

FINAL

SITE ASSESSMENT REPORT

**THE CAMPBELL STREET
JP-5 PIPELINE
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA**

CONTRACT TASK ORDER 0013

Prepared For:

**DEPARTMENT OF THE NAVY
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ENGINEERING COMMAND
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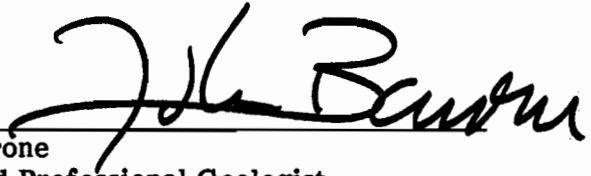
**BAKER ENVIRONMENTAL, INC.
*Coraopolis, Pennsylvania***

AUGUST 12, 1992

CTO-0013
Campbell Street JP-5 Pipeline
Final Site Assessment Report

Certified Professional Geologist's Statement

I, John Barone, a Certified Professional Geologist in the State of North Carolina, confirm that this report and its contents have been prepared in accordance with the approved Work Plan, dated December 3, 1991, and with the standards of best professional practice.

A handwritten signature in black ink, appearing to read "John Barone", written over a horizontal line.

John Barone
Certified Professional Geologist
State of North Carolina
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EXECUTIVE SUMMARY

In accordance with the State of North Carolina's Underground Storage Tank (UST) Regulations, a Site Assessment Investigation was performed at the New River Air Station, Jacksonville, North Carolina. The Site Assessment Investigation was performed to address concerns related to the Campbell Street JP-5 Pipeline. The pipeline is used to transfer JP-5 aviation fuel from the Campbell Street Fuel Farm to the aircraft direct refueling area, approximately 1.0 mile southeast of the Campbell Street Fuel Farm. The underground pipeline currently in use was installed in 1985 as a replacement for the previous system. The former pipeline running from the Campbell Street Fuel Farm to the flightline was abandoned in place, except for a 400-foot section located at the flightline, which was removed.

The field investigation was initiated on December 9, 1991, and concluded on February 6, 1992. Assessment activities included reviewing background information, performing a soil gas survey, performing 20 penetrometers (hydropunches), installing 15 soil borings, subsurface soil screening, soil sampling and analysis, installing seven shallow monitoring wells and four deep monitoring wells, and groundwater sampling for chemical analysis. Hydraulic conductivity tests were also performed on two selected monitoring wells.

Chemical analyses performed on the selected soil samples indicated that total petroleum hydrocarbons (TPH) exceed the State of North Carolina action level of 35 mg/kg (established by the Site Sensitivity Evaluation) in 10 soil samples. The highest TPH concentrations were detected along the northern portion of the pipeline, east of the steam-generating building (Building AS-4151); and at the southern end of the pipeline, near the aircraft direct refueling area.

Volatile organic compounds (VOCs) were detected in all groundwater samples collected from the penetrometers and seven of the eleven samples from the monitoring wells. No groundwater monitoring wells were detected to have methyl tertiary butyl ether (MTBE). One groundwater sample, from MW-1, was detected to contain base neutral/acid extractables (BNAs). Benzene concentrations did not exceed the Federal Maximum Contaminant Level (MCL) of 5.0 µg/L while the State Water Quality Standard (WQS) of 1.0 µg/L was exceeded in three monitoring wells (MW-1, DW-1, and DW-3) as well as 11 penetrometers (HPs 5, 6, 7, 8, 10, 11, 12, 14, 18, 19, and 20). Three groundwater samples from the penetrometers (HP-10, HP-12, and HP-18) exceeded the interim state WQS of 50 µg/L for MTBE.

No direct exposure pathways for contamination are considered to exist at the Campbell Street Fuel Farm or along the JP-5 Pipeline. Typical exposure pathways might be groundwater ingestion, inhalation of volatile organics and direct contact with surface soils. There are three known water supply wells within a 1/4-mile radius of the pipeline, but these wells are either inactive or screened significantly deeper than the shallow aquifer that is beneath the pipeline. Therefore, groundwater ingestion is an unlikely exposure pathway at this site. The entire area along the pipeline is paved, or grass-covered; therefore, the risk of inhalation of volatile organics from the soil is relatively low.

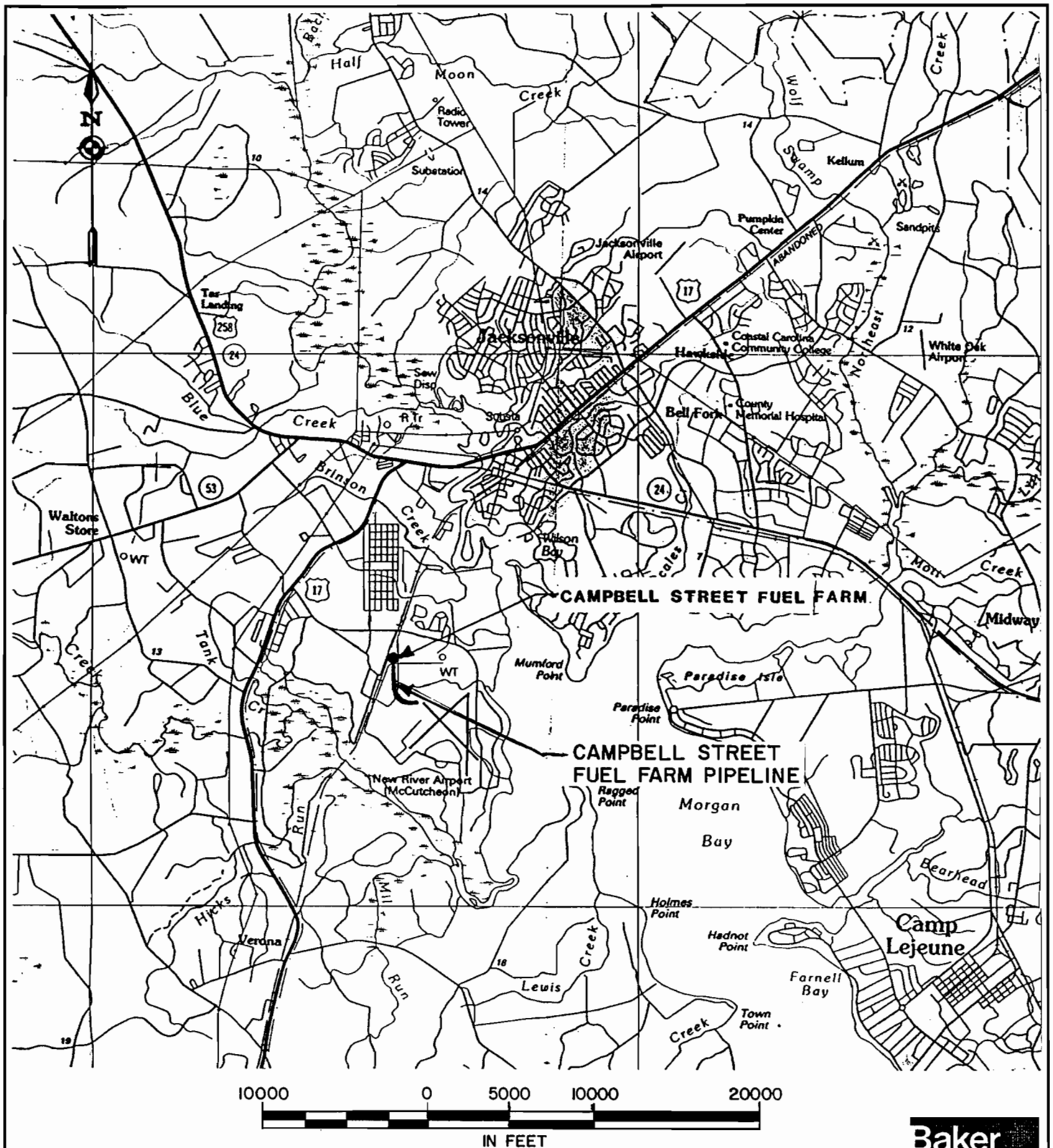
Based on the analytical findings, remediation only of the subsurface soils in the northern and southern portions of the pipeline is recommended. Although groundwater contamination is found at the site, the levels of contamination detected are such that the groundwater does not have to be remediated immediately. Rather, it is recommended that the source of contamination, the soils, be addressed. Periodic monitoring of the groundwater will assist in evaluating whether groundwater remediation will eventually be required.

1.0 INTRODUCTION

A Site Assessment Investigation was conducted by Baker Environmental, Inc., (Baker) along the Campbell Street JP-5 Pipeline. The Campbell Street JP-5 Pipeline is located at the New River Marine Corps Air Station (NRMCAS), in Jacksonville, North Carolina. The Campbell Street JP-5 Pipeline is approximately one mile in length and is used to transfer aviation fuel from the Campbell Street Fuel Farm (CSFF) to the aircraft direct refueling station. The location of the CSFF and Campbell Street JP-5 Pipeline are shown on Figure 1.

The specific objectives of the site assessment were to investigate the geologic and hydrogeologic conditions in the area of concern, and to define the extent and severity of potential subsurface fuel contamination or migration resulting from the Campbell Street JP-5 Pipeline or the abandoned pipeline that the current system has replaced.

Field activities commenced on December 9, 1991, and continued through February 6, 1992. These activities included a soil gas survey, soil borings, monitoring well installation, soil and groundwater sampling, penetrometer installation, field screening of petroleum hydrocarbons, fluid level measurements, and hydraulic conductivity tests. Standard operating procedures for these activities can be found in Appendix A. The Health and Safety Plan related to these field activities is provided in Appendix G.



SOURCE: U.S. TOPOGRAPHIC MAP, NEW RIVER, NORTH CAROLINA QUADRANGLE

Baker
Baker Environmental, Inc.

FIGURE 1
CAMPBELL STREET JP-5 PIPELINE
SITE LOCATION MAP

NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

2.0 SITE HISTORY/PREVIOUS INVESTIGATIONS

The flightline for the MCAS is supplied with fuel from the CSFF via an underground pipeline. The underground pipeline from the CSFF runs south along White Street (Figure 2), then turns to the east and connects to the aircraft direct refueling stations, which are located approximately 0.7 miles southeast of the CSFF.

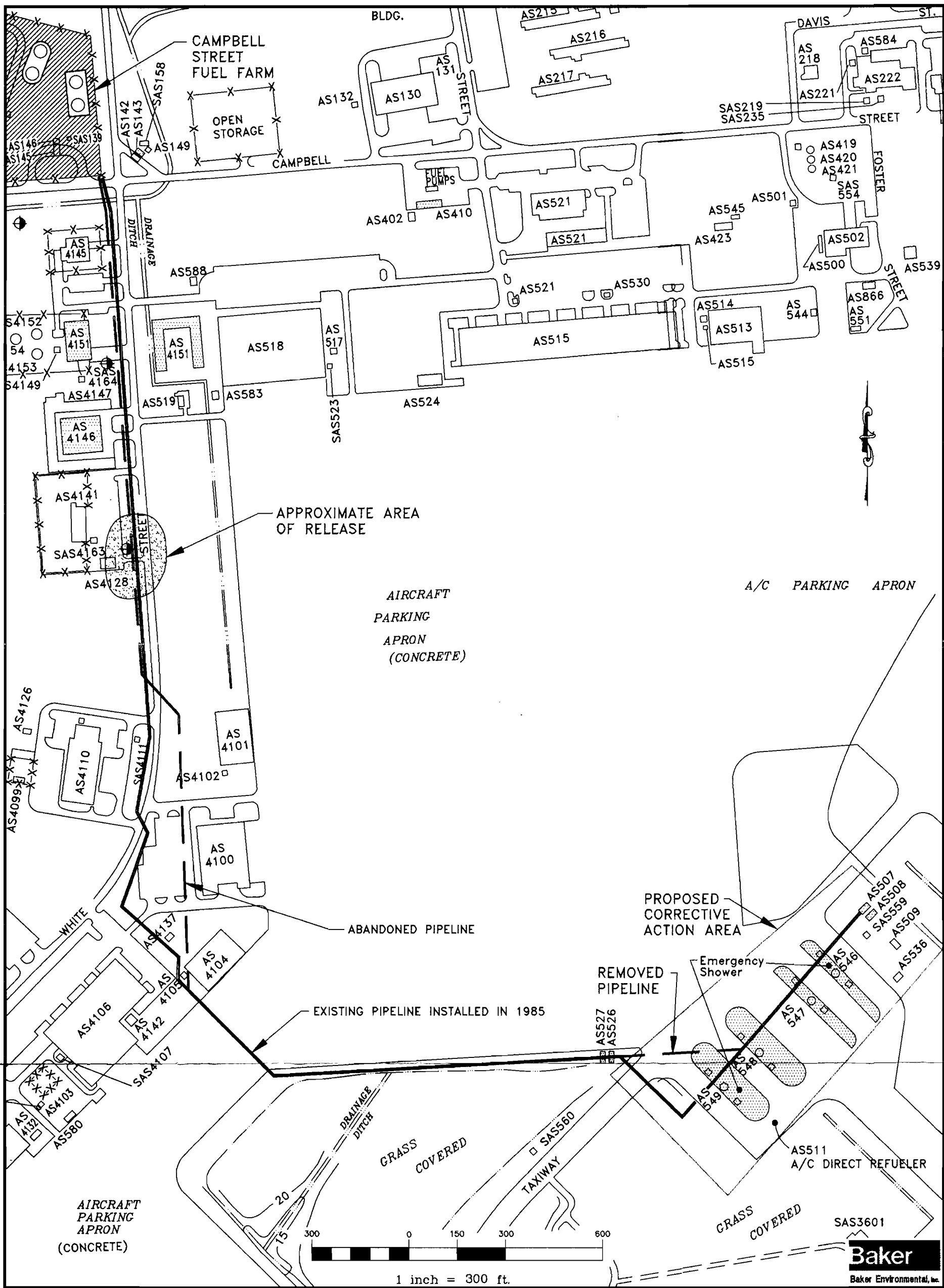
The underground pipeline currently in use was installed in 1985 as a replacement for the previous system. The previous underground pipeline was abandoned in place for most of its length. A 400-foot section of the abandoned pipeline was removed along the flightline as shown on Figure 2. For most of its length, the current, active pipeline is adjacent to the original, abandoned pipeline system. The approximate locations of the abandoned and currently used pipelines are shown on Figure 2. The previous underground pipeline was allowed to gravity empty before it was abandoned. The possibility of small amounts of JP-5 remaining in the line still exists.

The CSFF is located on the northwest corner of the intersection of White Street and Campbell Street. The CSFF consists of four above-ground storage tanks (AST). The ASTs were installed in 1985 and are constructed of steel. Each AST has a capacity of 215,000 gallons. The ASTs are used for storage of JP-5 aviation fuel.

A known release of JP-5 aviation fuel occurred from the Campbell Street JP-5 Pipeline approximately 0.35 miles south of the CSFF, in the vicinity of Buildings AS-4141 and AS-4146. This release was associated with the operation of the now-abandoned pipeline. Free product was identified in the area and an interim recovery system was installed and began operation in 1986; it is still ongoing. In June 1991, O'Brien and Gere submitted a Corrective Action Plan (CAP) for this area. The affected area is shown on Figure 2.

The southern end of the pipeline, where the aircraft direct refueling station is located, also has a history of releases. This area is reportedly being investigated by the Activity. The approximate limits of the area under investigation are shown on Figure 2.

Three groundwater monitoring wells, from previous hydrogeologic assessments were found by Baker personnel in the vicinity of the Campbell Street JP-5 Pipeline. The locations of these wells are shown on Figure 2. Baker personnel checked the fluid level measurements in the two northern monitoring wells with an oil/water interface probe. The third well could not be



LEGEND

- EXISTING MONITORING WELL
- BUILDING WITH RELATED PETROLEUM SYSTEM
- APPROXIMATE AREA OF RELEASE
- CAMPBELL STREET FUEL FARM
- ABANDONED PIPELINE
- EXISTING PIPELINE INSTALLED IN 1985

SOURCE: LANTRIV, OCT. 1991; OBRIEN & GERE, "CORRECTIVE ACTION PLAN, JP-5 LINE AREA", JUNE 1991.

FIGURE 2
CAMPBELL STREET JP-5 PIPELINE
POTENTIAL PETROLEUM SOURCES
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

accessed. No free product was detected in the two wells which were checked. Information regarding the reason for installation, date installed, well construction details, etc., were not obtainable at the time this report was prepared. Additional monitoring wells are likely located along the Campbell Street JP-5 Pipeline or other areas of the Activity through which the pipeline travels. Baker is not aware of such wells at this time.

3.0 POTENTIAL RECEPTORS/SITE UTILITIES

3.1 Site Description

The Campbell Street JP-5 Pipeline is primarily located along White Street at the New River MCAS, Jacksonville, North Carolina. As shown on Figure 3, both the present (active) and former (abandoned) pipelines originate from the southeast corner of the CSFF. The pipelines extend south under Campbell Street and parallel the western side of White Street. Approximately 2,000 feet south of the CSFF, the active pipeline passes beneath White Street and turns towards the southeast. The active pipeline eventually passed beneath an aircraft parking apron and then turns eastward until reaching the aircraft direct refueling station.

As shown on Figure 3, the abandoned pipeline parallels the active pipeline for a majority of the distance from the CSFF to the refueling station. The abandoned pipeline is separated from active pipeline in the vicinity of Buildings AS-4111 and AS-4100. In addition, approximately 400 feet of the abandoned pipeline were removed in the vicinity of the refueling station.

The Campbell Street JP-5 Pipeline along White Street is located beneath a combination of asphalt and concrete (in areas for vehicle traffic) as well as grass (in non-traffic areas). Once the pipeline turns to the southeast, it is primarily covered with a grass surface. The pipeline then passes beneath the aircraft parking apron for a distance of approximately 300 feet. The aircraft parking apron has a concrete surface. After crossing the aircraft parking apron, the pipeline progresses eastward parallel to the southern edge of the main aircraft parking apron. The entire length of pipeline in this area is beneath a grass surface area as shown on Figure 3.

In the northern portion of the pipeline, a network of surface water drainage channels intercepts surface runoff. These channels are 4 to 6 feet in depth. Shallow channels, 1 to 2 feet in depth, parallel White Street along the southern portions of the pipeline. The grass-covered area south of the main aircraft parking apron has a 6 to 8 foot drainage channel to intercept surface runoff in this area.

3.2 Off-Site Contamination Sources

Several potential contaminant sources were observed along the pipeline. The CSFF, with four ASTs, is located at the northern end of the pipeline. Approximately 0.2 miles south of the

northern end of the pipeline is a second fuel farm which contains three ASTs, this fuel farm is associated with the steam-generating facility (Building AS-4151).

UST AS-143 is associated with Building AS-143, which is located on the eastern side of White Street across from the CSFF. Building AS-143 serves as a military refueling station. UST AS-143 is constructed of steel and contains unleaded gasoline. The UST was installed in 1961 and has a capacity of 10,000 gallons.

Approximately 1,000 feet east of the intersection of White Street and Campbell Street is Building AS-410. This building is an active service station that dispenses gasoline products. The building currently operates two 4,000-gallon USTs for regular and premium unleaded gasoline. A 550-gallon UST is also used at the service station for the storage of waste oils.

Several areas along the pipeline reportedly operate petroleum systems. The various buildings where these potential sources may be located are shown on Figure 2. The information concerning these sources are summarized on Table 1.

3.3 Potential Receptors/Site Utilities

3.3.1 Local Land Use

Land cover in the subject area is mixed urban. Local land uses along White Street are related to base operations and are primarily commercial, light industrial and military. The pipeline is bordered to the north by the CSFF. Another fuel farm is located approximately 0.2 miles south of the northern end of the pipeline. The fuel farm is associated with Building AS-4151, the steam generation facility. Building AS-143 and its associated UST are located to the immediate east of the CSFF area on the northeast corner of the intersection of White Street and Campbell Street. The locations of these areas are shown on Figure 2.

The portion of pipeline south of the main parking apron is also associated with military aircraft operations, mainly parking, repairing and refueling. As shown on Figure 3, taxiways and other ground operations also occupy this area.

