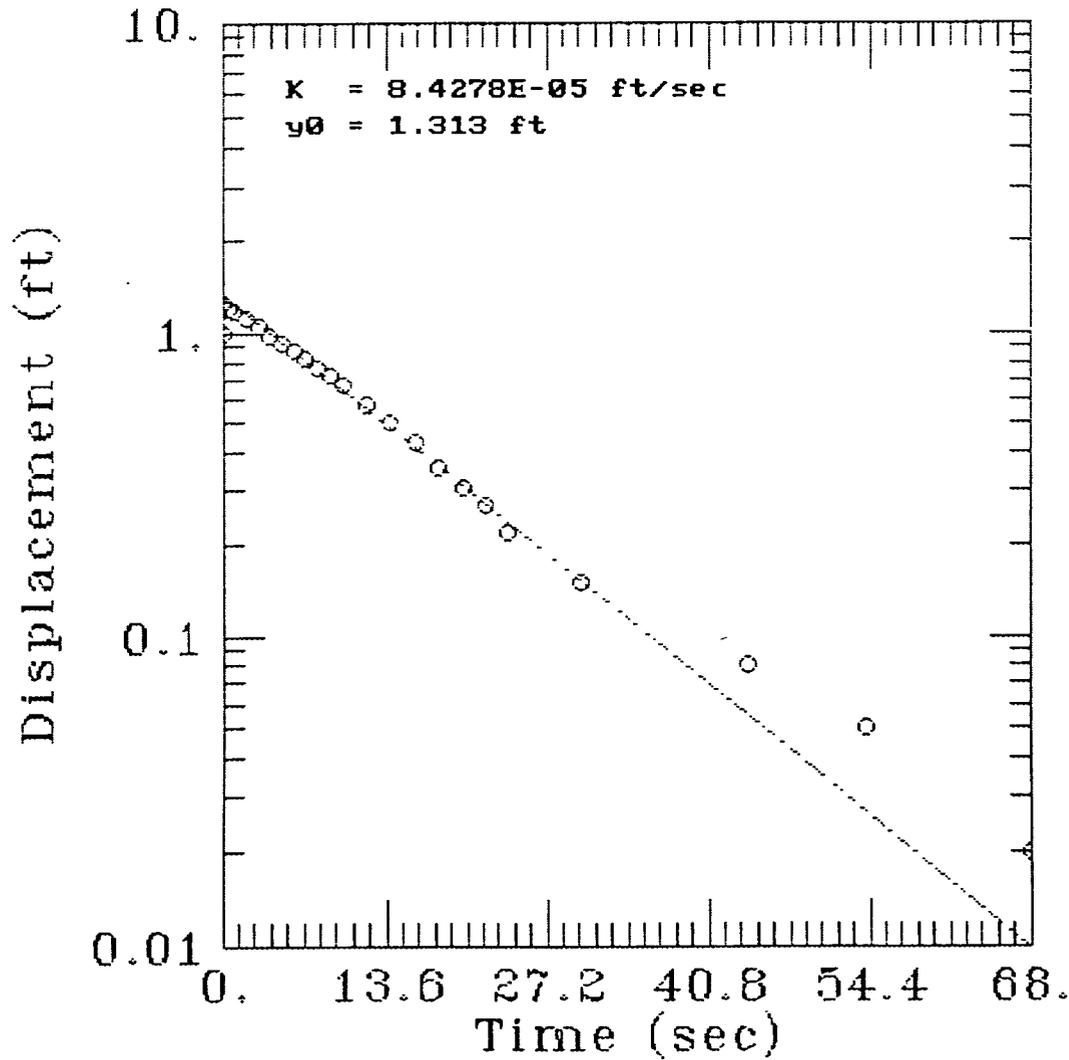
# NAS KEY WEST KYW-352-3 RUN NO. 1



AQTESOLV

**GERAGHTY  
& MILLER, INC.**  
 **Modeling Group**

# NAS KEY WEST KYW-352-3 RUN NO. 2



AQTESOLV

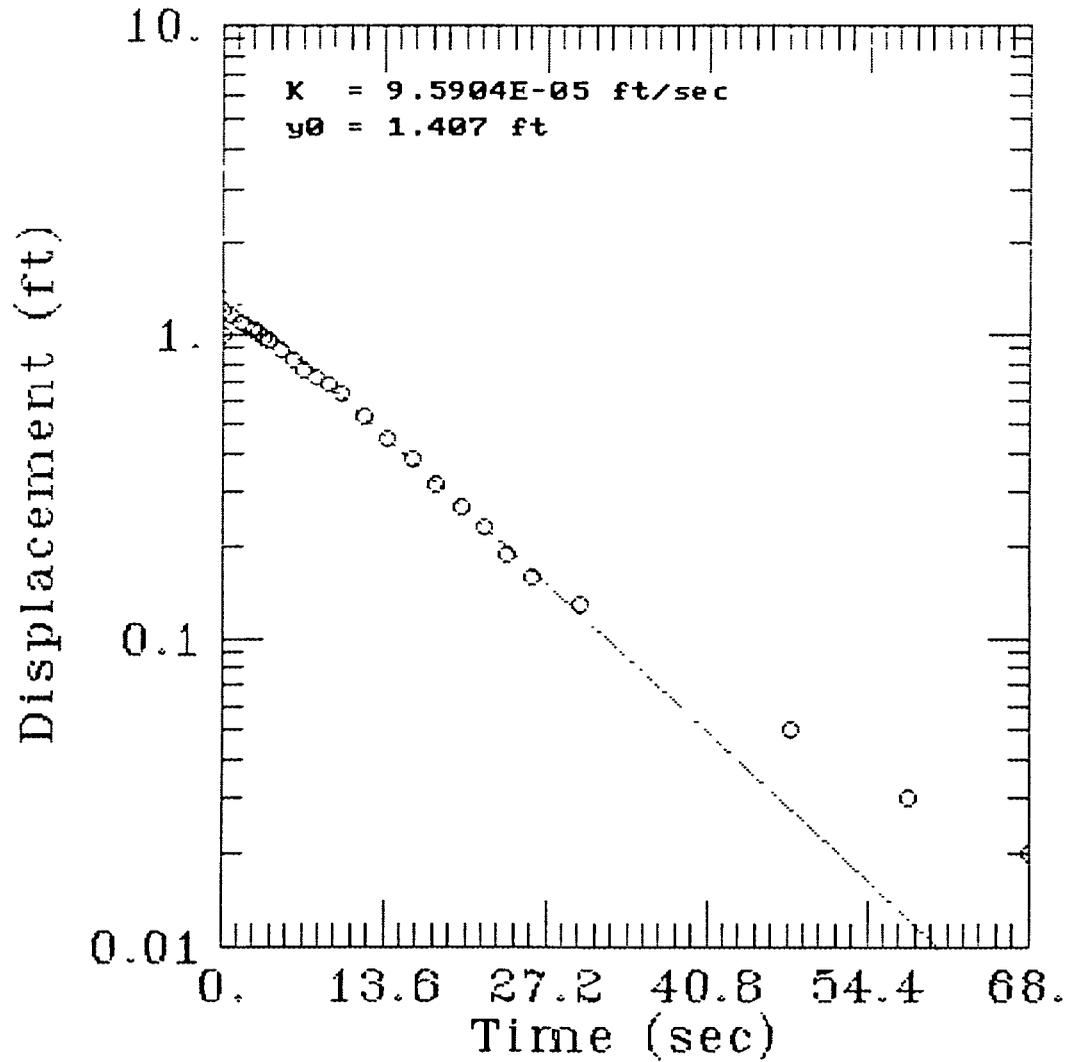


GERAGHTY  
& MILLER, INC.



Modeling Group

NAS KEY WEST KYW-352-3 RUN NO. 3



AQTESOLV



GERAGHTY  
& MILLER, INC.



Modeling Group

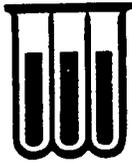
APPENDIX E  
GROUNDWATER ANALYTICAL RESULTS

TRU352DF.CAR  
02.92 (CLEAN 01)

Laboratory Analytical Data  
Conversion Table

<u>Monitoring Well Designation</u>	<u>Laboratory Sample Designation</u>
KYW-352-1	PRMW-1
KYW-352-2	PRMW-2
KYW-352-3	PRMW-3

Note: The duplicate sample for this site is associated with the sampling events at Building 103 and 189 at Truman Annex.



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-1  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/21/91

SAMPLE ID: PRMW-1 NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

**VOLATILE ORGANICS**  
**METHOD 601/602 - GC**

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	ND
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	ND
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	ND

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS
Bromochloromethane (HECD)	100	(78-122)
Trifluorotoluene (PID)	100	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-1  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/20/91

SAMPLE ID: PRMW-1      NAS KEY WEST-TRUMAN ANNEX

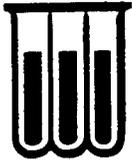
CERTIFICATION #: E84059  
HRS84297

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

---

PARAMETER	RESULT (ug/L )	DETECTION LIMIT
Ethylene dibromide	ND	0.02

NOTE: ND (None Detected) as rec'd  
J (Detected, but below quantitation limit; estimated value)



WADSWORTH/ALERT  
LABORATORIES, INC

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-1  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/19/91  
DATE ANALYZED: 8/22/91

SAMPLE ID: PRMW-1 NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

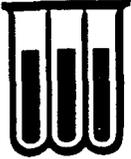
POLYNUCLEAR AROMATIC HYDROCARBONS  
METHOD 625 HSL/TCL LIST - GC/MS

---

Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(ghi)perylene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenz(a,h)anthracene	ND
Fluoranthene	ND
Fluorene	ND
Indeno(1,2,3-cd)pyrene	ND
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Naphthalene	ND
Phenanthrene	ND
Pyrene	ND

NOTE: ND (None Detected, lower detectable limit = 10 ug/L) as rec'd  
ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
-- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS	
		WATER	SOLID
Nitrobenzene-d5	35	(22-135)	(10-155)
Fluorobiphenyl	43	(34-140)	(12-153)
Terphenyl-d14	68	(10-132)	(13-140)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY : ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-1  
MATRIX : WATER

DATE RECEIVED: 8/15/91

SAMPLE ID : PRMW-1      NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

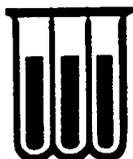
METALS ANALYTICAL REPORT  
SELECTED LIST

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Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Lead	8/26/91	ND	5	ug/L

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB ID: 1H1509-1  
MATRIX : WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/28/91  
DATE ANALYZED: 8/28/91

SAMPLE ID: PRMW-1 NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS REPORT

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	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/L	1

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-2  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/28/91

SAMPLE ID: PRMW-2 NAS KEY WEST-TRUMAN ANNEX

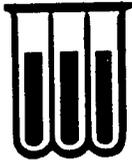
CERTIFICATION #: E84059  
HRS84297

VOLATILE ORGANICS  
METHOD 601/602 - GC

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	ND
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	ND
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	55

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS
Bromochloromethane (HECD)	111	(78-122)
Trifluorotoluene (PID)	100	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-2  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/20/91

SAMPLE ID: PRMW-2      NAS KEY WEST-TRUMAN ANNEX

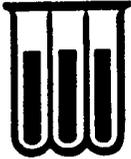
CERTIFICATION #: E84059  
HRS84297

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

---

PARAMETER	RESULT (ug/L )	DETECTION LIMIT
Ethylene dibromide	ND	0.02

NOTE: ND (None Detected) as rec'd  
J (Detected, but below quantitation limit; estimated value)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-2  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/19/91  
DATE ANALYZED: 8/22/91

SAMPLE ID: PRMW-2 NAS KEY WEST-TRUMAN ANNEX

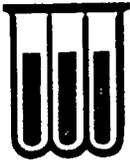
CERTIFICATION #: E84059  
HRS84297

POLYNUCLEAR AROMATIC HYDROCARBONS  
METHOD 625 HSL/TCL LIST - GC/MS

Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(ghi)perylene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenz(a,h)anthracene	ND
Fluoranthene	ND
Fluorene	ND
Indeno(1,2,3-cd)pyrene	ND
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Naphthalene	ND
Phenanthrene	ND
Pyrene	ND

NOTE: ND (None Detected, lower detectable limit = 10 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS	
		WATER	SOLID
Nitrobenzene-d5	48	(22-135)	(10-155)
Fluorobiphenyl	45	(34-140)	(12-153)
Terphenyl-d14	79	(10-132)	(13-140)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY : ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-2  
MATRIX : WATER

DATE RECEIVED: 8/15/91

SAMPLE ID : PRMW-2      NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

METALS ANALYTICAL REPORT  
SELECTED LIST

---

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT
Lead	8/26/91	ND	5 ug/L

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB ID: 1H1509-2  
MATRIX : WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/28/91  
DATE ANALYZED: 8/28/91

SAMPLE ID: PRMW-2 NAS KEY WEST-TRUMAN ANNEX

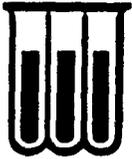
CERTIFICATION #: E84059  
HRS84297

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS REPORT

---

	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/L	1

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-3  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/28/91