TABLE 1
POTENTIAL OFF-SITE CONTAMINATION SOURCES

Building No.	Tank I.D. No.	Petroleum Type Stored	Age of Tank (Years)	Tank Capacity (gallons)	Status	Approximate Distance/Direction Pipeline to Source
AS-143	AS-143	Unleaded Gasoline	31	10,000	Active	150 Feet/East
AS-410	AS-0410-1	Unleaded Gasoline	30	4,000	Active	1,000 Feet/East
	AS-0410-2	Unleaded Gasoline	30	4,000	Active	1,000 Feet/East
	AS-0410-3	Unleaded Gasoline	30	4,000	Active	1,000 Feet/East
	AS-0410-4	Unleaded Gasoline	30	4,000	Active	1,000 Feet/East
	AS-0410-5	Unleaded Gasoline	30	4,000	Active	1,000 Feet/East
	AS-0410-6	Unleaded Gasoline	30	4,000	Abandoned	1,000 Feet/East
	AS-0410-7	Used Oil	30	200	Active	1,000 Feet/East
AS-4146	AS-4146-1	Diesel Fuel	12	5,000	Active	150 Feet/West
	AS-4146-2	Unleaded Gasoline	12	5,000	Active	150 Feet/West
	AS-4146-3	Used Oil	12	550	Abandoned	150 Feet/West
AS-4151	AS-4151-1	Used Oil	Unknown	1,000	Active	200 Feet/West
	AS-4151-2	Unleaded Gasoline	15	1,000	Active	200 Feet/West
AS-507	AS-507	JP-5 Aviation Fuel	21	20,000	Active	Southern Pipeline End
AS-508	AS-508-1	JP-5 Aviation Fuel	21	20,000	Active	Southern Pipeline End
	AS-508-2	JP-5 Aviation Fuel	21	750	Active	Southern Pipeline End
AS-511	AS-511-1	JP-5 Aviation Fuel	23	20,000	Active	250 Feet/South
	AS-511-2	JP-5 Aviation Fuel	23	20,000	Active	250 Feet/South
	AS-511-3	JP-5 Aviation Fuel	23	1,000	Active	250 Feet/South
	AS-511-4	JP-5 Aviation Fuel	23	1,000	Active	250 Feet/South
AS-526	AS-526	Empty	19	20,000	Abandoned	Southern Pipeline End
AS-527	AS-527-1	Empty	19	20,000	Abandoned	Southern Pipeline End
	AS-527-2	Empty	19	1,000	Abandoned	Southern Pipeline End
AS-546	AS-546	Used Oil	15	590	Active	Southern Pipeline End
AS-547	AS-547	Used Oil	15	590	Active	Southern Pipeline End
AS-548	AS-548	Used Oil	15	590	Active	Southern Pipeline End
AS-549	AS-549	Used Oil	15	590	Active	Southern Pipeline End

Source: LANTDIV, October 1991

3.3.2 Inventory of Water Supply Wells

As required by the North Carolina Department of Environment Health and Natural Resources (DEHNR), information on water supply and observation wells located in the vicinity of the site is provided in Table 2. Well locations are shown in Figure 4.

The U.S. Geological Survey (U.S. G.S.) provided the list of known wells in the vicinity. As shown on Table 2 and Figure 4, there are numerous wells reported in the vicinity of the Campbell Street JP-5 Pipeline. Eleven wells are within a 0.5-mile distance of the pipeline. These eleven wells are most likely water supply wells with screened intervals ranging from approximately 118 to 180 feet below ground surface. Two wells (MCAS-4140 and MCAS-4150), are located within 0.25 miles of the site. These wells are likely screened in the deeper Castle Hayne Aquifer.

According to Activity personnel, two wells in the vicinity of the pipeline have experienced chemical contamination problems. Supply wells MCAS-4150 and MCAS-106 are currently out of service due to groundwater contamination detected in the aquifer in which they are screened. Wells MCAS-4150 and MCAS-106 have had trichloroethane (TCE) and dichloroethane (DCE) constituents present.

3.3.3 Site Utilities

Various types of underground utilities are located along White Street and the pipeline. The approximate locations of the water, electric and sanitary sewage utilities are shown on Figure 5.

A fiber-optic cable is also reported along either Campbell Street or White Street. However, the exact location has not been determined by base personnel. Locations for standard underground telephone lines were also not available.

TABLE 2

RECORDS OF SELECTED WELLS IN THE VICINITY OF THE CAMPBELL STREET JP-5 PIPELINE

Well No.	U.S.G.S. I.D. No.	Approximate Distance/Direction Site to Well	Year Drilled	Depth (feet)	Driller	Screen Interval (feet below surface)	Well Diameter (inches)	Water Level (below land surface in feet)
MCAS-106	3443090772648.1	0.35 miles northeast	1954e	179	--	--	--	15.6
MCAS-131	3443260772701.1	0.4 miles east	--	200	--	--	14.75	15.0
MCAS-203	3443230772653.1	0.45 mile northeast	--	173	--	--	14.75	14.4
MCAS-1254	3443290772736.1	0.7 mile northwest	1975	195	Carolina Well and Pump Co.	118-122,145-160,175-185	--	32p
MCAS-4140	3442570772726.1	0.25 mile south-southwest	--	--	--	--	18.0	20.3
MCAS-4150	34422380772724.1	0.15 mile south-southwest	--	--	--	--	18.0	25p
MCAS-5001	3442230772728.1	0.43 mile south-southwest	--	193	--	--	--	34p
MCAS-5009	3442200772719.1	0.37 miles south	--	196	--	--	--	66p
N-52	3444180772729.1	1.4 miles north	1941	70	Layne Atlantic Co.	25-66	--	4.4

NOTE: Numbers are shown on the well location map (Figure 4) and are those assigned by the U.S. Marine Corps or its contractors to identify wells constructed at the base.

U.S.G.S. Identification Number: Numbers are comprised of degrees, minutes, and seconds of latitude (first six numbers) north of the equator and longitude (next seven numbers) west of the prime meridian. The number to the right of the decimal point is a sequential number for wells at a designated location.

(--) = No available data

(e) = estimated

(p) = Pumping water level (measured value given to tenths of a foot, reported to the nearest foot)

Source: U.S.G.S., Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989

TABLE 2 (CONTINUED)

RECORDS OF SELECTED WELLS IN THE VICINITY OF THE CAMPBELL STREET JP-5 PIPELINE

Well No.	U.S.G.S. I.D. No.	Approximate Distance/Direction Site to Well	Year Drilled	Depth (feet)	Driller	Screen Interval (feet below surface)	Well Diameter (inches)	Water Level (below land surface in feet)
T-15	3444250772701.1	1.6 miles north	1959	121	Heater Well Co.	--	--	--
TC-100	34444280772729.1	1.65 miles north	1941	67	Layne Atlantic Co.	--	18	6.1
TC-104	3444300772729.1	1.65 miles north	1941	182	Virginia Machine and Well Co.	107-182	10	14.4
TC-190	3443170772737.1	0.4 mile west-northwest	1978e	180	Carolina Well and Pump Co.	130-140 150-180	--	42p
TC-191	3443070772729.1	0.35 mile west	1977e	180	Carolina Well and Pump Co.	130-140 150-180	--	26.5
TC-201	3443280772831.1	1.35 miles west-northwest	1941	68	Layne Atlantic Co.	46-66	8	20.5
TC-202	3444120772755.1	1.65 miles north	1942	80	--	35-40, 45-50, 55-60, 65-70, 75-80	8	5.0
TC-325	3444120772755.2	1.5 miles north-northwest	1980	--	Carolina Well and Pump Co.	--	--	49.0p
TC-502	3444070772728.1	1.6 miles north	1941	184	Virginia Machine and Well Co.	110-184	10	24p

NOTE: Numbers are shown on the well location map (Figure 4) and are those assigned by the U.S. Marine Corps or its contractors to identify wells constructed at the base.

U.S.G.S. Identification Number: Numbers are comprised of degrees, minutes, and seconds of latitude (first six numbers) north of the equator and longitude (next seven numbers) west of the prime meridian. The number to the right of the decimal point is a sequential number for wells at a designated location.

(--) = No available data

(e) = estimated

(p) = Pumping water level (measured value given to tenths of a foot, reported to the nearest foot)

Source: U.S.G.S., Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989

TABLE 2 (CONTINUED)

RECORDS OF SELECTED WELLS IN THE VICINITY OF THE CAMPBELL STREET JP-5 PIPELINE

Well No.	U.S.G.S. I.D. No.	Approximate Distance/Direction Site to Well	Year Drilled	Depth (feet)	Driller	Screen Interval (feet below surface)	Well Diameter (inches)	Water Level (below land surface in feet)
TC-504	344409077284.1	1.5 miles northwest	1942	113	Layne Atlantic Co.	50-60 75-85	8	48p
TC-600	3444050772728.1	1.3 miles north	1941	70	Layne Atlantic Co.	48-70	8	37p
TC-604	3444000772811.1	1.5 miles northwest	1942	113	Layne Atlantic Co.	82-87, 97- 102, 108-113	8	4.4
TC-700	3443560772811.1	1.1 miles north	1941	76	--	27.5-75	18	36p
TC-901	3443450772727.1	0.9 mile north	1941	77	Layne Atlantic Co.	46-56 66-76	8	4.3
TC-1000	3443430772825.1	1.35 miles northwest	1942	137	Layne Atlantic Co.	116-136	8	38p
TC-1001	3444270772729.1	1.1 miles northwest	1942	100	Layne Atlantic Co.	70-100	8	9.5
TC-1251	344390772710.1	0.4 mile north	1975	240	Carolina Well and Pump Co.	120-140 160-170	--	27p

NOTE: Numbers are shown on the well location map (Figure 4) and are those assigned by the U.S. Marine Corps or its contractors to identify wells constructed at the base.

U.S.G.S. Identification Number: Numbers are comprised of degrees, minutes, and seconds of latitude (first six numbers) north of the equator and longitude (next seven numbers) west of the prime meridian. The number to the right of the decimal point is a sequential number for wells at a designated location.

(-) = No available data

(e) = estimated

(p) = Pumping water level (measured value given to tenths of a foot, reported to the nearest foot)

Source: U.S.G.S., Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989

TABLE 2 (CONTINUED)

RECORDS OF SELECTED WELLS IN THE VICINITY OF THE CAMPBELL STREET JP-5 PIPELINE

Well No.	U.S.G.S. I.D. No.	Approximate Distance/Direction Site to Well	Year Drilled	Depth (feet)	Driller	Screen Interval (feet below surface)	Well Diameter (inches)	Water Level (below land surface in feet)
TC-1253	3443370772729.1	0.6 mile north	1975	250	Carolina Well and Pump Co.	120-135 155-170	--	32p
TC-1255	3443290772754.1	0.75 mile northwest	1975	250	Carolina Well and Pump Co.	124-132,156- 166,180-190	--	58p
TC-1256	3443350772805.1	0.9 mile northwest	--	204	Carolina Well and Pump Co.	124-134,154- 164,182-192	--	54p
X25m2	3442180772734.1	0.5 miles south-southwest	1968	156	Hartsfield Water Company	--	--	--
X25616	3444350772640.1	1.85 miles north	1978	185	N.C. Division of Envir. Mnst.	--	4	--

NOTE: Numbers are shown on the well location map (Figure 4) and are those assigned by the U.S. Marine Corps or its contractors to identify wells constructed at the base.

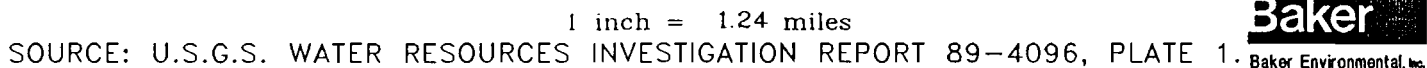
U.S.G.S. Identification Number: Numbers are comprised of degrees, minutes, and seconds of latitude (first six numbers) north of the equator and longitude (next seven numbers) west of the prime meridian. The number to the right of the decimal point is a sequential number for wells at a designated location.

(--)= No available data

(e) = estimated

(p) = Pumping water level (measured value given to tenths of a foot, reported to the nearest foot)

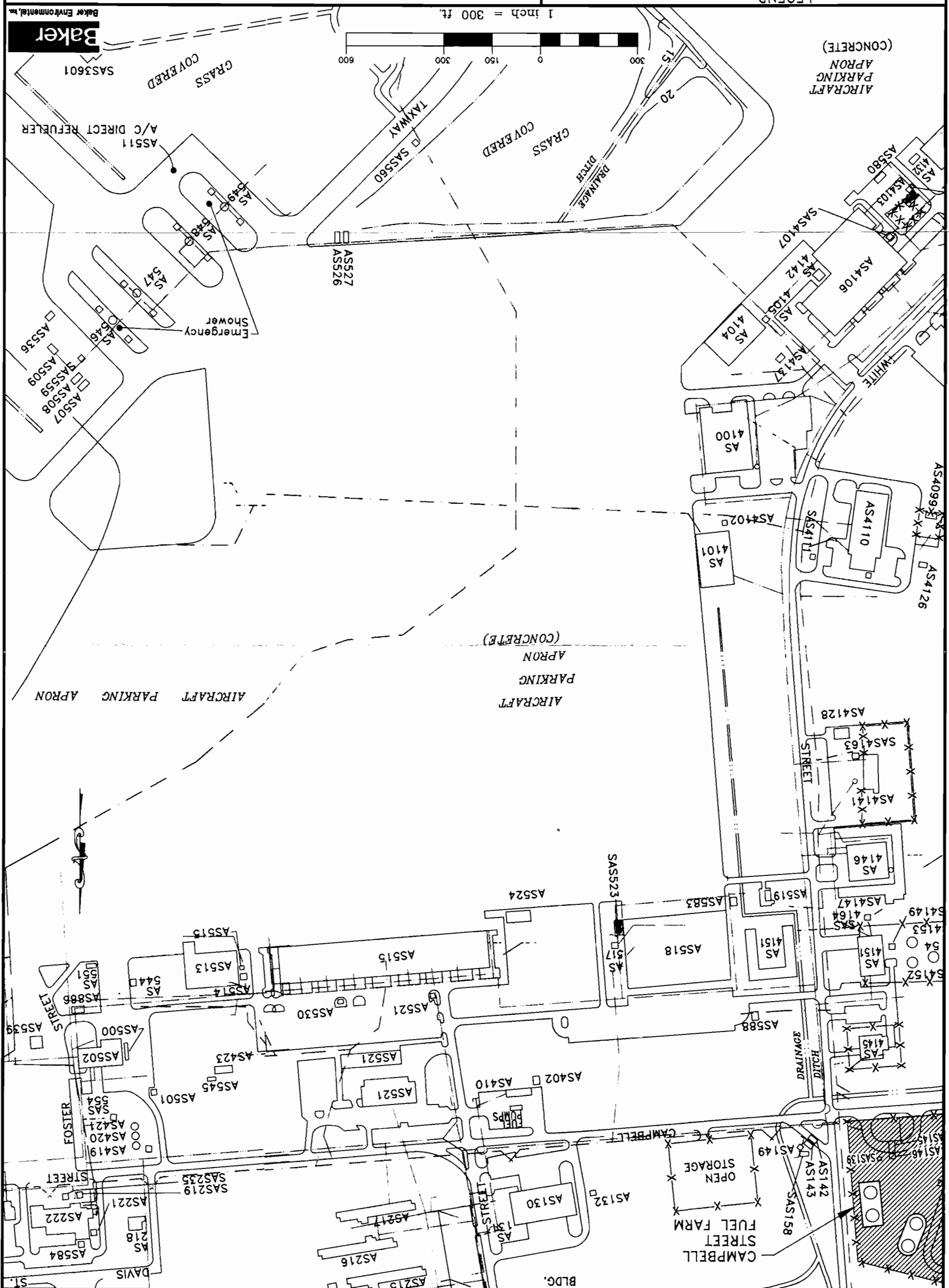
Source: U.S.G.S., Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989



NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

FIGURE 5
CAMPBELL STREET JP-5 PIPELINE
LOCATION OF UNDERGROUND UTILITIES
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

LEGEND
SANITARY SEWER LINE
ELECTRICAL LINE
PORTABLE WATER LINE



4.0 SITE TOPOGRAPHY AND SURFACE WATER FEATURES

4.1 Surface Water

The pipeline is situated approximately 1.0 mile west of the New River estuary. Southwest Creek and associated marshlands are located approximately 0.4 miles southwest of the site. The surface water features are shown on Figure 6.

The Marine Corps Air Station is drained by a network of ditches constructed for development of the base. Stormwater runoff from the highly developed portion of the installation is collected by this network of ditches, which conveys the water to the New River. In the immediate vicinity of the site, manmade drainage features along nearby roadways channelize surface runoff as shown on Figure 2.

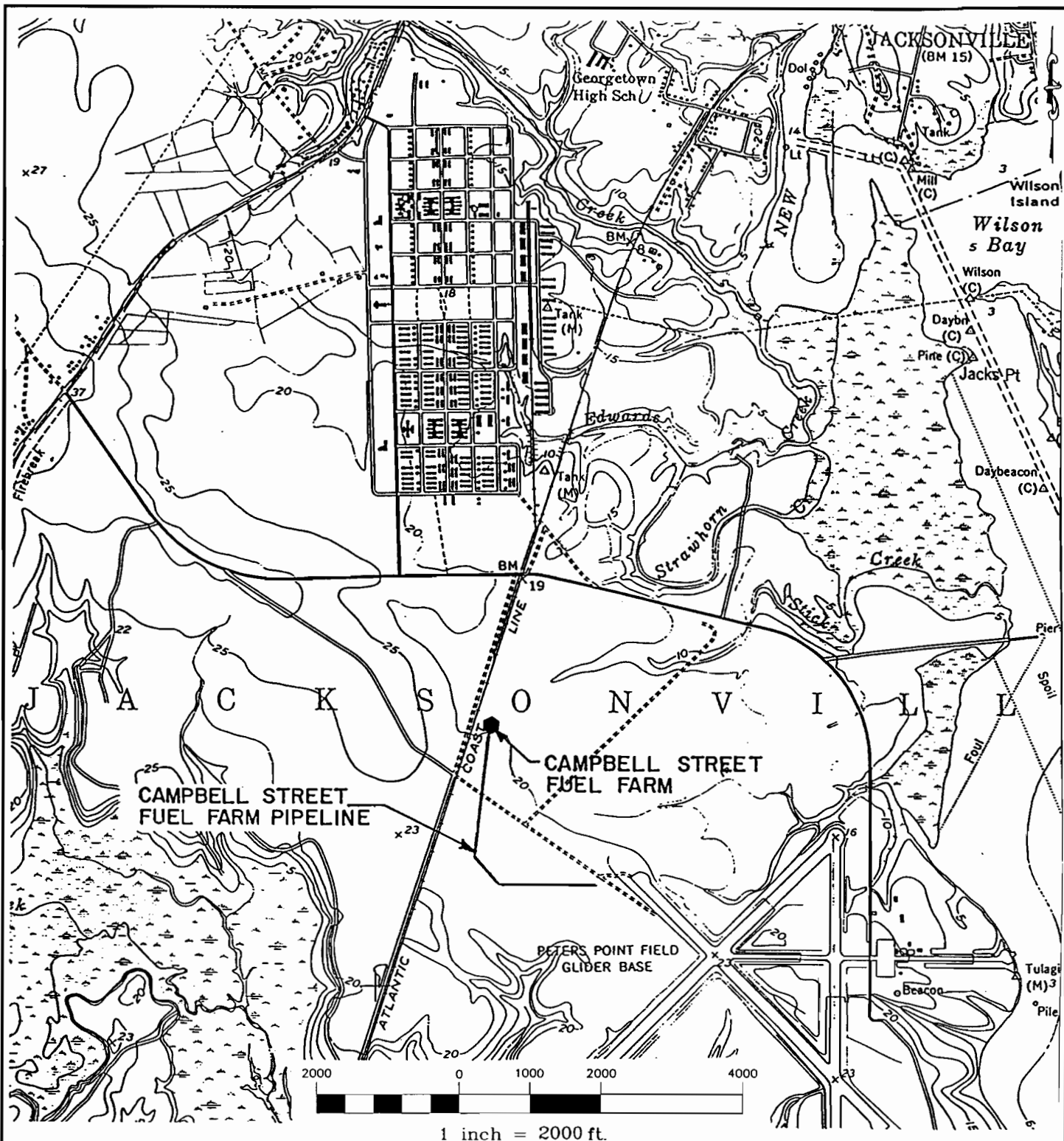
4.2 Site Topography

The area surrounding the pipeline is primarily flat with a very slight slope towards the east and southeast. Figure 6 is a topographic map which shows the relatively flat relief of the area. The site is approximately 20 feet above sea level.

Wooded areas lie to the north and east of the pipeline. Military buildings and services line both sides of White Street, south of Campbell Street.

The southern area of the pipeline is predominantly grass- and concrete-covered. This area has been graded flat to accommodate aircraft traffic.

In this area of the base, surface water is directed towards a network of drainage ditches or channels adjacent to the streets. These ditches are typically 4 to 6 feet in depth along the northern portion of the pipeline. The locations of these ditches are shown on Figure 2. Drainage ditches along the southern portion of the pipeline were 6 to 8 feet in depth.



SOURCE: U.S.G.S. TOPOGRAPHIC MAP, JACKSONVILLE SOUTH QUADRANGLE
 PHOTO INSPECTED 1971

Baker
 Baker Environmental, Inc.

FIGURE 6
 CAMPBELL STREET JP-5 PIPELINE
 SITE TOPOGRAPHY

NEW RIVER MARINE CORPS AIR STATION
 JACKSONVILLE, NORTH CAROLINA

5.0 SITE SOILS AND GEOLOGY

5.1 Regional Geology

The New River Marine Corps Air Station, Jacksonville, North Carolina, is situated in the Atlantic Coastal Plain physiographic province. The region is underlain by several thousand feet of unconsolidated deposits of gravel, sand and clay ranging in age from Lower Cretaceous to Holocene, resting on a bedrock basement of PreCambrian and Triassic/Jurassic age. Generally, these deposits dip and thicken gently eastward (i.e., seaward) with thicknesses ranging from 1,500 feet to 5,000 feet. The sediment complex at Jacksonville, North Carolina is approximately 1,500 feet thick (U.S.G.S W-RIR 89-4128).