SAMPLE ID: PRMW-3 NAS KEY WEST-TRUMAN ANNEX

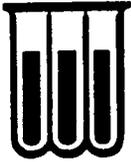
CERTIFICATION #: E84059  
HRS84297

VOLATILE ORGANICS  
METHOD 601/602 - GC

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	ND
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	ND
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	115

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS
Bromochloromethane (HECD)	103	(78-122)
Trifluorotoluene (PID)	99	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-3  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/20/91

SAMPLE ID: PRMW-3      NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

---

PARAMETER	RESULT (ug/L )	DETECTION LIMIT
Ethylene dibromide	ND	0.02

NOTE: ND (None Detected) as rec'd  
J (Detected, but below quantitation limit; estimated value)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-3  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/19/91  
DATE ANALYZED: 8/22/91

SAMPLE ID: PRMW-3 NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059

POLYNUCLEAR AROMATIC HYDROCARBONS  
METHOD 625 HSL/TCL LIST - GC/MS

HRS84297

Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(ghi)perylene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenz(a,h)anthracene	ND
Fluoranthene	ND
Fluorene	ND
Indeno(1,2,3-cd)pyrene	ND
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Naphthalene	ND
Phenanthrene	ND
Pyrene	ND

NOTE: ND (None Detected, lower detectable limit = 10 ug/L) as rec'd  
ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
-- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS	
		WATER	SOLID
Nitrobenzene-d5	36	(22-135)	(10-155)
Fluorobiphenyl	40	(34-140)	(12-153)
Terphenyl-d14	59	(10-132)	(13-140)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY : ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-3  
MATRIX : WATER

DATE RECEIVED: 8/15/91

SAMPLE ID : PRMW-3      NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

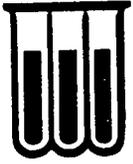
METALS ANALYTICAL REPORT  
SELECTED LIST

---

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT	
Lead	8/26/91	ND	5	ug/L

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB ID: 1H1509-3  
MATRIX : WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/28/91  
DATE ANALYZED: 8/28/91

SAMPLE ID: PRMW-3 NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS REPORT

---

	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/L	1

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-6  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/21/91

SAMPLE ID: EQUIPMENT BLANK NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

VOLATILE ORGANICS  
METHOD 601/602 - GC

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	1
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	ND
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	ND

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS
Bromochloromethane (HECD)	113	(78-122)
Trifluorotoluene (PID)	98	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-6  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/20/91

SAMPLE ID: EQUIPMENT BLANK NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

---

PARAMETER	RESULT (ug/L )	DETECTION LIMIT
Ethylene dibromide	ND	0.02

NOTE: ND (None Detected) as rec'd  
J (Detected, but below quantitation limit; estimated value)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-6  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/19/91  
DATE ANALYZED: 8/22/91

SAMPLE ID: EQUIPMENT BLANK NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059

POLYNUCLEAR AROMATIC HYDROCARBONS  
METHOD 625 HSL/TCL LIST - GC/MS

HRS84297

Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(ghi)perylene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenz(a,h)anthracene	ND
Fluoranthene	ND
Fluorene	ND
Indeno(1,2,3-cd)pyrene	ND
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Naphthalene	ND
Phenanthrene	ND
Pyrene	ND

NOTE: ND (None Detected, lower detectable limit = 10 ug/L) as rec'd  
ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
-- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS	
		WATER	SOLID
Nitrobenzene-d5	65	(22-135)	(10-155)
Fluorobiphenyl	61	(34-140)	(12-153)
Terphenyl-d14	80	(10-132)	(13-140)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY : ABB ENVIRONMENTAL SERVICES, INC.  
LAB # : 1H1509-6  
MATRIX : WATER

DATE RECEIVED: 8/15/91

SAMPLE ID : EQUIPMENT BLANK      NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

METALS ANALYTICAL REPORT  
SELECTED LIST

---

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT
Lead	8/26/91	ND	5 ug/L

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB ID: 1H1509-6  
MATRIX : WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/28/91  
DATE ANALYZED: 8/28/91

SAMPLE ID: EQUIPMENT BLANK NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS REPORT

---

	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/L	1

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-8  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/21/91

SAMPLE ID: TRIP BLANK

NAS KEY WEST-TRUMAN ANNEX

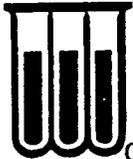
CERTIFICATION #: E84059  
HRS84297

VOLATILE ORGANICS  
METHOD 601/602 - GC

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	ND
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	ND
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	ND

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
-- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS
Bromochloromethane (HECD)	106	(78-122)
Trifluorotoluene (PID)	98	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB # 1H1509-7  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/21/91

SAMPLE ID: FIELD BLANK

NAS KEY WEST-TRUMAN ANNEX

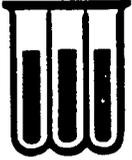
CERTIFICATION #: E84059  
HRS84297

VOLATILE ORGANICS  
METHOD 601/602 - GC

Benzene	ND	1,2-Dichloroethane	ND
Bromodichloromethane	ND	1,1-Dichloroethene	ND
Bromoform	ND	1,2-Dichloroethene (Total)	ND
Bromomethane	ND	1,2-Dichloropropane	ND
Carbon tetrachloride	ND	cis-1,3-Dichloropropene	ND
Chlorobenzene	ND	trans-1,3-Dichloropropene	ND
Chloroethane	ND	Ethylbenzene	ND
2-Chloroethylvinyl ether	ND	Methylene chloride	8
Chloroform	ND	1,1,2,2-Tetrachloroethane	ND
Chloromethane	ND	Tetrachloroethene	ND
Dibromochloromethane	ND	Toluene	ND
1,2-Dichlorobenzene	ND	1,1,1-Trichloroethane	ND
1,3-Dichlorobenzene	ND	1,1,2-Trichloroethane	ND
1,4-Dichlorobenzene	ND	Trichloroethene	ND
Dichlorodifluoromethane	ND	Trichlorofluoromethane	27
1,1-Dichloroethane	ND	Vinyl chloride	ND
		Xylenes	ND
		Methyl-tert-butylether	ND

NOTE: ND (None Detected, lower detectable limit = 1 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

<b>SURROGATE RECOVERY:</b>	<b>X</b>	<b>ACCEPTABLE LIMITS</b>
Bromochloromethane (HECD)	104	(78-122)
Trifluorotoluene (PID)	98	(73-131)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-7  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: NA  
DATE ANALYZED: 8/20/91

SAMPLE ID: FIELD BLANK

NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

SELECTED ORGANIC COMPOUNDS ANALYTICAL REPORT

---

PARAMETER	RESULT (ug/L )	DETECTION LIMIT
Ethylene dibromide	ND	0.02

NOTE: ND (None Detected) as rec'd  
J (Detected, but below quantitation limit; estimated value)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB #: 1H1509-7  
MATRIX: WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/19/91  
DATE ANALYZED: 8/22/91

SAMPLE ID: FIELD BLANK

NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059

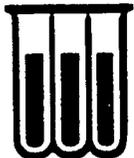
POLYNUCLEAR AROMATIC HYDROCARBONS  
METHOD 625 HSL/TCL LIST - GC/MS

HRS84297

Acenaphthene	ND
Acenaphthylene	ND
Anthracene	ND
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(ghi)perylene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenz(a,h)anthracene	ND
Fluoranthene	ND
Fluorene	ND
Indeno(1,2,3-cd)pyrene	ND
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Naphthalene	ND
Phenanthrene	ND
Pyrene	ND

NOTE: ND (None Detected, lower detectable limit = 10 ug/L) as rec'd  
 ND\* (None Detected, lower detectable limit = ug/L) as rec'd  
 -- (Not Analyzed)

SURROGATE RECOVERY:	%	ACCEPTABLE LIMITS	
		WATER	SOLID
Nitrobenzene-d5	58	(22-135)	(10-155)
Fluorobiphenyl	55	(34-140)	(12-153)
Terphenyl-d14	77	(10-132)	(13-140)



WADSWORTH/ALERT  
LABORATORIES, INC.

COMPANY : ABB ENVIRONMENTAL SERVICES, INC.

DATE RECEIVED: 8/15/91

LAB #: 1H1509-7

MATRIX : WATER

SAMPLE ID : FIELD BLANK

NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059

METALS ANALYTICAL REPORT

HRS84297

SELECTED LIST

---

Total metals analysis results - as received

ELEMENT	PREPARATION - ANALYSIS DATE	RESULT	DETECTION LIMIT
Lead	8/26/91	ND	5 ug/L

NOTE: ND (None Detected)