5.2 Site Geology

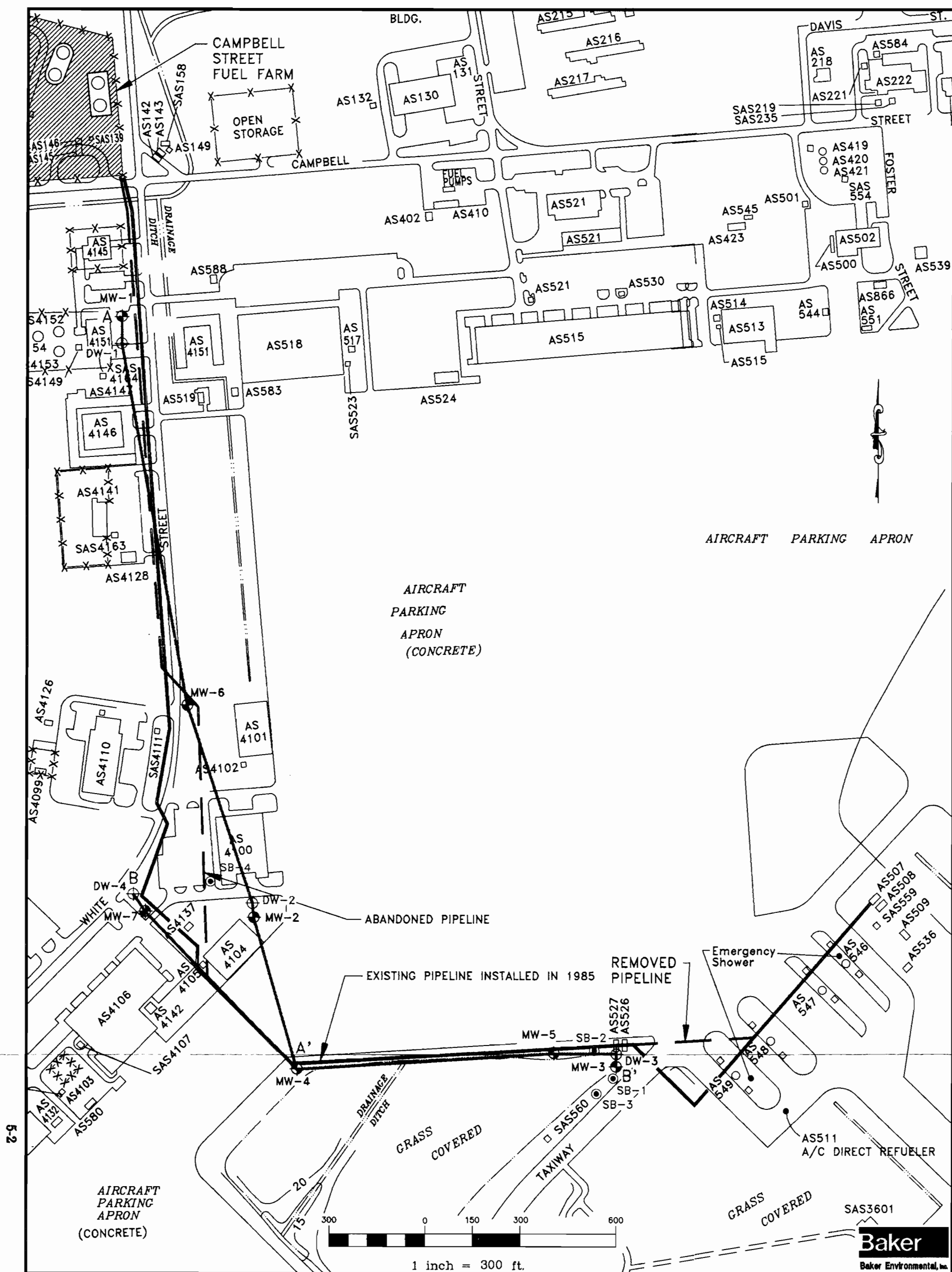
The pipeline is underlain by undifferentiated layers of sediments consisting of clays and sands which extend to depths between 50 and 100 feet. These serve as the surficial aquifer and are of Pleistocene and Holocene age.

These deposits are underlain unconformably by the Belgrade and River Bend Formations of Oligocene age which contain the Castle Hayne Aquifer, the main supply for the base (Section 7.1).

Hydrogeologic cross-sections were generated based on information obtained during advancement of the soil borings. As shown of Figure 7, two hydrogeologic cross-sections, A to A' and B to B', traverse the site to characterize horizontal and vertical subsurface soil conditions. In general, traverses A to A' was made north to south and traverse B to B' was made west to east across the site.

Cross-section A to A', Figure 8, depicts the hydrogeologic conditions from boring MW-1 (North) to boring MW-4 (South). The dominant lithology underlying the site is clay and sand or a varying degree of the two. At depths of approximately 27 feet, revealed by the borings of the two deep wells, a layer of fine gravel is present that is believed to be the beginning of the Castle Hayne Formation. Small lenses of clay and sand appear in MW-2 and DW-2.

Figure 9 depicts the hydrogeologic cross-section B to B' for conditions that were encountered from boring DW-4 (West) to MW-3 (East). Again the dominant lithologies were clay and sand.



LEGEND

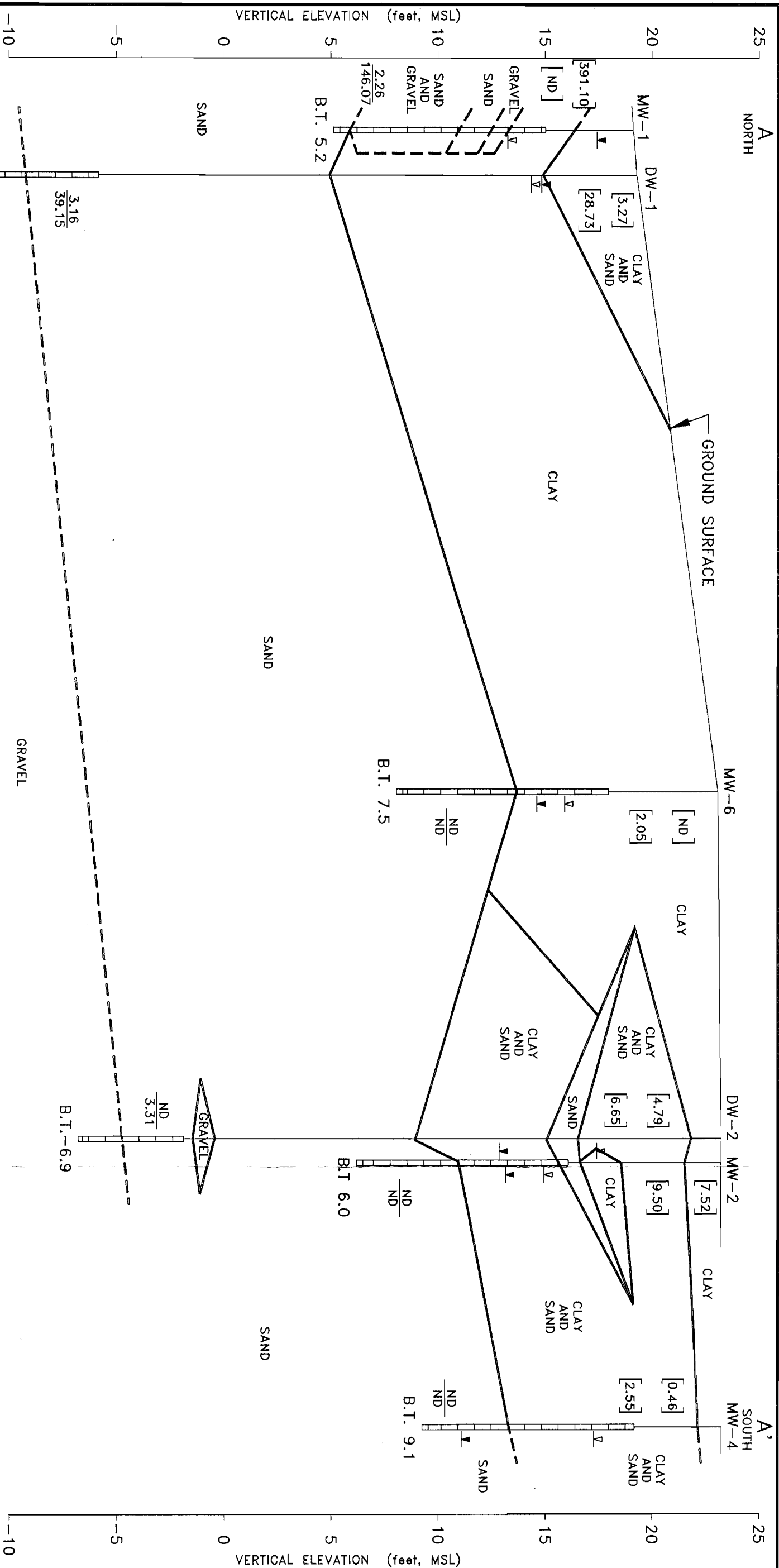
DW-1 TYPE III MONITORING WELL LOCATION	MW-1 TYPE II MONITORING WELL LOCATION
SB-4 SOIL BORING LOCATION	A-A' HYDROGEOLOGIC CROSS-SECTION TRAVERSE
— ABANDONED PIPELINE	
— EXISTING PIPELINE INSTALLED IN 1985	

SOURCE: LANTDIV, OCT. 1991

FIGURE 7
CAMPBELL STREET JP-5 PIPELINE
HYDROGEOLOGIC CROSS-SECTION
LOCATION MAP

NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

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LEGEND

GROUNDWATER ELEVATION (FEBRUARY 6, 1992)

GROUNDWATER ENCOUNTERED DURING DRILLING

B.T. 5.2' BORING TERMINATED, ELEVATION MSL

3.16 BENZENE CONCENTRATIONS (ug/L) IN GROUNDWATER

39.15 TOTAL VOC CONCENTRATIONS (ug/L) IN GROUNDWATER

[ND] TPH CONCENTRATIONS (mg/kg) IN SOILS

WELL SCREEN INTERVAL

NOT DETECTED AT METHOD DETECTION LIMITS

ESTIMATED PROJECTED

Horizontal Scale: 1 inch = 200 ft.

Vertical Scale: 1 inch = 5 ft.

THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

FIGURE 8

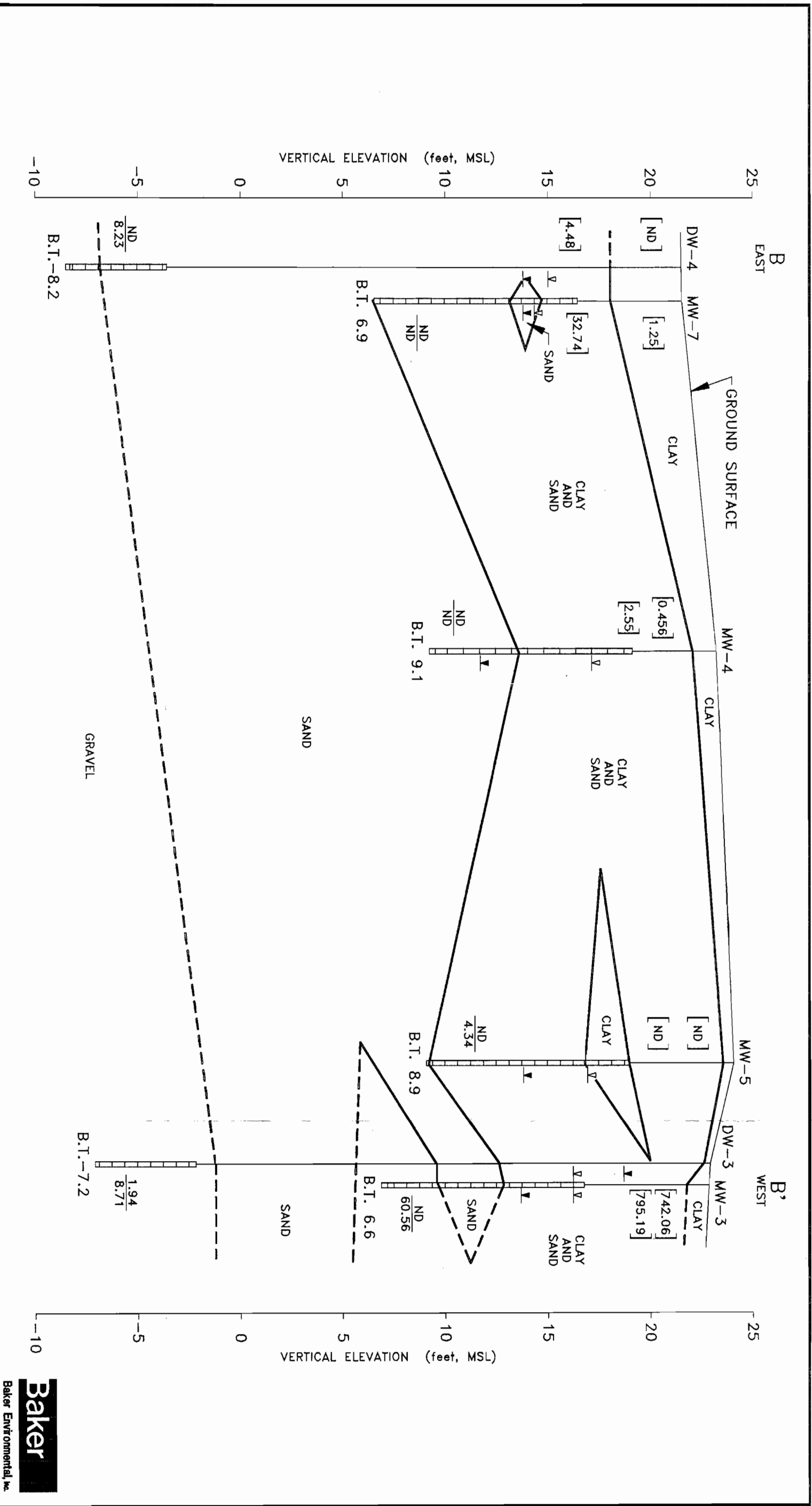
HYDROGEOLOGIC CROSS SECTION A-A'

WITH SOIL AND GROUNDWATER ANALYTICAL RESULTS

CAMBELL STREET JP-5 PIPELINE

NEW RIVER MARINE CORPS AIR STATION

JACKSONVILLE, NORTH CAROLINA



Clay alone was experienced nearer to the surface while a combination of clay with varying degrees of sand extended downward until a layer of sand only exists. Borings from the deep wells again indicate that fine gravel, which is the beginning of the Castle Hayne, exists near depths of approximately 27 feet.

5.3 Soil Boring Activities

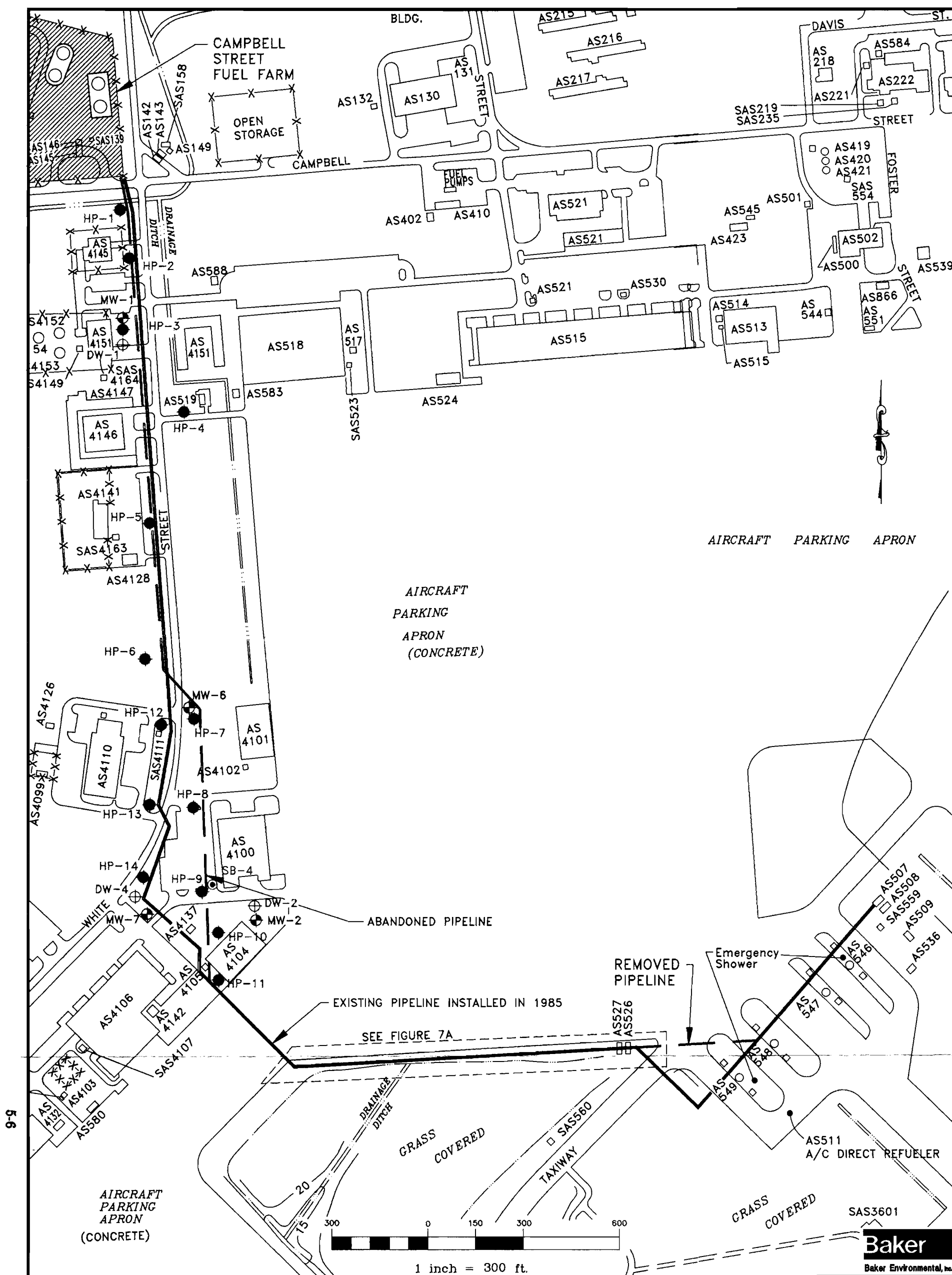
Fifteen soil borings were advanced in the vicinity of the pipeline from the CSFF at the northern end of the aircraft refueling stations to the southern end. These soil borings are designated B-1 through B-4, MW-1 through MW-7, and DW-1 through DW-4. The locations of these borings are shown on Figures 10 and 10A. The procedures used to perform the soil boring activities are provided in Appendix A. The Actual Field Test Boring Records for each soil boring are provided in Appendix B. These records depict soil conditions encountered at the time of drilling operations.

Four borings (B-1 through B-4) were advanced to the water table, approximately six to eight feet below ground surface. Seven soil borings (MW-1 through MW-7) were advanced to approximately fifteen feet below ground surface. Both types of soil borings were advanced using 6-1/4-inch inside diameter (I.D.), hollow-stem augers. Soil borings MW-1 through MW-7 were later converted into Type II shallow groundwater monitoring wells.

Four soil borings (DW-1 through DW-4) were advanced to a depth of approximately 30 feet. These borings were later converted into Type III monitoring wells. The initial soil borings were advanced to 20 feet using an 8-1/4-inch I.D. hollow stem augers. The borings were later advanced from 20 to 30 feet using a 5-7/8 inch tricone drill bit and rotary drilling methods. The methods used to complete these field activities are provided in Appendix A.

Soil cuttings obtained during drilling activities were containerized in steel 55-gallon drums and stored on site. All drums were labeled with the date of activity, site name, matrix (soil or water) and boring number to distinguish origin of the containerized material.

Standard penetration tests (SPT) were conducted following ASTM 1586-D guidelines. The split-spoon samples were collected at continuous, two-foot intervals until the final depth of the boring (except for DW-1, DW-2, DW-3 and DW-4, which were sampled at five-foot intervals after reaching the water table). All soil samples were visually classified using the Unified Soil Classification System (USCS) by the on-site geologist and described on a Test Boring Record.



LEGEND

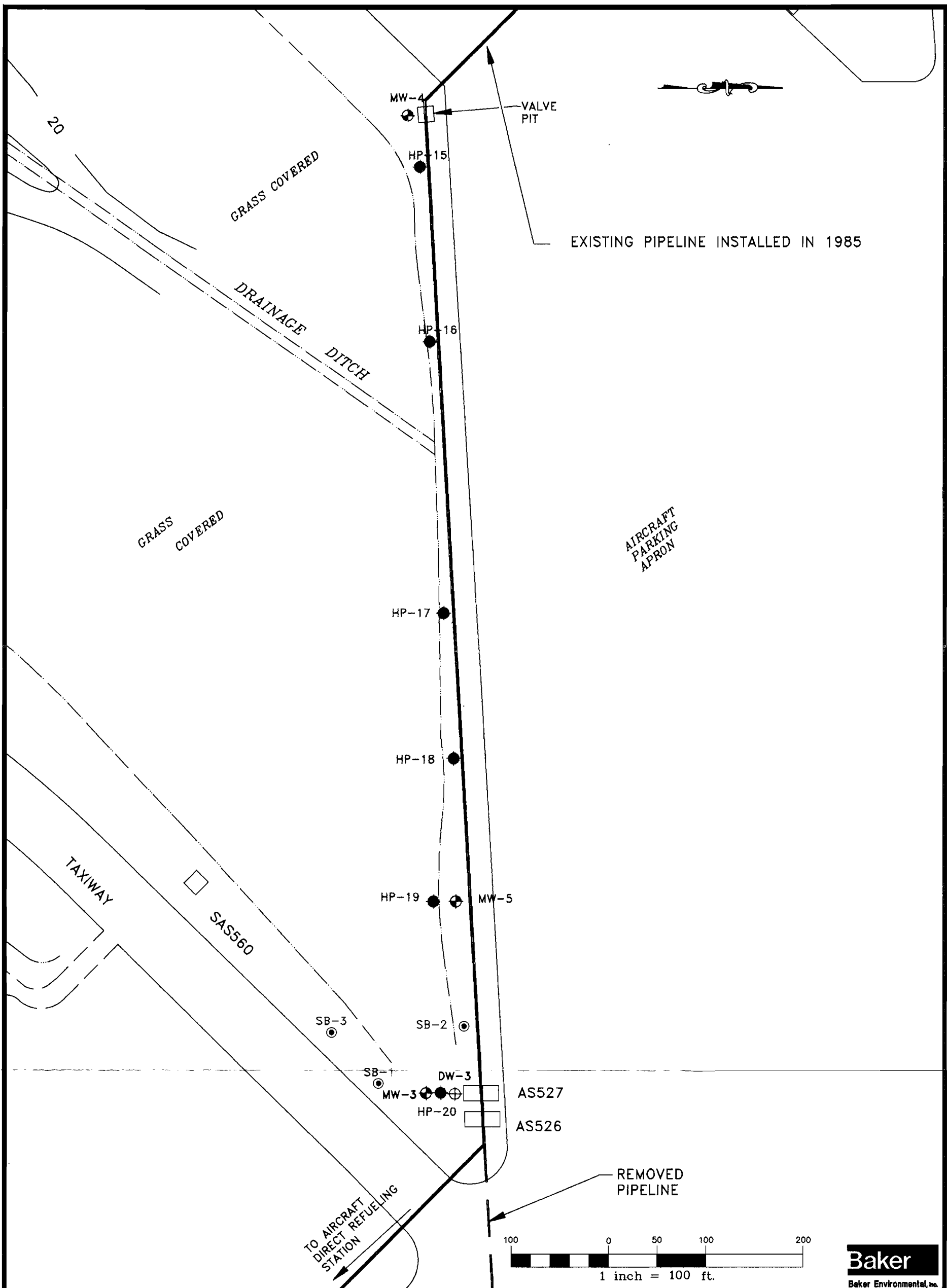
- DW-1 TYPE III MONITORING WELL LOCATION
- SB-4 SOIL BORING LOCATION
- ABANDONED PIPELINE
- EXISTING PIPELINE INSTALLED IN 1985
- MW-1 TYPE II MONITORING WELL LOCATION
- HP-1 HYDROPUNCH LOCATION

SOURCE: LANTDIV, OCT. 1991

FIGURE 10
CAMPBELL STREET JP-5 PIPELINE
SOIL BORING, MONITORING WELL
AND HYDROPUNCH LOCATION MAP
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

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MW-5 TYPE II MONITORING WELL LOCATION

SB-1 SOIL BORING LOCATION

DW-3 TYPE III MONITORING WELL LOCATION

HP-15 HYDROMPUNCH LOCATION

ABANDONED PIPELINE

EXISTING PIPELINE INSTALLED IN 1975

SOURCE: LANTDIV., OCT. 1991

FIGURE 10A
CAMPBELL STREET JP-5 PIPELINE
SOIL BORING, MONITORING WELL AND HYDROMPUNCH
LOCATION MAP - SOUTHERN PIPELINE SECTION
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

The classification included characterization of soil type, color, moisture content, relative density (blow counts), and other pertinent information such as evidence of petroleum contamination. Copies of the Test Boring Records are provided in Appendix B.

In addition to soil classification, each soil sample was screened with an HNu photoionization detector (PID) to measure the presence of volatile organic compounds (VOCs). These screening measurements were used to assist in determining the initial contamination location and the possible placement of additional groundwater monitoring wells to locate the extent of contamination. PID screening results are provided on the boring logs in Appendix B and are summarized on Table 3.

5.4 Soil Boring Results

The soil borings performed along the pipeline revealed the existence of a clay/sand layer that overlies a silt/sand layer. The clay/sand ranges in depth from approximately one to six feet below ground surface. The clay/sand layer thickens towards the south as the silt/sand ceases to be present. The depth at which the soil borings penetrated the water table varied by approximately five feet across the study area. The top of the water table coincides with the depth at which sand begins to be the dominant matrix of the clay/sand layer. These sands are fine-grained when first encountered but grade into a medium-grain size at depths greater than ten feet.

Boring logs from DW-1, DW-2, DW-3, and DW-4 indicate that at greater depths (15 to 30 feet), the sands remain a medium-grain size, with only alternating color changes occurring. Coarser sands ranging to a fine gravel of white color were detected at depths of 28 to 30 feet.

6.0 EXTENT OF SOIL CONTAMINATION

6.1 Soil Sample Collection

The soil samples were collected via split-spoon sampling as discussed in Section 5.3. In general, samples selected for chemical analyses were obtained at depths near and above the water table. Only soil samples obtained above the water table were submitted for chemical analyses. Standard sampling intervals were performed in two-foot intervals until the boring was terminated (with the exception of soil borings DW-1, DW-2, DW-3 and DW-4).

Each soil sample collected for chemical analysis was transferred into a laboratory-prepared bottle, properly labeled and stored on ice. The samples were transported via Federal Express to Solutions Laboratories, Inc., in Chesapeake, Virginia, for analysis. The analyses were performed according to the following methods: total petroleum hydrocarbons (TPH) EPA Method 5030/3550; pH-Method SW-9047; and Flashpoint Method SW-1010. Appropriate chain-of-custody documentation accompanied the samples to the laboratory.

Additional details on soil sampling procedures and sample preparation are provided in Appendix A. Copies of the actual chain-of-custody forms are provided in Appendix E.

6.2 Field Screening of Soils

Soil samples collected during the soil borings were screened with a PID to check for the presence of VOCs. Results of the field screening are shown on Table 3 and on the test boring records presented in Appendix B. VOC concentrations ranged from 1 to 1,400 ppm in the samples screened.

6.3 Soil Sampling

Subsurface soil samples were collected from the fifteen boring locations (B-1 through B-4, MW-1 through MW-7, and DW-1 through DW-4) as shown on Figures 11 and 11A. Two grab soil samples from each boring were collected and submitted for chemical analysis. Each of the selected soil samples were analyzed for TPH. One soil sample from each boring was analyzed for pH and flashpoint. Additionally, three duplicate samples for each parameter listed above were submitted for chemical analysis. Laboratory results are presented on Table 4. Chain-of-custody records and laboratory data sheets for soil samples are provided in

TABLE 3
SUMMARY OF PID FIELD SCREENING OF SOIL SAMPLES

Boring No.	Sample Depth (feet)/PID Readings (ppm)						
	0-2.0	2.0-4.0	4.0-6.0	6.0-8.0	8.0-10.0	10.0-12.0	12.0-14.0
MW-1	0	300*	350*	(5)250	200	16	5
MW-2	0	0	0*	0*	0	0	0
MW-3	0	200*	275*	900	1000	800	1000
MW-4	0	0*	0*	0	15	10	7-8
MW-5	0	0*	0*	0	0	0	0
MW-6	0	0*	08	0	0	0	0
MW-7	0	2*	7*	2	0	1	1
DW-1	0*	350*	400	--	--	--	--
DW-2	0	0*	0	0*	0	0	0
DW-3	700	500*	400*	400	--	--	--
DW-4	0	0*	1*	--	--	--	--
B-1	50	300*	1200*	1400	--	--	--
B-2	40*	200*	350	300	--	--	--
B-3	0	3*	250*	700	--	--	--
B-4	1*	1*	5	2	--	--	--

Notes: (1) Result presented as the maximum concentration detected.
(2) -- = Below termination of boring
(3) N/A = Not Analyzed
(4) *Indicates soil sample selected for chemical analyses.
(5) Bold line denotes groundwater levels encountered at time of boring.
PID = Photoionization Detector
PID readings obtained using a HNu Model 101 Organic Vapor Analyzer.

TABLE 3 (Continued)**SUMMARY OF PID FIELD SCREENING OF SOIL SAMPLES**

Boring No.	Sample Depth (feet)/PID Readings (ppm)			
	14.0-16.0	18.0-20.0	24.0-26.0	28.0-30.0
MW-1	--	--	--	--
MW-2	0	--	--	--
MW-3	--	--	--	--
MW-4	--	--	--	--
MW-5	--	--	--	--
MW-6	0	--	--	--
MW-7	1	--	--	--
DW-1	--	--	--	--
DW-2	0	0	0	0
DW-3	400	500	1000	200
DW-4	1	0	0	0
B-1	--	--	--	--
B-2	--	--	--	--
B-3	--	--	--	--
B-4	--	--	--	--

Notes: (1) Result presented as the maximum concentration detected.
(2) -- = Below termination of boring
(3) N/A = Not Analyzed
PID = Photoionization Detector
PID readings obtained using a HNu Model 101 Organic Vapor Analyzer.

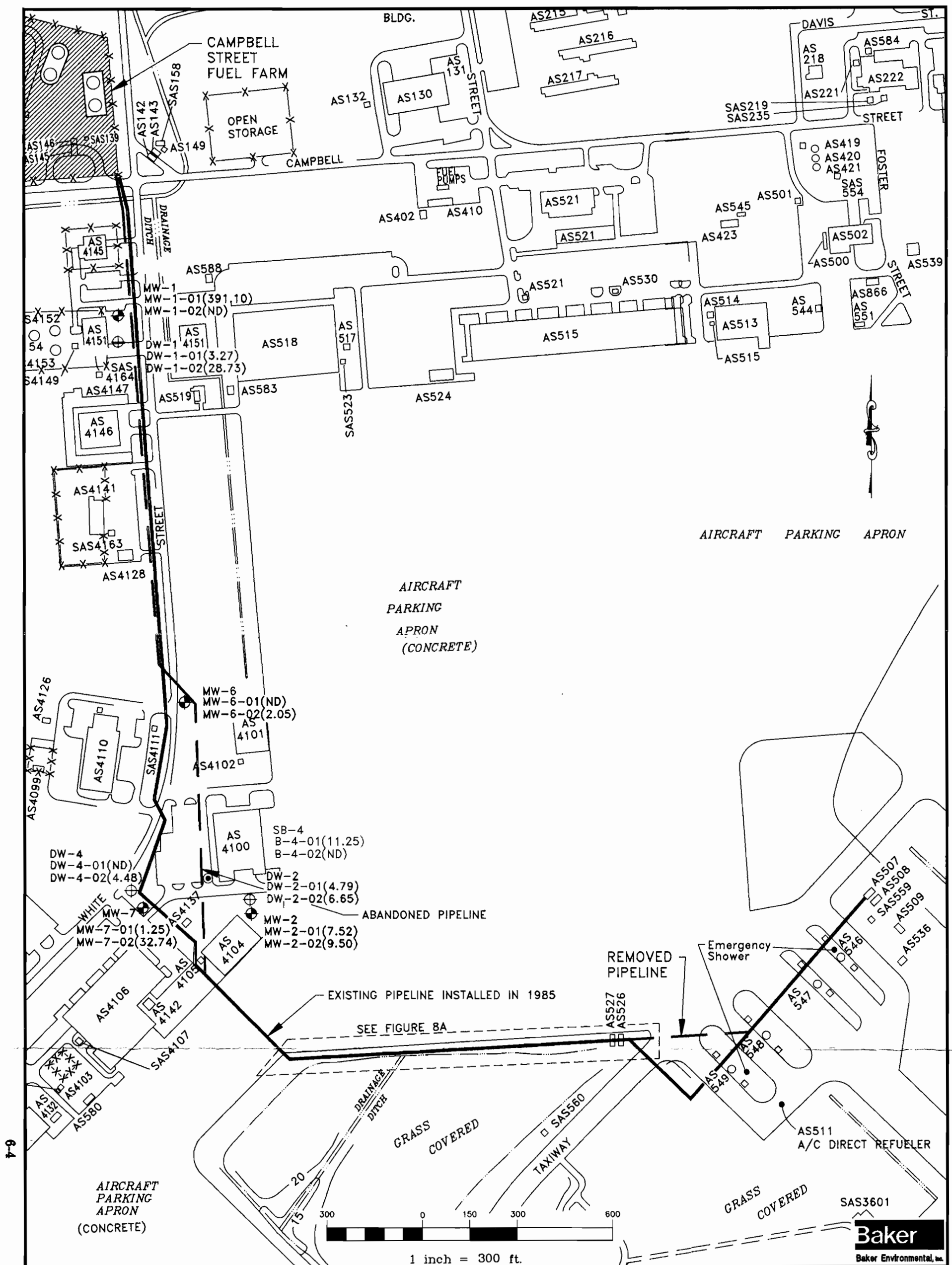
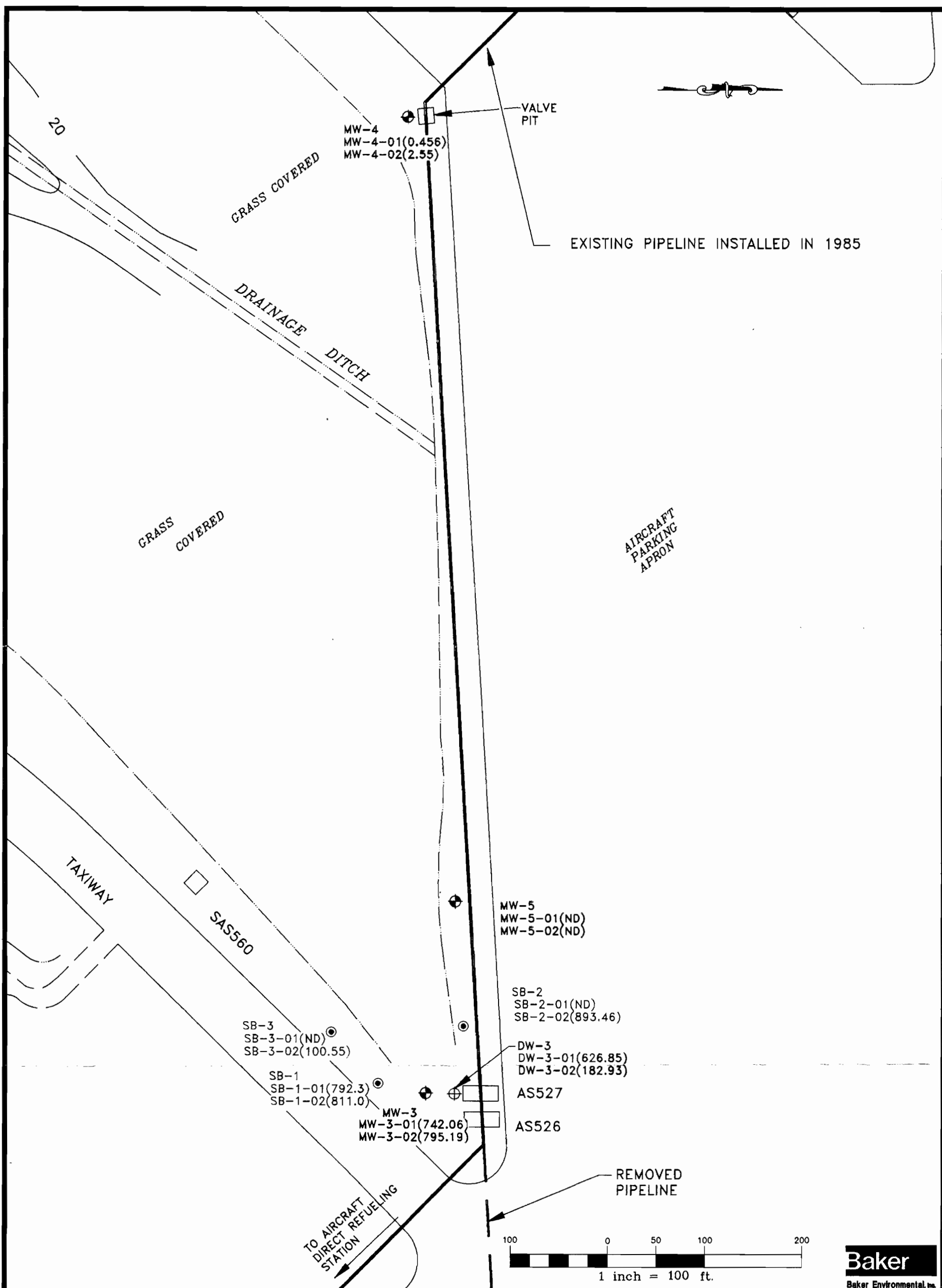


FIGURE 11
CAMPBELL STREET JP-5 PIPELINE
SOIL TPH CONCENTRATION MAP

NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

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MW-5	TYPE II MONITORING		
⊕	WELL LOCATION	MW-3-01(742.06)	SOIL SAMPLE NUMBER AND TPH CONCENTRATION LEVEL (ppm)
DW-3	TYPE III MONITORING		
⊕	WELL LOCATION		
SB-1	SOIL BORING LOCATION	(ND)	NOT DETECTED AT METHOD DETECTION
⊙			
---	ABANDONED PIPELINE		
---	EXISTING PIPELINE INSTALLED IN 1975		

SOURCE: LANTDIV., OCT. 1991

FIGURE 11A
CAMPBELL STREET JP-5 PIPELINE
SOIL TPH CONCENTRATION MAP
SOUTHERN PIPELINE SECTION

NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

TABLE 4

**SUMMARY OF TOTAL PETROLEUM HYDROCARBONS, pH, AND FLASHPOINT ANALYSES
FOR SOIL SAMPLES**

Boring No.	Field Sample No.	Parameter				Sample Depth (feet, below ground surface)
		Total Petroleum Hydrocarbons (mg/kg)	Petroleum Type ⁽³⁾	pH	Flashpoint (°F)	
MW-1	PL-S-MW1-01	391.10	weathered jet fuel	NA	NA	2.0 - 4.0
MW-1	PL-S-MW1-02	-- ⁽¹⁾	NA ⁽⁴⁾	6.85	> 140	4.0 - 6.0
MW-2	PL-S-MW2-01	7.52	weathered jet fuel	NA	NA	4.0 - 6.0
MW-2	PL-S-MW2-02	9.50	weathered jet fuel	4.27	> 140	6.0 - 8.0
MW-3	PL-S-MW3-01	742.06	weathered jet fuel	NA	NA	2.0 - 4.0
MW-3	PL-S-MW3-02	795.19	weathered jet fuel	6.01	> 140	4.0 - 6.0
MW-4	PL-S-MW4-01	0.456	weathered jet fuel	NA	NA	2.0 - 4.0
MW-4	PL-S-MW4-02	2.55	weathered jet fuel	4.04	> 140	4.0 - 6.0
MW-4	PL-S-MW8-02 ⁽²⁾	NA	NA	4.20	> 140	4.0 - 8.0
MW-5	PL-S-MW5-01	--	NA	NA	NA	2.0 - 4.0
MW-5	PL-S-MW5-02	--	NA	4.9	> 140	4.0 - 6.0
MW-6	PL-S-MW6-01	--	NA	NA	NA	2.0 - 4.0

Notes:

- (1) -- = Not detected
 (2) Duplicate sample
 (3) EPA Method 5030/3550 estimated range of petroleum type
 (4) Not Analyzed

Total Petroleum Hydrocarbons analyzed using EPA Method 5030/3550.

TABLE 4 (CONTINUED)
SUMMARY OF TOTAL PETROLEUM HYDROCARBONS, pH, AND FLASHPOINT ANALYSES
FOR SOIL SAMPLES

Boring No.	Field Sample No.	Parameter				Sample Depth (feet, below ground surface)
		Total Petroleum Hydrocarbons (mg/kg)	Petroleum Type ⁽³⁾	pH	Flashpoint (°F)	
MW-6	PL-S-MW6-02	2.05	weathered jet fuel	4.36	> 140	4.0 - 6.0
MW-7	PL-S-MW7-01	1.25	weathered jet fuel	NA	NA	2.0 - 4.0
MW-7	PL-S-MW7-02	32.74	weathered jet fuel	4.55	> 140	4.0 - 6.0
B-1	PL-S-B1-01	792.30	weathered jet fuel	NA	NA	2.0 - 4.0
B-1	PL-S-B1-02	811.00	weathered jet fuel	NA	NA	4.0 - 6.0
B-1	PL-S-B5-01 ⁽²⁾	358.07	weathered jet fuel	NA	NA	2.0-4.0
B-2	PL-S-B2-01	-- ⁽¹⁾	NA ⁽⁴⁾	NA	NA	0.0-2.0
B-2	PL-S-B2-02	893.46	weathered jet fuel	NA	NA	2.0-4.0
B-3	PL-S-B3-01	--	NA	NA	NA	2.0-4.0
B-3	PL-S-B3-02	100.55	weathered jet fuel	NA	NA	4.0-6.0
B-4	PL-S-B4-01	11.25	weathered jet fuel	NA	NA	0.0-2.0
B-4	PL-S-B4-02	--	NA	NA	NA	2.0-4.0
B-4	PL-S-B6-01 ⁽²⁾	4.10	weathered jet fuel	NA	NA	2.0-4.0
DW-1	PL-S-DW1-01	3.27	weathered jet fuel	NA	NA	0.0-2.0

Notes:

- (1) -- = Not detected
- (2) Duplicate sample
- (3) EPA Method 5030/3550 estimated range of petroleum type
- (4) Not Analyzed

Total Petroleum Hydrocarbons analyzed using EPA Method 5030/3550.