WADSWORTH/ALERT  
LABORATORIES, INC

COMPANY: ABB ENVIRONMENTAL SERVICES, INC.  
LAB ID: 1H1509-7  
MATRIX : WATER

DATE RECEIVED: 8/15/91  
DATE EXTRACTED: 8/28/91  
DATE ANALYZED: 8/28/91

SAMPLE ID: FIELD BLANK

NAS KEY WEST-TRUMAN ANNEX

CERTIFICATION #: E84059  
HRS84297

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS REPORT

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	RESULT	UNITS	LOWER DETECTION LIMIT
Total Recoverable Petroleum Hydrocarbons	ND	mg/L	1

NOTE: ND (None Detected)

APPENDIX F

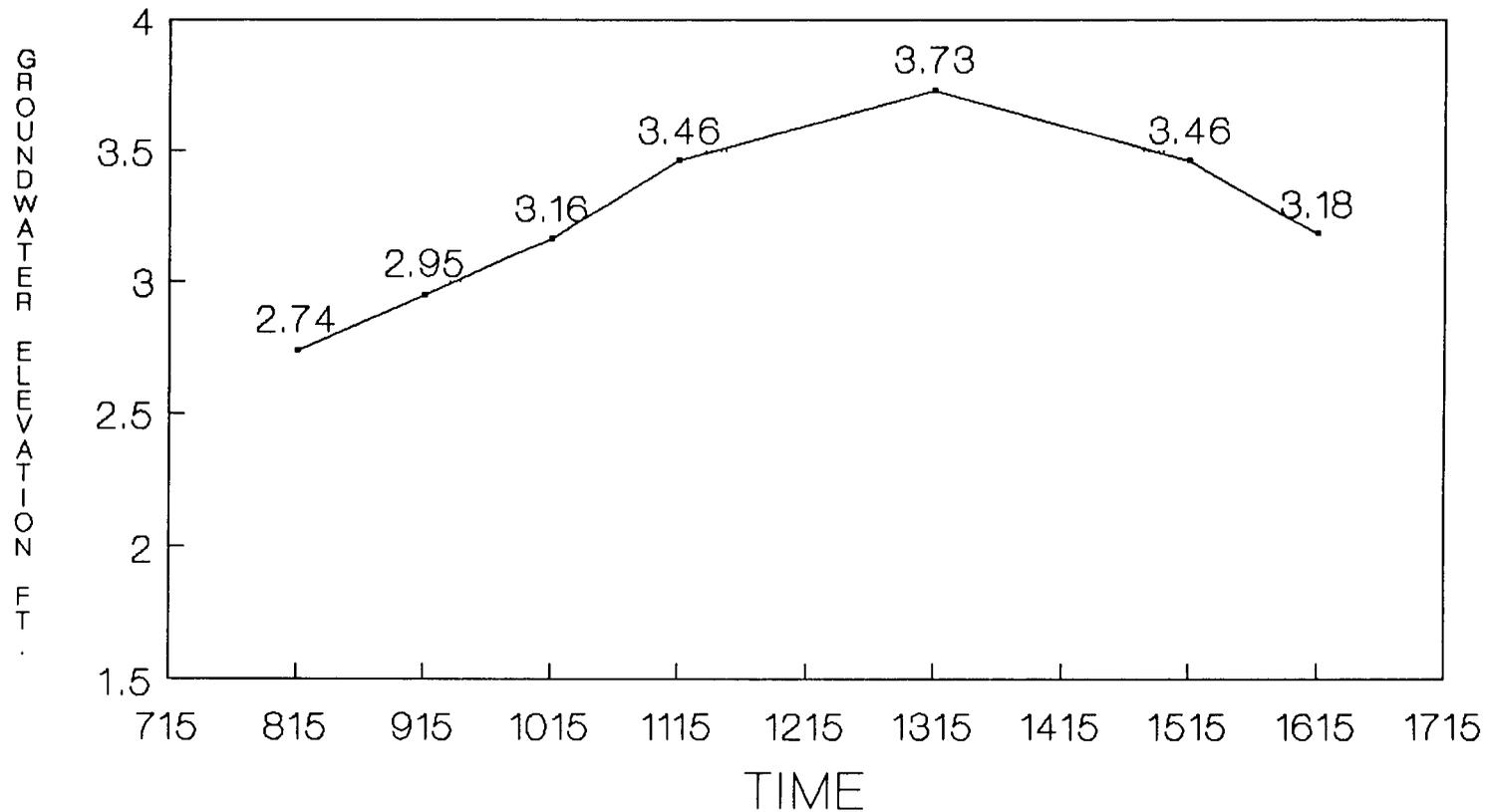
GROUNDWATER ELEVATION GRAPHS FROM TIDAL INFLUENCE STUDY

AUGUST 13, 1991 (8 HOUR PERIOD)