TABLE 4 (CONTINUED)
SUMMARY OF TOTAL PETROLEUM HYDROCARBONS, pH, AND FLASHPOINT ANALYSES
FOR SOIL SAMPLES

Boring No.	Field Sample No.	Parameter				Sample Depth (feet, below ground surface)
		Total Petroleum Hydrocarbons (mg/kg)	Petroleum Type ⁽³⁾	pH	Flashpoint (°F)	
DW-1	PL-S-DW1-02	28.73	weathered jet fuel	NA	NA	2.0-4.0
DW-2	PL-S-DW2-01	4.79	weathered jet fuel	NA	NA	4.0-6.0
DW-2	PL-S-DW2-02	6.65	weathered jet fuel	NA	NA	6.0-8.0
DW-2	PL-S-DW5-01 ⁽²⁾	-- ⁽¹⁾	NA ⁽⁴⁾	NA	NA	4.0-6.0
DW-3	PL-S-DW3-01	626.85	weathered jet fuel	NA	NA	2.0-4.0
DW-3	PL-S-DW3-02	182.93	weathered jet fuel	NA	NA	4.0-6.0
DW-4	PL-S-DW4-01	--	NA	NA	NA	2.0-4.0
DW-4	PL-S-DW4-02	4.48	weathered jet fuel	NA	NA	4.0-6.0

Notes:

- (1) -- = Not detected
- (2) Duplicate sample
- (3) EPA Method 5030/3550 estimated range of petroleum type
- (4) Not Analyzed

Total Petroleum Hydrocarbons analyzed using EPA Method 5030/3550.

Appendices E and F, respectively. Figures 11 and 11A provides TPH concentrations at the various locations.

Acceptable TPH concentrations in soils were determined by the Site Sensitivity Evaluation (SSE) developed by the North Carolina Department of Environmental Management (DEM). Based on the SSE. The site had a ranking score of 43. This resulted in an action level guideline of 35 mg/kg for the site. The SSE ranking form is provided in Appendix A.

Of the 33 soil samples analyzed (two from each boring and three duplicates) 10 of the samples were found to have concentrations of TPH which exceeded 35 mg/kg, the action level established by the DEHNR. The detected TPH concentrations ranged from 0.456 mg/kg in boring MW-4 (2.0 to 4.0 foot) to 893.46 mg/kg in boring B-2 (2.0 to 4.0 foot). The laboratory analytical results for the other two parameters, pH and flashpoint, were below hazardous values.

6.4 Soil Gas Survey

A soil gas survey was performed to evaluate the integrity of the active pipeline. Tracer Research Corporation (Tracer) was subcontracted to Baker to perform these services.

The method of leak detection used by Tracer to evaluate the pipeline relied upon the addition of a highly volatile liquid chemical tracer to the fuel stored at the CSFF. Tracer then installed 155 permanent soil vapor probes at 25-foot intervals along the pipeline. The chemical tracer was given a period of approximately two weeks to mix with the aviation fuel and be dispersed through the pipeline; if the pipeline was leaking, fuel and chemical tracer would migrate into the soils. The soil gas probes were then sampled and analyzed for the chemical tracer.

A more detailed description of the tracer method and procedures is provided in Appendix A. The location of the soil gas probes and the results of the soil gas survey are provided in a report submitted by Tracer and included in Appendix H.

6.5 Horizontal Extent of Soil Contamination

The soil gas survey indicated that the active pipeline is tight and has not experienced a subsurface release. The chemical tracer was detected in two of the 165 probes installed along the pipeline. Small amounts of the chemical tracer were detected in soil probe 33 (0.03 µg/L) and 106 (0.005 µg/L). Concentrations of the chemical tracer greater than 0.1 µg/L indicate leakage.

As indicated by the Tracer report provided in Appendix H, total volatile hydrocarbons (TVHC) were detected in several of the sampling probes. The TVHC concentrations ranged from non-detected (<0.5 µg/L) to 8,300 µg/L in soil probe 106. Three areas along the active pipeline were detected to have TVHC concentrations; Building AS-4141 (probe 46, 230 µg/L); Building AS-4104 (probes 105 and 106, 250 µg/L and 8,300 µg/L, respectively); and the end of the pipeline (probe 149, 40 µg/L).

As shown on Table 4, soil contamination at the site consisted of weathered jet fuel. This chemical evaluation in combination with the soil gas survey suggests that petroleum products detected during this investigation are related to the abandoned pipeline.

The highest TPH concentrations were found at soil borings located along the northern and southern portions of pipeline. The northern soil boring, MW-1, had a TPH concentration of 391.10 mg/kg. The southern portion of the pipeline, soil borings B-1, B-2, MW-3 and DW-3, had TPH concentrations of 811.0 mg/kg, 893.46 mg/kg, 795.19 mg/kg and 626.85 mg/kg, respectively. Overall, soil boring MW-1 along the northern portion and soil borings B-1, B-2, B-3, MW-3 and DW-3 in the southern vicinity had TPH concentrations that exceeded the action level established by the DEHNR of 35 mg/kg.

The TPH concentrations detected at soil borings MW-1 and DW-1 appear to be related to the releases associated with the abandoned pipeline. Considering the fuel type detected, it is unlikely that the fuel farm associated with the steam generating facility (Building AS-4151) is the source of contamination in this area.

The high TPH concentrations detected at the southern portion of the pipeline, near the aircraft direct refueling station may be the result of two possible sources: the first potential source is the abandoned pipeline; the second potential source is the aircraft direct refueling station. It is likely that both the abandoned pipeline and the refueling station have contributed to the

contamination detected in this area. Figure 11A provides TPH concentrations for the soil borings performed in this area.

As shown on Table 4, flashpoint analyses were performed on selected soil samples. All the soil samples analyzed for flashpoint had values greater than 140°F. None of the selected soil samples were classified as a hazardous material based on the flashpoint results.

The pH values ranged from 4.04 to 6.85. The pH values did not classify any of the analyzed soils as hazardous.

6.6 Vertical Extent of Contamination

Soil analyses indicate that petroleum contamination extends to the groundwater in the vicinity of soil borings MW-1, MW-3 and MW-7, the northern, southern and central portions of the pipeline, respectively, with groundwater located approximately six to ten feet below the ground surface along the pipeline. This contamination is apparently the result of subsurface releases and does not appear to be related to a surface spill or release. Given the concentrations of TPH detected in the soil borings and the associated depths, it is apparent that petroleum contamination has migrated vertically in the soils and has encountered the shallow water table along portions of the abandoned pipeline.

7.0 SITE HYDROGEOLOGY

7.1 Regional Hydrogeology

The hydrogeologic framework of the Jacksonville, North Carolina area includes seven principal aquifers listed in superposition as follows: (1) the surficial water table; (2) the Castle Hayne; (3) Beaufort; (4) Peedee; (5) Black Creek; (6) Upper Cape Fear; and (7) Lower Cape Fear. Only the surficial and Castle Hayne Aquifers are of concern in this report. Aquifers below the Castle Hayne lie in a thick sequence of sand and clay. Although some of these aquifers are used for water supply elsewhere in the coastal plain, they contain saltwater in the Camp Lejeune area and are not used. (U.S.G.S., W-RIR 89-4096) The generalized relation between geologic and hydrogeologic units for this area are presented on Table 5.

The surficial aquifer is found in beds and lenses of sand and clay. These deposits range in thickness from 25 to 100 feet and overlie the sediments containing the Castle Hayne. The sand lenses (i.e., the major water-bearing strata) are very heterogeneous and discontinuous because of the complex marine/estuarine environments in which they were deposited. In some areas, the surficial aquifer is reported to contain water contaminated by waste disposal practices (Putnam, 1983).

The Castle Hayne Aquifer underlies the surficial aquifer. Most of the supply wells in the area tap this aquifer at depths ranging from 50 to 300 feet. This aquifer ranges in thickness from 250 to 400 feet but brackish water is normally encountered below 300 feet. The water-bearing zones are a series of sandstone, limestone and clay beds of the Oligocene River Bend Formation and the Middle Eocene Castle Hayne Formation.

The upper half of the Castle Hayne Aquifer is primarily sand; the lower half is sand and limestone. The top of the aquifer slopes from about 20 feet above sea level in the northern part of the area to about 40 feet below sea level in the southeastern part. The aquifer thickens toward the southeast from 175 feet at the MCAS to about 375 feet at the coast (U. S. Geological Survey W-RIR 89-4096).

Clay layers occur in both the Castle Hayne and the surficial aquifers. However, no continuous clay layer separates the surficial and the Castle Hayne. The clay layers appear to be more continuous in the northwestern part of the base (U.S.G.S. W-RIR 89-4096).

TABLE 5

**GENERALIZED RELATION BETWEEN GEOLOGIC AND HYDROGEOLOGIC UNITS IN
THE COASTAL PLAIN OF NORTH CAROLINA**

Geologic Units			Hydrogeologic Units
System	Series	Formation	Aquifer and Confining Unit
Quaternary	Holocene Pleistocene	Undifferentiated	Surficial Aquifer
Tertiary	Pliocene	Yorktown Formation ⁽¹⁾	Yorktown Confining Unit
	Miocene	Eastover Formation ⁽¹⁾	Yorktown Aquifer
		Pungo River Formation ⁽¹⁾	Pungo River Confining Unit
		Belgrade Formation ⁽²⁾	Pungo River Aquifer
			Castle Hayne Confining Unit
	Oligocene	River Bed Formation	Castle Hayne Aquifer
	Eocene	Castle Hayne Formation	Beaufort Confining Unit
	Paleocene	Beaufort Formation	Beaufort Aquifer
			Peedee Confining Unit
	Cretaceous	Peedee Formation	Peedee Aquifer
			Black Creek Confining Unit
		Black Creek and Middendorf Formations	Black Creek Aquifer
			Upper Cape Fear Confining Unit
		Cape Fear Formation	Upper Cape Fear Aquifer
			Lower Cape Fear Confining Unit
			Lower Cape Fear Aquifer
			Lower Cretaceous Confining Unit
	Lower Cretaceous ⁽¹⁾	Unnamed Deposits ⁽¹⁾	Lower Cretaceous Aquifer
Pre-Cretaceous Basement Rocks		--	--

(1) Geologic and hydrologic units probably not present beneath Camp Lejeune.

(2) Constitutes part of the surficial aquifer and Castle Hayne Confining Unit beneath Camp Lejeune.

(3) Estimated to be confined to deposits of Paleocene Age in the study area.

Source: U.S.G.S., Water Resources Investigations Report 89-4096, "Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina," 1989.

Confining sediment beds restrict the direct exchange of groundwater between the surficial and the Castle Hayne aquifers. However, some hydraulic connection between the two aquifers has been observed (Department of the Navy, 1990).

7.2 Site Hydrogeology

The hydrogeologic characteristics of the water table aquifer (surficial) are influenced in part by various land development activities at MCAS. As topographic relief across the site is slight, surface water not intercepted by drainage ditches would flow generally east-southeast towards the New River. Considering surface water factors discussed in Section 4.0, most of the groundwater recharge would migrate laterally towards natural and developed discharge areas through the surficial aquifer. Downward movement of groundwater is hindered by the presence of an aquitard of relatively impermeable sediments.

The large concrete surface areas near the southern portion of the pipeline may also be influencing groundwater movement. The main aircraft parking area is over 100 acres in size. This large concrete surface reduces the quantity of the groundwater to be recharged. This has a major influence on groundwater patterns in the area.

Groundwater was encountered beneath the site approximately four to ten feet below ground surface. Tables 6 and 7 summarizes water level measurements and elevations from the CSFF obtained on January 15-16 and February 6, 1992, respectively. As shown on Tables 6 and 7, petroleum product (free product) was not detected in any of the monitoring wells. Based on the February 6, 1992, groundwater elevation data, shallow groundwater appears to be flowing southeast across the site (Figure 12). Based on measurements obtained on February 6, 1992, the horizontal groundwater gradient in the shallow groundwater zone is calculated at 0.002.

The four deep monitoring wells, DW-1, DW-2, DW-3 and DW-4, were used to evaluate the groundwater gradient in the deeper portion of the aquifer. Based on the February 6, 1992, measurements, the direction of groundwater migration in this zone is towards the southwest (Figure 13).

Based upon the hydraulic conductivity tests performed on January 15, 1992, the average hydraulic conductivity for the site is 1.6×10^{-2} ft./day (5.6×10^{-6} cm/sec). This value was calculated using the Geraghty and Miller aquifer test solver (AQTESOLV) program which uses the Bouwer and Rice (1976) method. The results of the hydraulic conductivity test are

TABLE 6

SUMMARY OF FLUID LEVEL MEASUREMENTS
JANUARY 15 and 16, 1992

Well No.	Top of Casing Elevation ⁽¹⁾ (feet, above MSL)	Depth to Product (feet, below top of casing)	Depth to Groundwater (feet, below top of casing)	Product Thickness (feet)	Product Elevation (feet, above MSL)	Groundwater Elevation (feet, above MSL)
MW-1	21.84	--(2)	5.55	--	--	16.29
MW-2	25.50	--	12.77	--	--	12.73
MW-3	22.40	--	7.86	--	--	14.54
MW-4	22.82	--	15.21	--	--	7.61
MW-5	23.85	--	14.35	--	--	9.50
MW-6	25.55	--	11.90	--	--	13.65
MW-7	24.78	--	10.96	--	--	13.82
DW-1	22.17	--	7.73	--	--	14.44
DW-2	25.79	--	12.70	--	--	13.09
DW-3	22.81	--	12.13	--	--	10.68
DW-4	25.12	--	11.45	--	--	13.67

Notes: (1) MSL - Mean Sea Level

(2) -- Not Detected

Fluid Level Measurements Obtained Using an Oil Recovery System (ORS) Probe, Model No. 1068013.

TABLE 7

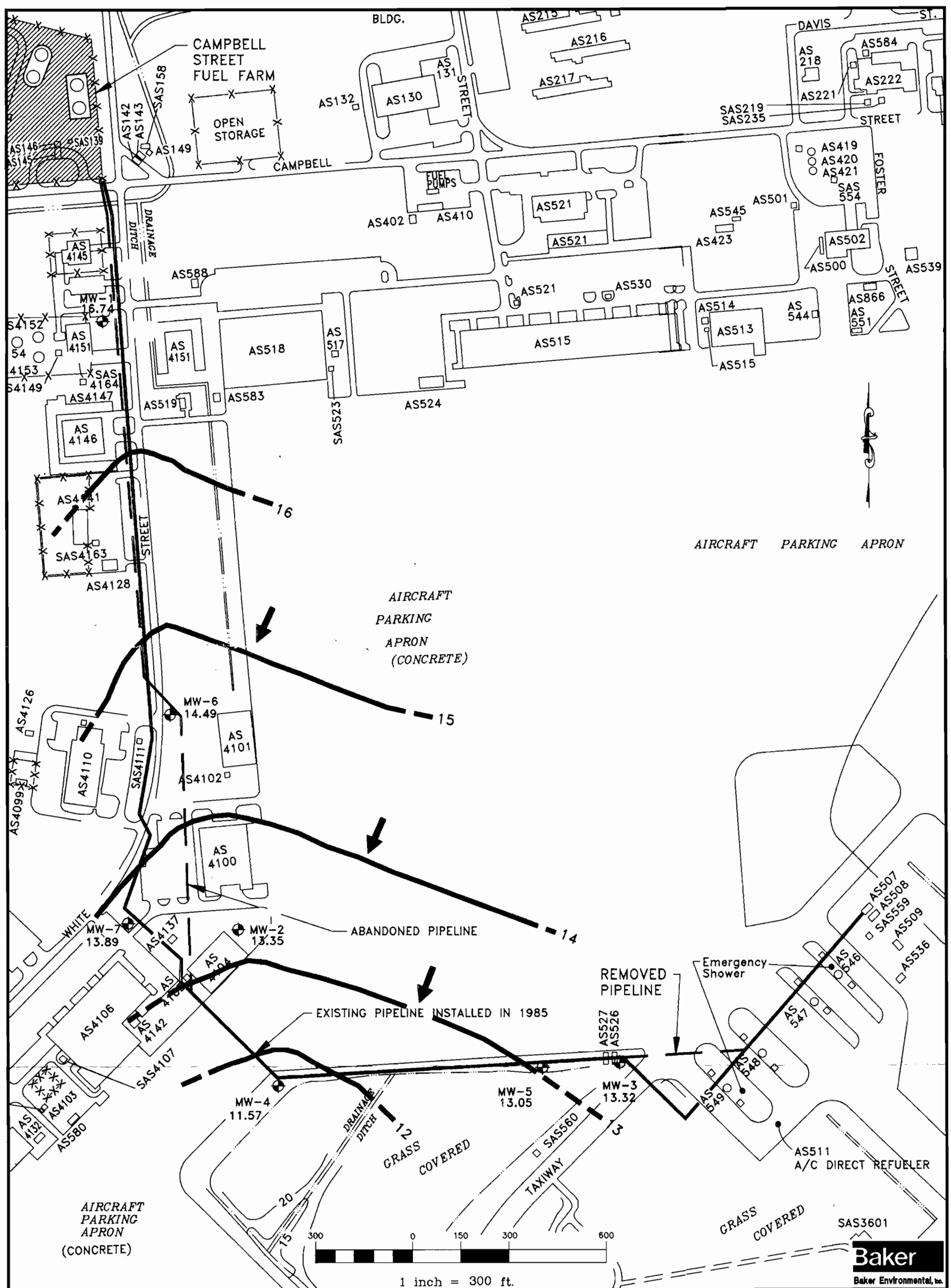
**SUMMARY OF FLUID LEVEL MEASUREMENTS
FEBRUARY 6, 1992**

Well No.	Top of Casing Elevation ⁽¹⁾ (feet, above MSL)	Depth to Product (feet, below top of casing)	Depth to Groundwater (feet, below top of casing)	Product Thickness (feet)	Product Elevation (feet, above MSL)	Groundwater Elevation (feet, above MSL)
MW-1	21.84	--(2)	5.10	--	--	16.74
MW-2	25.50	--	12.15	--	--	13.35
MW-3	22.40	--	9.08	--	--	13.32
MW-4	22.82	--	11.25	--	--	11.57
MW-5	23.85	--	10.80	--	--	13.05
MW-6	25.55	--	11.06	--	--	14.49
MW-7	24.78	--	10.89	--	--	13.89
DW-1	22.17	--	7.26	--	--	14.91
DW-2	25.79	--	12.49	--	--	13.30
DW-3	22.81	--	4.26	--	--	18.55
DW-4	25.12	--	11.28	--	--	13.84

Notes: (1) MSL - Mean Sea Level

(2) -- = Not Detected

Fluid Level Measurements Obtained Using an Oil Recovery System (ORS) Probe, Model No. 1068013.