# TIDAL INFLUENCE STUDY, BUILDING 352

## TRUMAN ANNEX PHMRON RAMP, AUG. 13, 1991

### KYW-352-1

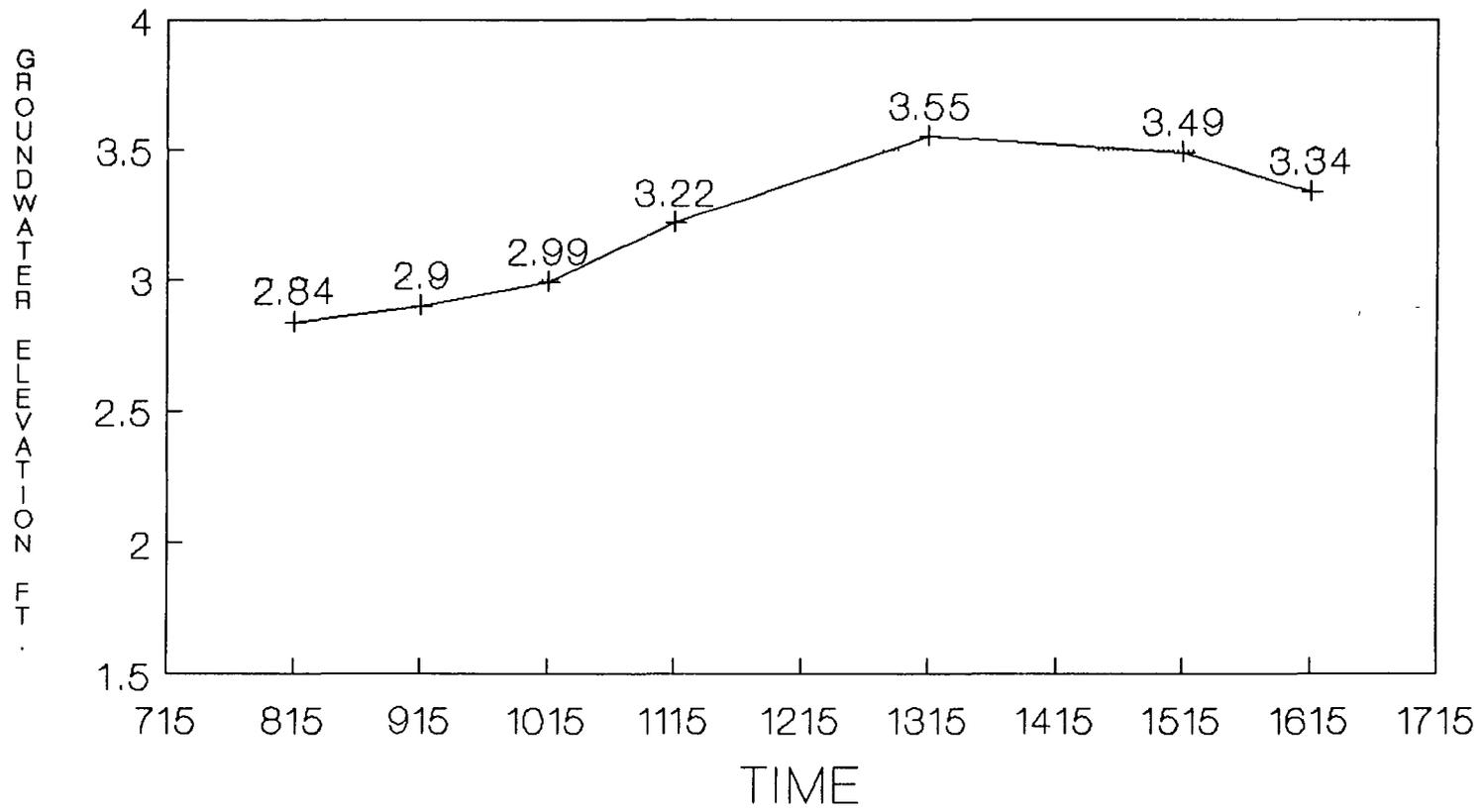


HIGH TIDE: 1301 HOURS  
LOW TIDES: 0530 & 1844 HOURS  
TRUMAN ANNEX PHMRON RAMP

# TIDAL INFLUENCE STUDY, BUILDING 352

## TRUMAN ANNEX PHMRON RAMP, AUG. 13, 1991