LEGEND

MW-1 TYPE II MONITORING WELL LOCATION

16.74 GROUNDWATER ELEVATION (WELL SPECIFIC)

12 GROUNDWATER CONTOUR ELEVATION

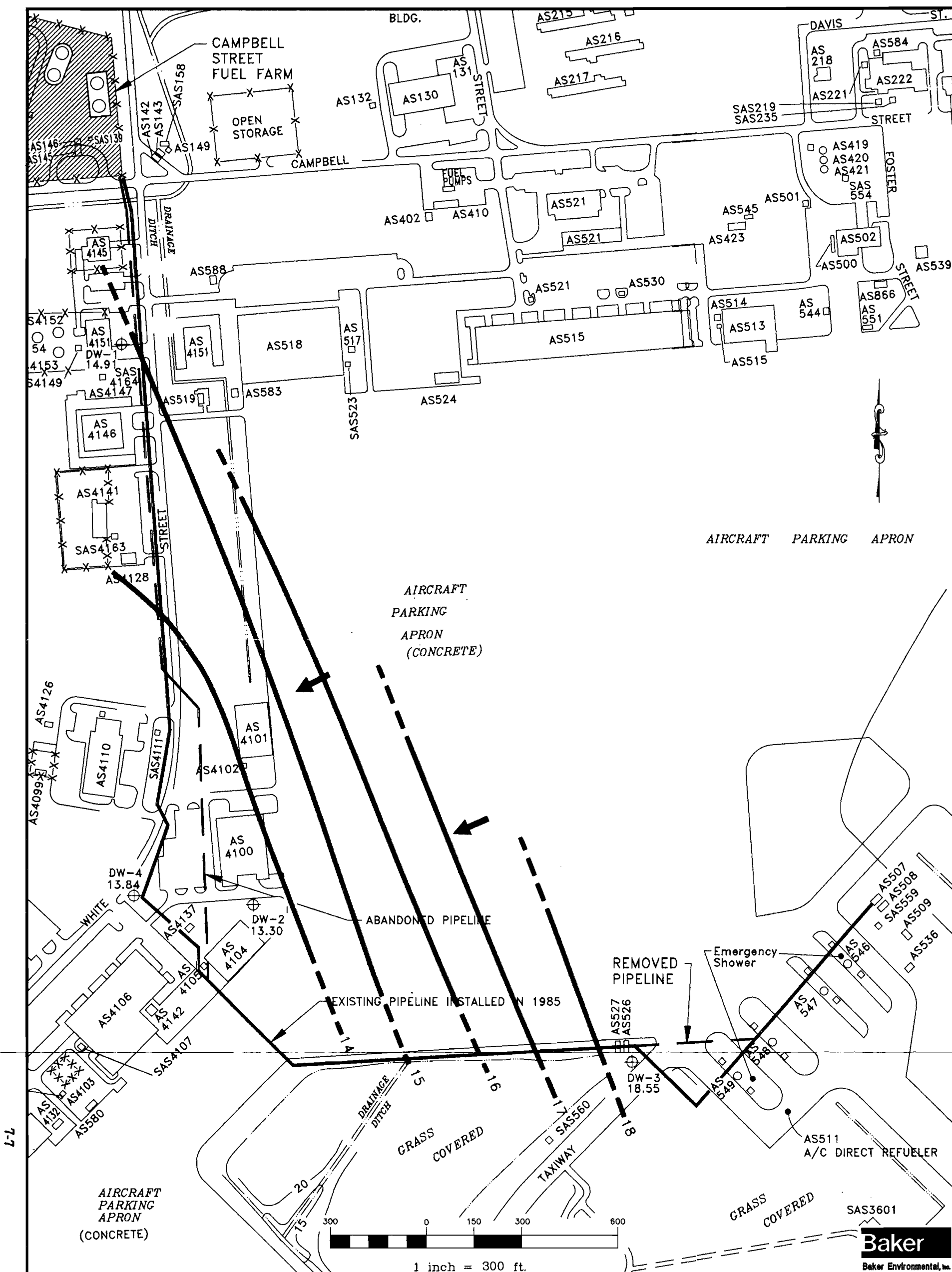
→ ESTIMATED GROUNDWATER FLOW DIRECTION

— ABANDONED PIPELINE

— EXISTING PIPELINE INSTALLED IN 1985

SOURCE: LANTDIV, OCT. 1991

FIGURE 12
CAMPBELL STREET JP-5 PIPELINE
POTENTIOMETRIC SURFACE MAP
SHALLOW AQUIFER - FEBRUARY 6, 1992
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA



LEGEND

- DW-1 TYPE III MONITORING WELL LOCATION
- 14.91 GROUNDWATER ELEVATION (WELL SPECIFIC)
- 14 GROUNDWATER CONTOUR ELEVATION
- ESTIMATED GROUNDWATER FLOW DIRECTION
- ABANDONED PIPELINE
- EXISTING PIPELINE INSTALLED IN 1985

SOURCE: LANTDIV, OCT. 1991

FIGURE 13
CAMPBELL STREET JP-5 PIPELINE
POTENTIOMETRIC SURFACE MAP
DEEP AQUIFER - FEBRUARY 6, 1992
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

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summarized on Table 8. A copy of the actual field data and AQTESOLV computer printouts are provided in Appendix D.

Using the calculated gradient and the average hydraulic conductivity determined for the site, the average groundwater flow velocity can be estimated using the following equation:

$$V = Ki/n_e$$

Where V = the estimated groundwater flow velocity
 K = hydraulic conductivity
 i = the groundwater gradient
 n_e = the average effective porosity, as a decimal fraction

Using the average value $K = 1.6 \times 10^{-2}$ feet/day calculated from the hydraulic conductivity test, a groundwater gradient of 0.002, and an estimated effective porosity of 0.28 (Fetter 1980), the average groundwater flow velocity is calculated as 0.04 feet/year.

7.3 Monitoring Well Installation

Eleven of the fourteen soil borings were converted into groundwater monitoring wells. The locations of these wells are shown on Figure 10. Wells were installed at specific boring locations in order to define the horizontal and vertical extent of groundwater contamination in the vicinity of the site, and to provide information on the groundwater flow patterns in the area. The depths of the monitoring wells ranged approximately from 14 to 30 feet below ground surface. Table 9 provides a summary of well construction details.

Monitoring wells MW-1 through MW-7, the shallow monitoring wells, were constructed of two-inch nominal diameter Schedule 40, flush-joint and threaded PVC casing, with a ten-foot long, 0.010-inch slotted screen. These shallow monitoring wells are designated as Type II monitoring wells. The deeper monitoring wells, DW-1 through DW-4, were constructed with five-foot long, 0.010-inch slotted screen. The deep monitoring wells are designated as Type III monitoring wells.

A medium-grained sand pack extending two feet above the top of the screen was placed in the annulus between the screen and the borehole wall. A bentonite pellet seal was placed above the sand pack and hydrated with potable water. The remaining annular space was backfilled

TABLE 8
SUMMARY OF HYDRAULIC CONDUCTIVITY TESTS

Well No.	Hydraulic Conductivity Falling Test		Hydraulic Conductivity Rising Test	
	ft/day	cm/sec	ft/day	cm/sec
MW-2	6.52×10^{-3}	2.29×10^{-6}	8.24×10^{-4}	2.90×10^{-7}
MW-3	5.55×10^{-2}	1.95×10^{-5}	1.66×10^{-3}	5.85×10^{-7}

Hydraulic conductivity average for site:
 1.61×10^{-2} ft/day

Notes: Hydraulic conductivity test results analyzed using Bouwer and Rice method as presented in the Geraghty & Miller "AQTESOLV" program, Version 1.10.

Hydraulic conductivity tests conducted on January 15 and 16, 1992, using an In-Situ Environmental Data Logger (Model SE-1000C) and pressure transducer.

with a cement/bentonite mixture to ground surface. A PVC locking cap was fitted at the top of each well. Well construction diagrams for each type of monitoring well are presented in Appendix C and are summarized on Table 9.

The procedures for installing the monitoring wells are discussed in Appendix A. Schematic diagrams of typical Type II and Type III monitoring wells are provided on Figures 14 and 15, respectively.

Following well construction activities, each monitoring well was developed to remove sediments from the well and to facilitate the hydraulic connection between the well and the aquifer. The wells were developed by surging for approximately ten minutes and pumping using a centrifugal pump until the water was essentially sediment-free. Approximately 50 gallons of water (approximately 17 to 35 well volumes for Type III and Type II wells, respectively) were removed from each well. The water recovered from each well was containerized in 55-gallon, steel drums and stored at a central staging area on-site.

Following monitoring well installation, each newly installed monitoring well was surveyed by a surveyor registered in the State of North Carolina using standard procedures. The firm of James E. Stewart and Associates, Inc., of Jacksonville, North Carolina, was retained to perform the surveying services. The top of casing and ground surface elevations were measured for each monitoring well location to the nearest 0.01-foot. A temporary benchmark was established on-site based on existing National Geodetic Vertical Datum (NGVD) elevations relative to Mean Sea Level (MSL). The top of casing and ground surface elevations for each monitoring well are provided on Table 9.

7.4 Hydropunch - Groundwater Testing

Along the pipeline, twenty hydropunch (penetrometer) samples of groundwater were collected from the surficial aquifer for field and laboratory chemical analysis. The sample locations are shown in Figure 10.

The hydropunch drive casing was advanced into the aquifer using a combination of hydraulic pressure and hammer driving depending on the resistance of the specific soils. Due to the soil conditions (which restricted sample recovery) encountered at the site, it was necessary to extend the hydropunches several feet below the water table to obtain an appropriate amount of sample. The hydropunch was operated in the hydrocarbon sampling mode. In this mode, the

TABLE 9

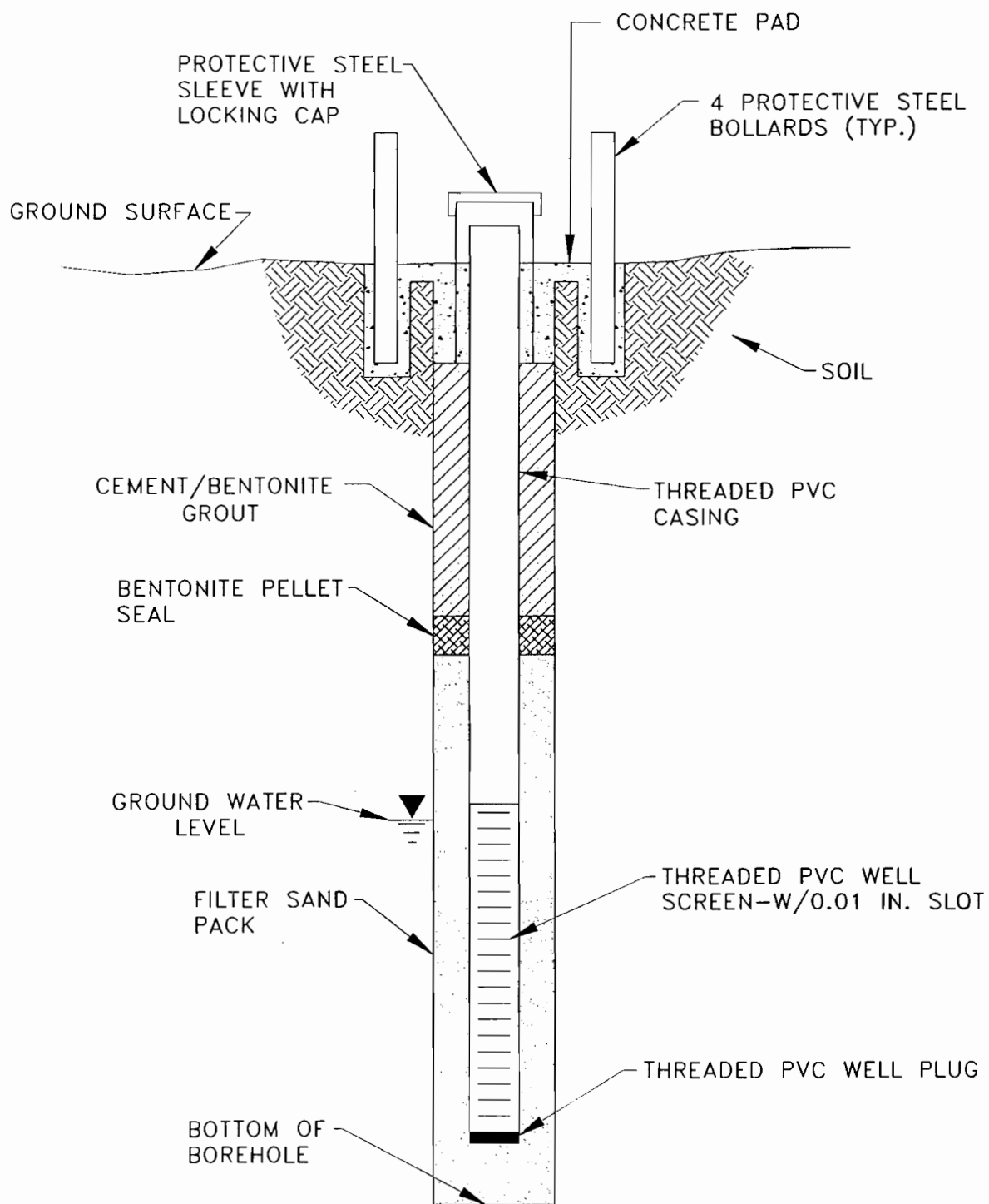
SUMMARY OF WELL CONSTRUCTION DETAILS

Well No.	Date Installed	Top of Casing Elevation ⁽¹⁾ (feet, above MSL)	Ground Surface Elevation (feet, above MSL)	Boring Depth (feet, below ground surface)	Depth of Outer Casing (feet, below ground surface)	Well Depth (feet, below ground surface)	Screen Interval Depth (feet, below ground surface)	Depth to Sand Pack (feet, below ground surface)	Depth to Bentonite (feet, below ground surface)
MW-1	1-8-92	21.84	19.2	14.0	NA ⁽²⁾	14.0	4.1-13.7	3.0	2.0
MW-2	1-8-92	25.50	23.0	17.0	NA	17.0	7.1-16.7	5.0	3.0
MW-3	1-11-92	22.40	22.6	16.0	NA	16.0	6.1-15.7	4.0	2.0
MW-4	1-11-92	22.82	23.1	14.0	NA	14.0	4.1-13.7	2.0	1.0
MW-5	1-12-92	23.85	23.9	15.0	NA	15.0	5.1-14.7	3.0	1.0
MW-6	1-14-92	25.55	22.5	15.0	NA	15.0	5.1-14.7	3.0	1.0
MW-7	1-14-92	24.78	21.9	15.0	NA	15.0	5.1-14.7	3.0	1.0
DW-1 ⁽³⁾	1-8-92 1-10-92	22.17	19.4	30.0	20.0	30.0	25.1-29.8	23.0	21.0
DW-2	1-9-92 1-10-92	25.79	23.1	30.0	20.0	30.0	25.1-29.8	23.0	21.0
DW-3	1-11-92 1-12-92	22.81	22.8	30.0	20.0	30.0	25.1-29.8	23.0	21.0
DW-4	1-14-92 1-15-92	25.12	21.8	30.0	20.0	30.0	25.1-29.8	23.0	21.0

(1) MSL - Mean Sea Level

(2) NA = Not Applicable

(3) Monitoring Wells DW-1, DW-2, DW-3 and DW-4 were constructed as Type III monitoring wells.

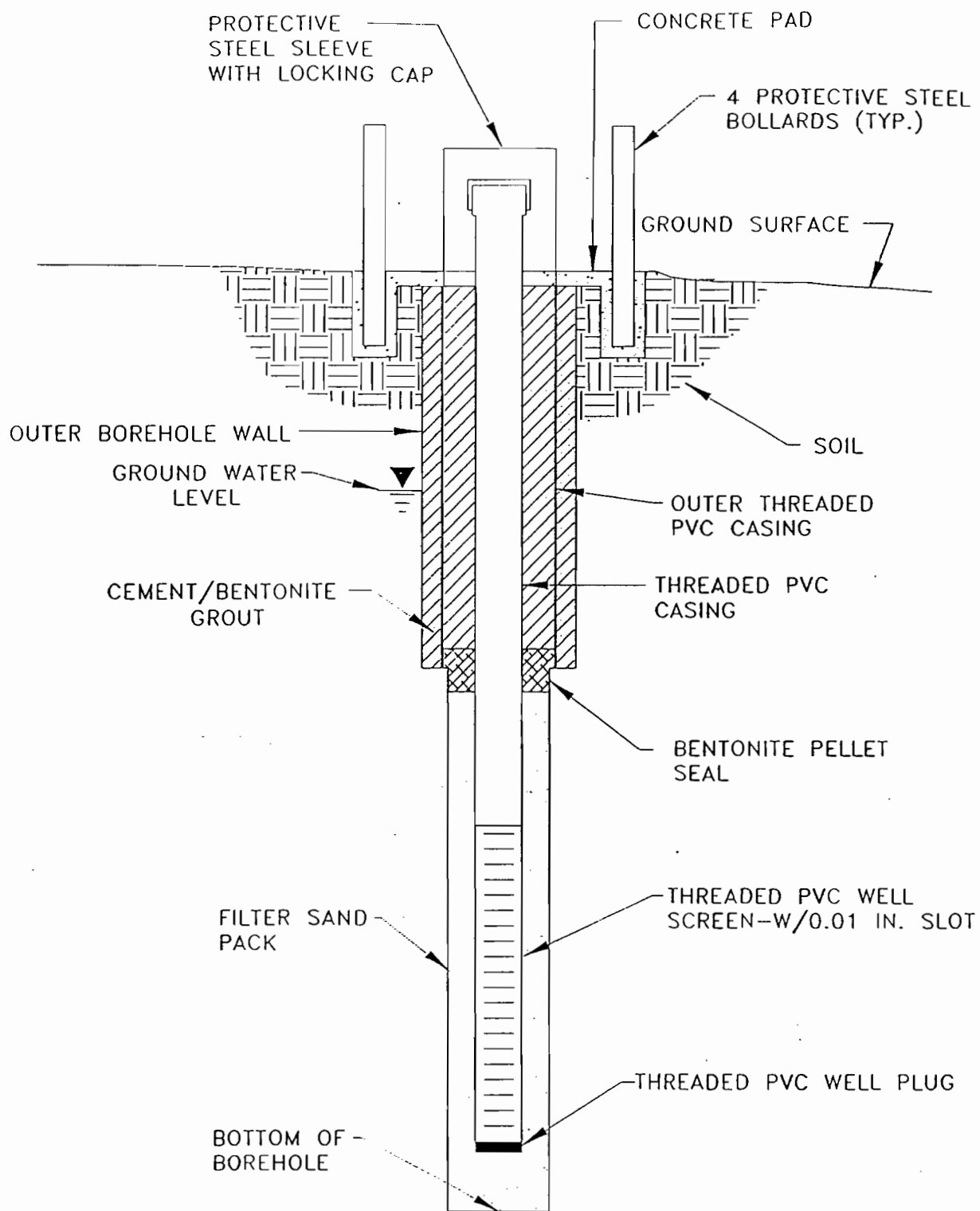


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FIGURE 14
CAMPBELL STREET JP-5 PIPELINE
TYPICAL TYPE II GROUNDWATER
MONITORING WELL CONSTRUCTION DIAGRAM

NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA



N.T.S.

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Baker Environmental, Inc.

FIGURE 15
CAMPBELL STREET JP-5 PIPELINE
TYPICAL TYPE III GROUNDWATER
MONITORING WELL CONSTRUCTION DIAGRAM
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

hydropunch is pushed to intercept the water table, at which time a bailer is lowered to recover the sample. The Hydropunch Field Users Guide, which explains the operating sequence, can be found in Appendix A.

Groundwater samples were collected with a dedicated polyethylene bailer. Pertinent information such as turbidity, color or petroleum odor was recorded in the field log book by the site geologist. When possible, 580 milliliters of groundwater were collected for chemical analysis. Groundwater samples were transferred to the appropriate laboratory-prepared bottles, properly labeled and stored on ice. The samples were transported via Federal Express to Solution Laboratories, Inc., in Chesapeake, Virginia, where they were analyzed using EPA Method 602.

Portions of the groundwater samples were tested in the field for the presence of polynuclear and polycyclic aromatic hydrocarbons. The results of this field screening assisted in the placement of the monitoring wells. This field testing aided in reducing field delays while awaiting laboratory results. The field testing procedure is discussed in detail in Section 8.2 and in Appendix A.

All hydropunch components were decontaminated to minimize the potential for cross-contamination between sample locations. The components were decontaminated between locations by high-pressure steam. Decontamination fluids were contained within a temporary decontamination area to prevent the fluids from contacting the ground surface. These fluids were eventually transferred into 55-gallon steel drums, and stored on site.

7.5 Fluid Level Measurements and Well Elevation Survey

Fluid level measurements for each monitoring well were recorded during the field investigation and prior to groundwater sampling. The depth to water was measured using an oil/water interface probe capable of detecting product layers as thin as 0.01 feet. Depths were measured to the nearest 0.01-foot. The interface probe was decontaminated between readings by washing with a non-phosphate soap solution, rinsing with distilled water, and final rinsing with reagent-grade hexane. Fluid level measurements are summarized on Tables 6 and 7; no free product was encountered, so all fluid levels are for the groundwater surface.

8.0 EXTENT OF GROUNDWATER CONTAMINATION

8.1 Groundwater Samples Collected by Hydropunch Procedure

Twenty (20) groundwater samples were collected using hydropunch procedures. The samples were transferred into laboratory-prepared sample containers and placed immediately on ice. Groundwater samples were collected by slowly pouring water from a bailer into the appropriate sample container to minimize volatilization. Samples were transported by Federal Express to Solutions Laboratories in Chesapeake, Virginia, for analysis. Appropriate chain-of-custody documentation, accompanied the samples to the laboratory. Each hydropunch groundwater sample was analyzed for purgeable aromatics using EPA Method 602. The analytical results for groundwater samples collected with the hydropunch procedure are presented in Table 10.

8.2 hnu-hanby (Field Test for Aromatic Hydrocarbons)

The hnu-hanby Field Test is a procedure for the analysis of polynuclear and polycyclic aromatic hydrocarbons over a wide range of concentrations in groundwater. The hnu-hanby test was performed by the site geologist on each groundwater sample collected from the hydropunch procedure (except for hydropunch HP-2 because of an insufficient amount of groundwater collected). Additional information and step-by-step procedures are outlined in Appendix A.

Petroleum fuel type and estimated concentration in parts per million were recorded in the field log book by the site geologist. Actual penetrometer records for each hydropunch are provided in Appendix B. The results of the aromatics tests and the physical characteristics of the samples obtained by the hydropunch procedure were used to evaluate potential soil boring and monitoring well locations.

The results of the hnu-hanby field test are presented in Table 11 compared to the laboratory results obtained using EPA Method 602. Although the hnu-hanby procedure is only accurate to one part per million (ppm) of petroleum hydrocarbon, it correctly indicated that no petroleum constituents are present in the groundwater.

TABLE 10

SUMMARY OF CHEMICAL ANALYSES FOR GROUNDWATER SAMPLES COLLECTED BY HYDROPUNCH PROCEDURE

Well No.	Field Sample No.	Parameter (µg/L)								Total VOCs ⁽⁵⁾
		MTBE ⁽³⁾	1,3 and 1,4-Dichloro-benzene	1,2-Dichloro-benzene	Benzene	Toluene/EDB ⁽⁴⁾	Ethyl-benzene	Chloro-benzene and m- & p-Xylenes	o-Xylene	
HP-1	PL-W-H1	--(1)	--	--	0.28	0.29	0.44	--	--	1.01
HP-2	PL-W-H2	--	--	--	0.87	0.57	0.15	1.09	--	2.68
HP-3	PL-W-H3	--	--	--	--	--	0.55	--	--	0.55
HP-4	PL-W-H4	0.34	--	--	--	0.18	0.28	1.05	2.47	4.32
HP-5	PL-W-H5	0.32	53.50	24.46	3.06	0.73	1.80	2.48	1.62	87.97
HP-6	PL-W-H6	0.32	--	--	1.99	0.63	--	--	--	2.94
HP-7	PL-W-H7	--	--	--	1.97	0.63	--	--	0.20	2.80
HP-8	PL-W-H8	0.35	--	--	1.96	--	--	0.72	--	3.03
HP-9	PL-W-H9	1.44	--	--	--	--	--	--	--	1.44
HP-10	PL-W-H10	81.98	1.86	1.14	3.04	4.79	0.67	6.36	1.02	100.86
HP-11	PL-W-H11	0.36	2.79	1.74	1.96	0.56	--	0.89	--	8.30
HP-12	PL-W-H12	194.56	1.62	0.98	2.82	5.65	0.99	7.73	1.13	215.48
HP-13	PL-W-H13	0.23	2.57	4.97	--	0.52	0.26	1.61	--	10.16
HP-14	PL-W-H14	0.66	--	--	1.97	0.84	--	0.75	--	4.22
HP-15	PL-W-H15	0.27	--	--	--	0.65	--	--	--	0.92
HP-16	PL-W-H16	0.29	--	--	--	0.65	--	--	--	0.94
HP-17	PL-W-H17	0.39	--	--	0.20	0.97	--	--	--	1.56
Federal MCL's ⁽⁶⁾		NE ⁽⁸⁾	NE/75	600	5.0	1,000/0.05	700	NE/10,000 ⁽¹⁰⁾	10,000 ⁽¹⁰⁾	
State WQS ⁽⁷⁾		50 ⁽⁹⁾	620/1.8	620	1.0	1,000/0.0005	29	300/400	400	

Notes:

- (1) -- = Not detected
 (2) Duplicate sample
 (3) MTBE = Methyl Tertiary Butyl Ether
 (4) EDB = Ethylene Dibromide
 (5) Sum of Total Organic Compounds Detected Using EPA Method 602
 (6) MCL = Maximum Contaminant Level
 (7) WQS = North Carolina Water Quality Standard
 (8) NE = Not Established
 (9) MTBE WQS is an Interim Standard
 (10) Xylenes (Total) MCL is 10,000 µg/L

Samples analyzed using EPA Method 602.

Groundwater samples obtained on December 17 and 18 1991

TABLE 10 (CONTINUED)

SUMMARY OF CHEMICAL ANALYSES FOR GROUNDWATER SAMPLES COLLECTED BY HYDROPUNCH PROCEDURE

Well No.	Field Sample No.	Parameter (µg/L)								Total VOCs ⁽⁶⁾
		MTBE ⁽³⁾	1,3 and 1,4-Dichloro-benzene	1,2-Dichloro-benzene	Benzene	Toluene/EDB ⁽⁴⁾	Ethyl-benzene	Chloro-benzene and m- & p-Xylenes	o-Xylene	
HP-18	PL-W-H18	128.55	1.54	0.95	2.42	3.79	0.14	4.72	0.76	142.87
HP-19	PL-W-H19	1.08	2.01	3.40	2.13	0.60	0.33	1.86	--	11.41
HP-20	PL-W-H20	0.16	6.95	16.05	1.96	--	0.39	0.65	0.75	26.91
HP-20	PL-W-H21 ⁽²⁾	0.31	66.75	156.08	--	0.49	12.08	10.83	6.57	253.11

Notes:

- (1) -- = Not detected
 (2) Duplicate sample
 (3) MTBE = Methyl Tertiary Butyl Ether
 (4) EDB = Ethylene Dibromide
 (5) Sum of Total Organic Compounds Detected Using EPA Method 602
 (6) MCL = Maximum Contaminant Level
 (7) WQS = North Carolina Water Quality Standard
 (8) NE = Not Established
 (9) MTBE WQS is an Interim Standard
 (10) Xylenes (Total) MCL is 10,000 µg/L

Samples analyzed using EPA Method 602.

Groundwater samples obtained on December 17 and 18, 1991.

TABLE 11

**SUMMARY OF FIELD SCREENING RESULTS FOR
AROMATIC HYDROCARBONS (hnu-hanby Method)**

Hydropunch No.	Date Performed	Depth (feet below ground surface)	hnu-hanby Concentration (ppm)	Total VOCs ⁽¹⁾ (in ppm)
HP-1	12-17-91	15	--(2)	0.001
HP-2	12-17-91	22	NA(3)	0.0027
HP-3	12-17-91	20	--	0.0006
HP-4	12-17-91	20	--	0.0041
HP-5	12-18-91	18	--	0.088
HP-6	12-18-91	20	--	0.0029
HP-7	12-18-91	20	--	0.0028
HP-8	12-18-91	20	--	0.0030
HP-9	12-18-91	20	--	0.0014
HP-10	12-18-91	20	--	0.1009
HP-11	12-18-91	20	--	0.0083
HP-12	12-18-91	20	--	0.2155
HP-13	12-18-91	20	--	0.0102
HP-14	12-18-91	20	--	0.0042
HP-15	12-18-91	20	--	0.0009
HP-16	12-18-91	20	--	0.0009
HP-17	12-18-91	20	--	0.0016
HP-18	12-18-91	20	--	0.1429
HP-19	12-18-91	20	--	0.1429
HP-20	12-18-91	22	--	0.0269

(1) This value represents the concentration of Volatile Organic Compounds (VOCs) detected by EPA Method 602 from the same location as the field test.

(2) -- = Not detected

(3) (NA) = Not Analyzed

Groundwater samples were collected on December 17 and 18, 1991.
Samples were analyzed using the hnu-hanby, Field Test (see Appendix A).

8.3 Groundwater Sampling and Analyses

Groundwater samples were collected from the eleven monitoring wells (MW-1 through MW-7, and DW-1 through DW-4) on January 15 and 16, 1992. Groundwater samples from each monitoring well were analyzed by EPA Method 602. Four monitoring wells (MW-1, MW-3, MW-7 and DW-3) were selected for chemical analyses by EPA Method 601, and two monitoring wells (MW-1 and MW-3) were selected for analyses by EPA Method 625. Additionally, one duplicate sample for each parameter was collected and analyzed. The duplicate sample for EPA Method 601 was obtained from monitoring well MW-1 and labeled as MW-9. A duplicate sample for EPA Method 602 was obtained from monitoring well MW-4 and labeled as MW-8. The duplicate sample for EPA Method 625 was obtained from monitoring well MW-3 and labeled as MW-10.

Prior to groundwater sampling, five well volumes were purged from each well. A dedicated polyethylene bailer was used to purge the wells. Purge water was containerized in 55-gallon, steel drums and stored at a central staging area on site. Three measurements of pH, specific conductance and temperature were made prior to sampling to ensure that the groundwater had stabilized. The measurements were taken after the third, fourth and fifth well volumes had been removed.

Groundwater samples were collected from the wells using dedicated polyethylene bottom-loading bailers. These bailers had also been used to develop the monitoring wells. The samples were transferred into laboratory-prepared sample containers and placed immediately on ice. Groundwater samples were collected by slowly pouring water from the bailer into the appropriate sample container to minimize volatilization. Samples were transported via Federal Express to Solutions Laboratories, in Chesapeake, Virginia, for analysis. Appropriate chain-of-custody documentation, along with a trip blank sample, accompanied the samples to the laboratory. Results of the laboratory analyses are presented on Table 12.

Chain-of-custody records, along with laboratory data sheets are provided in Appendix E and F, respectively. Quality control (QA/QC) procedures and laboratory quality assurance results are provided in Appendix A and F, respectively. In addition, field parameters including pH, temperature and specific conductance were measured at the time of sampling. These field parameter measurements are reported on Table 13.

TABLE 12

SUMMARY OF CHEMICAL ANALYSES FOR GROUNDWATER SAMPLES COLLECTED FROM MONITORING WELLS

Parameter/Method	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8(6)	MW-9(7)	MW-10(8)	DW-1	DW-2	DW-3	DW-4	Field Blank	Maximum Concentration Level $\mu\text{g/L}$	N.C. Water Quality Standard $(\mu\text{g/L})$
EPA Method 601	--	NA	--	NA	NA	NA	NA	--	--	NA	NA	NA	NA	NA	--		
Purgable Halocarbons (1)	--	NA	--	NA	NA	NA	NA	--	--	NA	NA	NA	NA	NA	--		
EPA Method 602 (2)	--	--	--	--	--	--	--	--	NA	NA	--	--	--	--	--	NE(9)	50(10)
MTBE (3)	2.26	--	--	--	--	--	--	--	--	--	3.16	--	1.94	--	--	5.0	1.0
Benzene	--	--	--	--	--	--	--	--	--	--	7.35	1.86	0.94	8.23	--	1,000/0.05	1,000/0.0005
Toluene/EDB (4)	--	--	--	--	--	--	--	--	--	--	1.88	--	0.38	--	0.08	700	29
Ethyl Benzene	5.72	--	0.08	--	--	--	--	--	--	--	2.05	1.45	3.50	--	--	10,000/100	400/300
m-, p- Xylene and Chlorobenzene	2.75	--	--	--	--	--	--	--	--	--	1.14	--	--	--	--	10,000(11)	400
o-Xylene	0.74	--	2.15	--	0.66	--	--	--	--	--	18.28	--	1.18	--	--	NE/75	620/1.8
1,3 & 1,4-Dichlorobenzene	63.75	--	37.72	--	2.05	--	--	--	--	--	5.29	--	0.77	--	--	600	620
1,2-Dichlorobenzene	70.85	--	20.61	--	1.63	--	--	--	--	--	--	--	--	--	--		
EPA Method 625 (5)	48	NA	--	NA	NA	NA	NA	NA	NA	28	NA	NA	NA	NA	--	NE	NE
Naphthalene																	

Notes: -- Not Detected

(1) NA - Not Analyzed

(2) Purgable Halocarbons analyzed using EPA Method 601. No purgable halocarbons were detected.

(3) Purgable aromatics analyzed using EPA Method 602.

(4) MTBE - Methyl Tertiary Butyl Ether.

(5) EDB - Ethylene Dibromide

(6) Base Neutral/Acid Extractables (BNAs) analyzed using EPA Method 625. Only one contaminant was detected.

(7) Duplicate Sample Obtained from MW-4, Method 602.

(8) Duplicate Sample Obtained from MW-1, Method 601.

(9) Duplicate Sample Obtained from MW-3, Method 625.

(10) NE = Not Established.

(11) MTBE WQS is an Interim Standard.

(12) The MCL for Xylene (Total) Includes Meta, Para, and Ortho Xylenes.

Table reflects only those parameters which were detected. Complete list of tested parameters are provided in Appendix F.

TABLE 13

SUMMARY OF GROUNDWATER FIELD PARAMETERS

Well No.	Field Parameter		
	pH ⁽¹⁾	Specific ⁽²⁾ Conductance (cm/ μ mhos)	Temperature ⁽²⁾ (°C)
MW-1	5.28	355	17.0
	5.40	355	16.0
	5.31	355	16.0
MW-2	5.20	230	15.0
	5.32	225	17.0
	4.63	270	15.5
MW-3	12.27	300	15.0
	11.94	1,000	16.0
	12.05	1,200	14.0
MW-4	5.66	270	16.0
	5.41	270	16.0
	5.53	265	16.0
MW-5	4.82	150	14.0
	4.81	150	17.0
	4.86	110	15.0
MW-6	5.02	70	14.0
	4.93	75	18.0
	5.01	80	19.0
MW-7	4.70	150	16.0
	7.71	150	16.0
	7.70	150	16.0
DW-1	10.76	450	19.0
	10.86	385	19.5
	10.57	280	20.5
	10.63	255	21.0
DW-2	10.83	335	18.0
	10.68	320	16.5
	10.35	330	18.5
	10.15	330	18.0
DW-3	12.60	500	17.0
	12.54	3,600	14.0
	12.56	3,700	13.0
	12.58	4,000	14.0
DW-4	12.57	3,400	16.0
	12.46	2,000	15.0
	12.47	2,200	16.0
	12.31	1,500	16.0

Notes: Groundwater samples obtained on January 15 and 16, 1992

(1) pH measured using an Orion pH meter, Model No. 290A.

(2) Specific conductance and temperature measured using YSI conductivity meter, Model No. 335 CT.

8.4 Extent of Horizontal Groundwater Contamination

Before groundwater analytical results are discussed, some general comments must be made concerning the laboratory results. The method used to analyze all groundwater samples was EPA Method 602. This method utilizes the gas chromatograph (GC) in order to identify compounds based on their retention times. Due to the similarities in solubilities of certain compounds, some tend to elute at the same time, making it difficult to differentiate compound identities by this method of analysis.

This is the case for meta-xylene (m-xylene) and chlorobenzene; 1,3-dichlorobenzene and 1,4-dichlorobenzene; and toluene and ethylene dibromide (EDB). As a conservative resolution to this issue, the total concentration for each compound pair was combined and reported as one concentration by the laboratory. When evaluation of the laboratory data is performed, the total concentration reported is attributed to both compounds separately. It should be noted that this is an extremely conservative approach to this situation.

As shown on Table 10, all hydropunch samples had detectable concentrations of chemical constituents. However the VOC concentrations detected were relatively low. Three samples, HP-10, HP-12 and HP-18, had detectable VOC concentrations exceeding 100 µg/L. When evaluating the various chemical constituents detected in EPA Method 602 for each sample, only three samples, HP-3, HP-5 and HP-6, were detected to have total VOC concentrations less than 1.0 µg/L. The detectable levels of total purgeable aromatics concentrations ranged from 0.55 µg/L at hydropunch HP-3 to 215.48 µg/L in hydropunch HP-12.

Several of the chemical constituents analyzed in EPA Method 602 have established Federal Maximum Contaminant Levels (MCLs) and State Water Quality Standards (WQS). These standards are provided on Table 10. None of the groundwater samples collected during the hydropunch procedures exceeded the MCLs. Eleven of the twenty hydropunch samples were detected to have benzene concentrations which exceed the WQS of 1 µg/L. These eleven samples ranged in concentrations of 1.96 µg/L to 3.06 µg/L. Toluene EDB may also have exceeded the MCLs. If EDB is present instead of toluene, 17 hydropunch samples exceeded the WQS and MCL of 0.0005 µg/L and 0.05 µg/L, respectively. However, none of these samples would have exceeded acceptable State or Federal levels for toluene. The detectable toluene/EDB concentrations ranged from 0.18 µg/L to 5.65 µg/L.

Methyl tertiary butyl ether (MTBE) was detected in 16 of the 20 hydropunch groundwater samples. Samples from hydropunch HP-1, HP-2, HP-3 and HP-7 had no detectable concentrations of MTBE present. The detectable concentrations of MTBE ranged from 0.27 µg/L in HP-15 to 194.56 µg/L in HP-12. Two hydropunch samples, HP-10 and HP-12, had MTBE concentrations of 81.98 µg/L and 194.56 µg/L, respectively. These concentrations did not exceed Federal MCLs but did exceed the interim State WQS of 50 µg/L. More detailed discussions on the actual concentration of the various organic compounds are provided in Section 9.4.

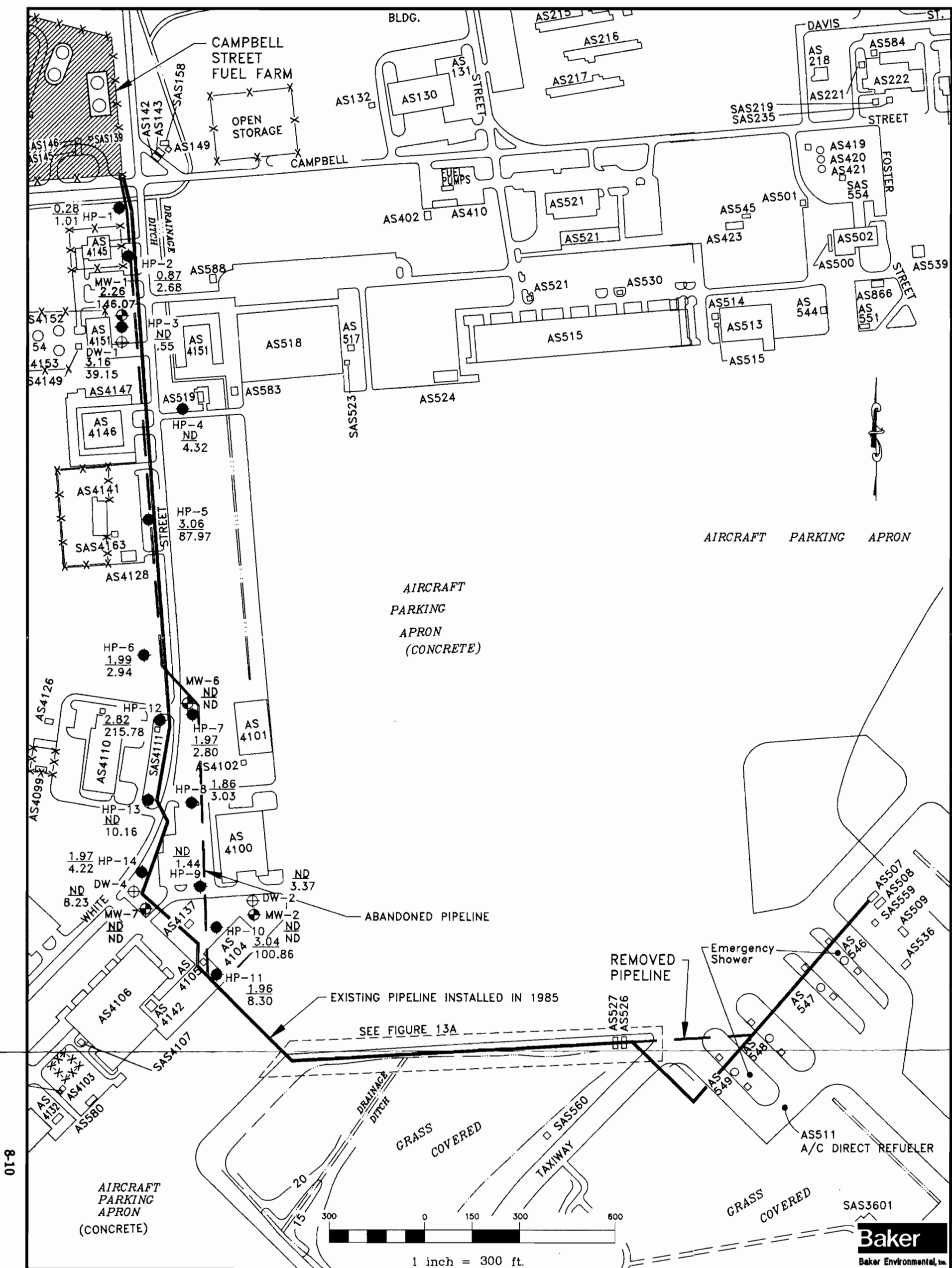
As shown on Table 12, no purgeable halocarbons were detected in groundwater samples from monitoring wells MW-1, MW-3, MW-7 and DW-3, using EPA Method 601. Two monitoring wells (MW-1 and MW-3) were analyzed for base neutral/acid extractables using EPA Method 625. The groundwater sample from monitoring well MW-3 did not have any detectable concentrations. Monitoring well MW-1 did have one contaminant detected: Naphthelene, at a concentration of 48 µg/L.

The chemical results provided on Table 12 indicate that none of the chemical constituents analyzed using EPA Method 602 exceeded Federal MCLs. The exception may be for toluene/EDB, which was detected in four monitoring wells in concentrations ranging from 0.94 µg/L to 8.23 µg/L in monitoring wells DW-3 and DW-4, respectively. If the concentrations detected are toluene, then they are well below the MCL of 1,000 µg/L. If these concentrations are EDB, then all four exceed the MCL 0.05 µg/L.

The groundwater samples from the monitoring wells do exceed some State WQS. Benzene which was detected in three monitoring wells, MW-1, DW-1 and DW-3, in concentrations of 2.26 µg/L, 3.16 µg/L and 1.94 µg/L, respectively. These concentrations exceed the WQS of 1.0 µg/L.

The WQS for toluene/EDB concentrations are in a similar situation as the toluene/EDB MCLs. The concentrations detected would not exceed the WQS for toluene (1,000 µg/L) but would exceed the WQS for EDB (0.0005 µg/L). A similar situation also exists for 1,3- and 1,4-dichlorobenzene which have a WQS of 620 µg/L and 1.8 µg/L, respectively.