### KYW-352-2

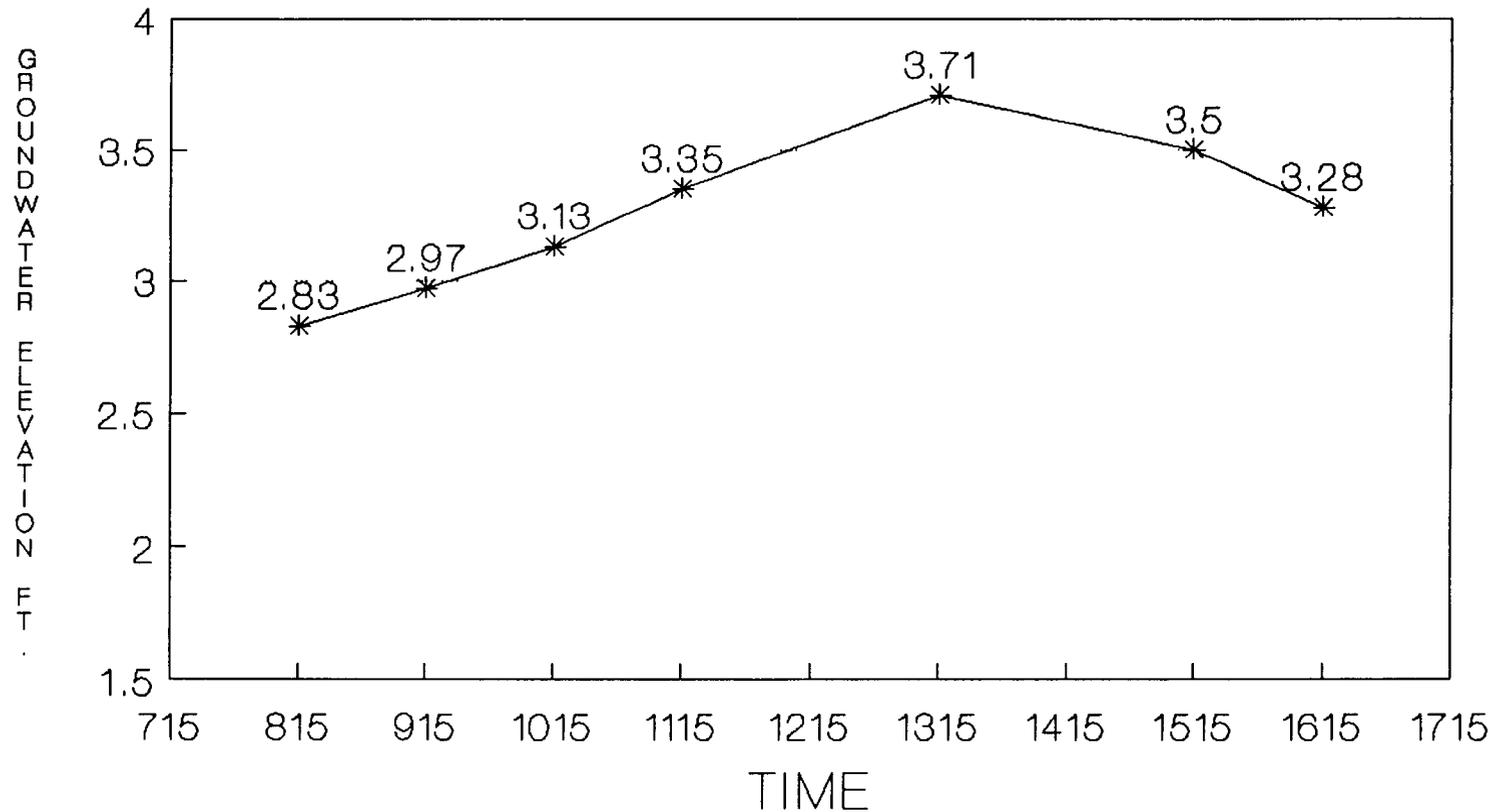


HIGH TIDE: 1301 HOURS  
LOW TIDES: 0530 & 1844 HOURS  
TRUMAN ANNEX PHMRON RAMP

# TIDAL INFLUENCE STUDY, BUILDING 352

## TRUMAN ANNEX PHMRON RAMP, AUG. 13, 1991

### KYW-352-3



HIGH TIDE: 1301 HOURS  
LOW TIDES: 0530 & 1844 HOURS  
TRUMAN ANNEX PHMRON RAMP