As shown on Figures 16 and 16A, groundwater contamination in the shallow portion of the aquifer is present along a majority of the pipeline but is relatively low. The primary areas of concern appear to be the southern portion of the pipeline in the vicinity of the aircraft direct



LEGEND

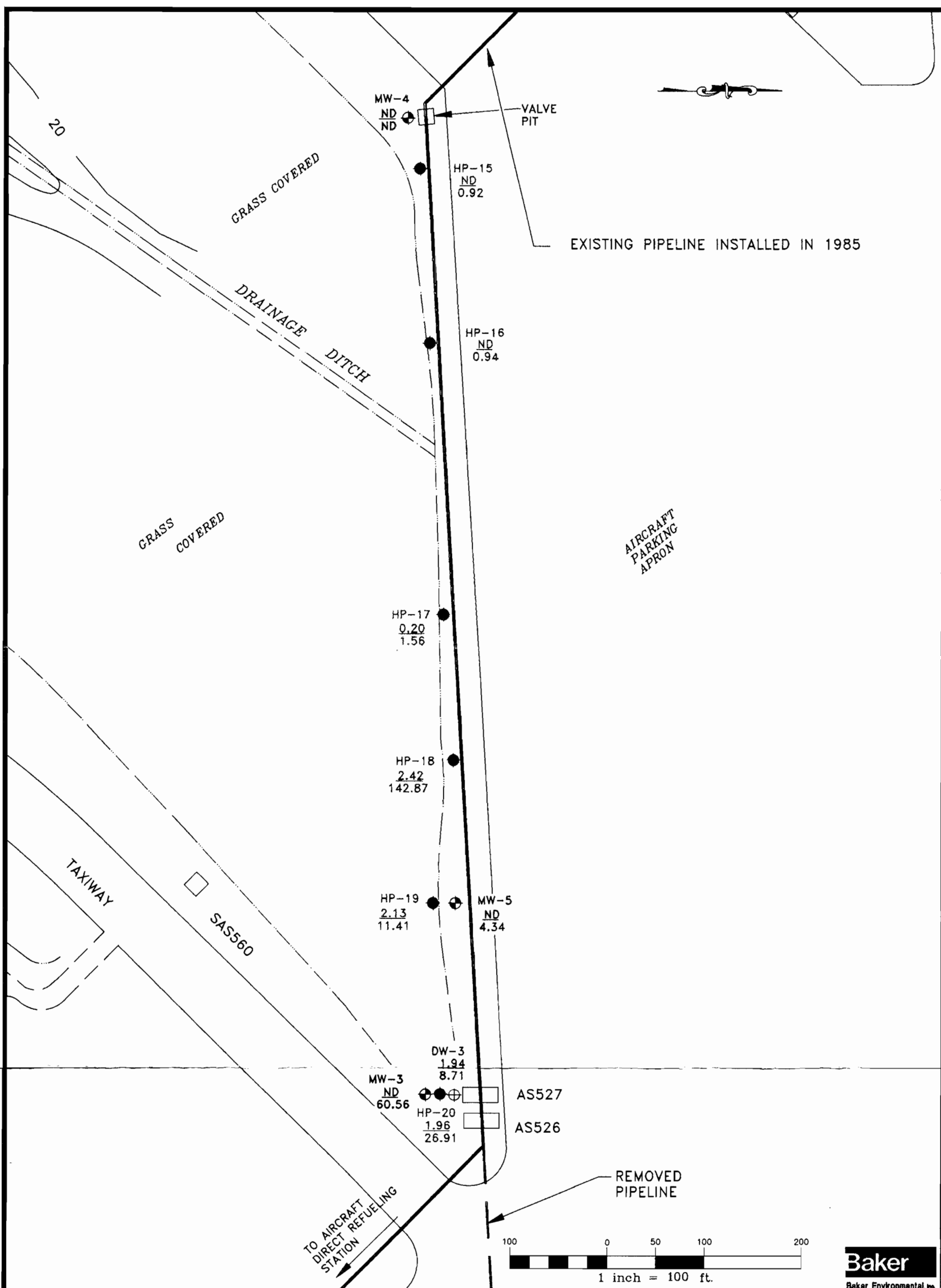
DW-1 TYPE III MONITORING WELL LOCATION
 HP-1 HYDROPUNCH LOCATION
 0.28 BENZENE CONCENTRATION (ug/L)
 1.01 TOTAL VOLATILE ORGANIC COMPOUND (VOC) CONCENTRATION (ug/L)
 --- ABANDONED PIPELINE
 --- EXISTING PIPELINE INSTALLED IN 1985

MW-1 TYPE II MONITORING WELL LOCATION
 (ND) NOT DETECTED AT METHOD DETECTION LIMITS

SOURCE: LANTDIV, OCT. 1991

FIGURE 16
CAMPBELL STREET JP-5 PIPELINE
BENZENE AND TOTAL VOC CONCENTRATIONS
IN GROUNDWATER
NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA

Baker
 Baker Environmental, Inc.



LEGEND

MW-5 TYPE II MONITORING WELL LOCATION
 (ND) NOT DETECTED AT METHOD DETECTION LIMIT
 0.20 BENZENE CONCENTRATION ug/L
 1.56 TOTAL VOLATILE ORGANIC COMPOUND (VOC) CONCENTRATION (ug/L)
 --- ABANDONED PIPELINE
 --- EXISTING PIPELINE INSTALLED IN 1975
 SOURCE: LANTDIV., OCT. 1991

DW-3 TYPE III MONITORING WELL LOCATION
 HP-15 HYDROPUNCH LOCATION

FIGURE 16A
 CAMPBELL STREET JP-5 PIPELINE
 BENZENE AND TOTAL VOC CONCENTRATIONS
 IN GROUNDWATER - SOUTHERN PIPELINE SECTION
 NEW RIVER MARINE CORPS AIR STATION
 JACKSONVILLE, NORTH CAROLINA

Baker
 Baker Environmental, Inc.

refueling station and the northern end of the pipeline in the vicinity of the steam-generating facility (Building AS-4151).

The groundwater contamination detected in the vicinity of monitoring wells MW-1 and DW-1 (Building AS-4151) appears to be the northern limit of petroleum contamination in this portion of the pipeline. The VOC concentrations detected in groundwater samples obtained from hydropunches HP-1 and HP-2, decrease in concentration north of MW-1 and DW-1 (Figure 16). Towards the south, VOC concentrations in hydropunches HP-5 and HP-6 also decrease in concentrations though hydropunch HP-5 still has substantial concentrations.

The VOC concentrations detected in monitoring wells MW-1 and DW-1 and hydropunch HP-5 are most likely related to previous pipeline releases. The low VOC concentrations detected in hydropunch HP-4 may be influenced by the surface drainage channel intercepting the shallow groundwater zone and acting as a barrier to such migration. Also, because the release occurred within an underground pipeline, the contaminants may find it easier to migrate within the backfill of the pipeline trench.

The area of the pipeline where it crosses White Street and where the active and abandoned pipelines separate, in general has low levels of groundwater contamination. As shown on Figure 16, benzene and VOC concentrations are lowest in this area of the pipeline.

Figure 16A shows chemical concentrations in the groundwater for the final portion of pipeline prior to the aircraft direct refueling station. As shown on Figure 16A, VOC concentrations increase along the pipeline as it nears the refueling station. The contamination detected in this area is apparently related to the abandoned pipeline and the USTs and refueling pipelines located in this area.

The pH and specific conductance measurements obtained from shallow monitoring wells MW-1 through MW-7, are typical for this area with the exception of monitoring well MW-3. As shown on Table 13, the pH and specific conductance values in this well are the highest of the shallow wells. The soil boring for MW-3 did have significant levels of TPH present in the soils which is affecting the groundwater conditions.

8.5 Extent of Vertical Contamination

As shown on Figures 16 and 16A and Table 11, Type III wells DW-1 and DW-3 indicate that the deeper portions of the aquifers in these areas have relatively low concentrations of organic compounds. Monitoring well DW-1 does have higher levels of organics detected than the other deep wells. None of the purgeable halocarbons or base neutral/acid extractables were detected in any of the Type III wells. Despite the elevated levels of contamination detected, only monitoring wells DW-1 and DW-3 had benzene concentrations that exceeded established state WQS.

The high pH and specific conductivity levels detected in the deep wells apparently are not the result of contamination, but appear to be related to aquifer characteristics. As shown on Table 13, the highest pH and specific conductivity values were consistently detected in the four deep wells. The elevated pH and specific conductivity values are apparently due to the physical soil conditions encountered in these soil boring locations.

9.0 PRELIMINARY EXPOSURE ASSESSMENT

This section discusses the preliminary exposure assessment performed for the CSFF. The issues that will be addressed in this section, as per the directive of North Carolina's UST regulations are: 1) a qualitative fate and transport assessment for the contaminants found at the site; 2) the identification of major contaminants found at the site; the violation of the 2L Standard (North Carolina Water Quality Standards) at supply wells will be the "risk threshold"; 3) a qualitative evaluation of potential human exposure pathways for the most mobile and/or toxic contaminants found; and 4) identification of potential receptors at greatest risk from the existing contamination.

9.1 Fate and Transport of Petroleum in the Environment

Petroleum products are complex mixtures of hydrocarbons; more than one hundred compounds can be found in a typical fuel mixture (EPRI, 1989). Each constituent has different chemical and physical properties that control the ultimate fate and transport of the petroleum products in soil. In general, when petroleum hydrocarbons (PHCs) are released into unsaturated soils, they tend to migrate vertically under the force of gravity, with some slight lateral spread (Schwendeman, 1989). This migration pathway may be interrupted by adsorption to soil particles, inhibition by a geologic formation, (i.e., low transmissive capability) or by cultural features (i.e., pipe channels or foundations).

The subsurface transport of contaminants is also controlled by complex interactions between chemical, physical, and biological processes. Some conditions which effect migration are:

- Soil texture
- Soil uniformity or non-uniformity
- Soil layer configuration
- Depth to water table
- Soil structure
- Flow stability
- Soil moisture

Due to these complexities, mathematical models have been developed to estimate chemical movement in soils. One model, the Seasonal Soil Compartment Model (SESOIL), developed for the U.S. Environmental Protection Agency's Office of Toxic Substances, has been useful in

determining the mobility and fate of certain chemicals. SESOIL results have classified organic compounds into four categories (EPRI, 1989):

- Chemicals which preferentially adsorb onto soil particles.
- Chemicals which volatilize rapidly.
- Chemicals which pose an immediate threat to groundwater supplies.
- Chemicals for which there is no dominant migration pathway.

The major implication of this model is that lighter PHCs are more likely to volatilize, while heavier PHCs will tend to bind tightly to soil particles.

The relative environmental partitioning of petroleum constituents and examples of various migration pathways are presented in Tables 14 and 15, respectively. As is evident, benzene, ethylbenzene, toluene and xylene (BTEX) have multiple migration pathways. Their chemical nature is such that these compounds are volatile, adsorb to soil particles, and are soluble. In contrast, the heavier PHCs, such as polycyclic aromatic hydrocarbons (PAHs), tend to adsorb to soil particles and become immobilized (i.e., benzo(a)pyrene is 100% adsorbed to soil particles). It can, therefore, be assumed that the lighter constituents of oils (i.e., BTEX), may be found in air, soils, and/or groundwater, while the heavier constituents of oils (i.e., Total Petroleum Hydrocarbons (TPH), will usually be found only in soils.

9.2 Identification of Major Contaminants

9.2.1 Soils

The analytical data for soils is presented in Appendix F. The soil data shows that TPH concentrations were detected in all of the soil borings, except for MW-5. The TPH concentrations for the 30 soil samples analyzed ranged from 0.456 mg/kg (MW-4, 2-4 ft.) to 893.46 mg/kg (B-2, 2-4 ft.). Twelve (12) soil samples exceeded the DEHNR action level of 35 mg/kg for TPHs in soil.

9.2.2 Groundwater

The analytical data for groundwater is presented in Appendix F.

TABLE 14

**RELATIVE ENVIRONMENTAL PARTITIONING OF PETROLEUM
CONSTITUENTS BASED ON SESOIL RESULTS**

Petroleum Compound	Adsorption Onto Soil Particles (%)	Volatilization (%)	Soluble Portion in Groundwater and Soil Moisture (%)
Benzene	3	62	35
Ethylbenzene	21	59	20
(n)Heptane	0.1	99.8	0.1
(n)Hexane	0.1	99.8	0.1
(n)Pentane	0.1	99.8	0.1
Benzo(a)Anthracene	100	0	0
Benzo(a)Pyrene	100	0	0
Naphthalene	61	8	31
Phenanthrene	88	2	10
1-Pentene	0.1	99.8	0.1
Phenol	9	0.01	91
Toluene	3	77	20
(o)Xylene	15	54	31

Source: EPRI, 1989

TABLE 15

CATEGORIES OF MIGRATION PATHWAYS

Adsorb to Soil Particles	Volatilize in Air	Solubilize in Groundwater	Multiple Pathways
Benzo(a)Pyrene Phenanthrene Benzo(a)Anthracene	(n)Hexane (n)Heptane (n)Pentane 1-Pentene	Phenol	Benzene Ethylbenzene Naphthalene Toluene (o)Xylene

Source: EPRI, 1989

Three different analytical methods were applied to evaluate the organic chemical concentrations in the groundwater at the CSFF pipeline site. The EPA Methods 601, 602 and 625 were used to detect purgeable halocarbons, purgeable aromatics and base neutral/acid extractables (BNAs), respectively.

All 31 groundwater samples were analyzed for purgeable aromatics, four samples were analyzed for purgeable halocarbons, and two samples were analyzed for BNAs (Table 11). Of the four groundwater samples analyzed for purgeable halocarbons, none were found to have detectable concentrations of halocarbons. For the two groundwater samples analyzed for BNAs, only monitoring wells MW-1 had any (naphthalene, 48 µg/L) detectable concentrations. Naphthalene is a constituent of petroleum fuels and is non-carcinogenic. At the present time there is no MCL or North Carolina WQS for naphthalene.

As presented on Tables 10 and 12, purgeable aromatics analyzed using Method 602 were detected in all but 4 of the 31 groundwater samples obtained from the hydropunches and monitoring wells. EPA Method 602 utilizes the Gas Chromatograph (GC) to identify compounds. The GC procedure identifies compounds based on their retention times. Due to the similarities in solubilities of certain compounds, some tend to elute approximately at the same time, making it difficult to differentiate compound identities by this method of analysis. This is the case for 1,3-dichlorobenzene and 1,4-dichlorobenzene; toluene and EDB; and m-,p-xylenes and chlorobenzene. As a result the laboratory reported the concentration of these pairs as a combined value. Since all of these chemicals have State and Federal standards, a conservative resolution to this issue of combined values would be to attribute all of the contamination to the chemical constituent with the most stringent standard. This is the approach that has been taken for this qualitative risk assessment.

The following is a summary, by compound, of the purgeable aromatic compounds identified at the CSFF:

- Benzene was detected in 17 of the 31 groundwater samples collected. The detected concentrations ranged from 0.20 µg/L in HP-17 to 3.16 µg/L in DW-1. None of the samples exceeded the MCL of 5.0 µg/L, however, fourteen of the seventeen samples, ranging in concentrations of 1.94 in DW-3 and 3.16 in DW-1, exceeded the State WQS of 1.0 µg/L.
- Toluene/EDB was detected in 20 of the 31 groundwater samples collected. The detected concentrations ranged from 0.18 µg/L in HP-4 to 8.23 µg/L in DW-4. The

MCL for toluene is 1,000 µg/L; none of the groundwater samples exceeded this concentration. The MCL for EDB is 0.05 µg/L, and the State WQS is 0.0005 µg/L. Twenty of the groundwater samples exceeded the State and Federal standards for EDB.

- Ethylbenzene was detected in 15 of the 31 groundwater samples. The detected concentrations ranged from 0.08 µg/L in MW-3 to 2.52 µg/L in HP-15. None of the concentrations detected exceeded ethylbenzene's MCL of 700 µg/L or the State WQS of 29 µg/L.
- Chlorobenzene and m-,p-xylene were detected in 16 of the 31 groundwater samples. The detected concentrations ranged from 0.65 µg/L in HP-20 to 6.36 µg/L in HP-10. Chlorobenzene has an MCL of 100 µg/L, and a State WQS of 400 µg/L. Xylenes (total), which includes ortho, meta and para xylenes, have an MCL of 10,000 µg/L and a State WQS of 400 µg/L. None of the detected concentrations exceeded Federal or State standards for chlorobenzene or xylenes.
- o-Xylene was detected in 11 of the 31 groundwater samples. The detected concentrations ranged from 0.20 µg/L in HP-7 to 2.15 µg/L in MW-3. Both concentrations are below the MCL of xylenes (total), which includes ortho, meta and para xylenes, and the State WQS of 10,000 µg/L and 400 µg/L, respectively. Even if o-Xylene concentrations were combined with the chlorobenzene/m-and p-xylene concentrations, the combined concentrations would be well below the MCL and State WQS values.
- 1,2-Dichlorobenzene was detected in 13 of the 31 groundwater samples. The detected concentrations ranged from 0.77 µg/L in DW-3 to 70.85 µg/L in MW-1. The MCL for 1,2-dichlorobenzene is 600 µg/L; none of the detected concentrations exceeded this standard. The State of North Carolina has established a standard of 620 ppm for this chemical.
- 1,3- and 1,4-Dichlorobenzene were detected in 13 of the 31 groundwater samples. The detected concentrations ranged from 1.18 µg/L in DW-3 to 63.75 µg/L in MW-1. Currently, there is only an MCL for 1,4-dichlorobenzene of 75 µg/L. None of the detected concentrations exceeded the MCL of 75 µg/L. The North Carolina State standard for the chemicals are 620 and 1.8 ppb, respectively. No concentration

exceeded the MCL for 1,3-dichlorobenzene; however, 10 concentrations did exceed the WQS for 1,4-dichlorobenzene.

9.3 Identification of Human Exposure Pathways

Groundwater ingestion, the potential inhalation of volatile organic chemicals from groundwater and soil, soil dermal contact and soil ingestion would most likely be the major exposure pathways of concern at the pipeline site. Since there are no identified drinking water sources within a 1/4-mile radius of the site in the surficial aquifer, and all drinking water on the base is supplied by the deeper Castle Hayne Aquifer, no groundwater exposure pathways are considered to exist.

The Campbell Street JP-5 Pipeline runs south from the fuel farm along White Street. It then traverses an industrial area which is primarily grass and concrete, and includes the concrete aircraft parking apron. The pipeline then runs east along a grassy area until it reaches the airport refueling station (see Figure 10). Due to most of this area being grass or concrete covered, the potential for soil dispersion due to fugitive dust is not considered to exist and no exposure to contaminated soils is expected. Exposure to any of the contaminated soils would be contingent upon site disturbance via construction or remediation activities. In the event that soil remediation is required, there could be an exposure route due to inhalation from volatilization of the TPHs found in the soils. Since this would be an occupational exposure, the receptor analysis for these exposure pathways should be considered as part of the site remediation design plan. Therefore, it is not expected that soil ingestion or dermal contact exposure pathways are likely to exist, although a potential exposure pathway due to inhalation during remediation may occur.

9.4 Identification of Receptors

No actual or potential human receptors have been identified that would be exposed to groundwater at this site since the surficial aquifer is not used as a drinking water source. Receptors identified that could be exposed to contaminated soils are limited to the workers performing the site remediation, if required. No other receptors have been identified on-site because the area is mostly grass-covered and, therefore, limits exposure pathways from contaminated soils.

10.0 REMEDIATION ASSESSMENT

This section of the Site Assessment Report discusses the type and extent of soil and groundwater contamination in the vicinity of Campbell Street JP-5 Pipeline and evaluates applicable remediation alternatives for soil and groundwater remediation. A remediation alternative consists of a combination of technologies or a single technology capable of addressing the site-specific contamination at the site.

10.1 Objectives

The objectives of this Remediation Assessment are as follow:

- Evaluate whether soil and groundwater require remediation.
- Identify areas requiring remediation.
- Evaluate technologies for soil and groundwater remediation.

Several remedial technologies were evaluated with respect to their ability to correct the specific contamination detected in the vicinity of the Campbell Street JP-5 Pipeline.

10.2 Potential/Feasibility of Remediation

TPH concentrations were detected in the soil borings in three areas of the pipeline; the northern area near Building AS-4151; the central area where the abandoned and active pipelines are in separate trenches; and the southern area near the aircraft direct refueling station. Purgeable aromatics and BNAs were detected in relatively low concentrations in the groundwater at various locations across the site. This was confirmed by field observations, PID screening and analytical results, described in Sections 6 and 8 of this report. Based on the analytical results, remediation is recommended only for the soils at two areas of the pipeline, the northern and southern areas. Because low TPH concentrations in the soils detected in the center area of the pipeline are within the 35 ppm concentration limits established by the SSE, remediation is not recommended for this area.

The soil areas of concern requiring remediation are in the immediate vicinity of MW-1 and MW-3. The extent of the area requiring remediation is not known at this time. Given the levels of TPH detected in the soils immediately above the groundwater table, soil remediation is necessary to the depth of the water table. Soil remediation requirements for TPHs are

determined by the SSE developed by the DEM. Based on the SSE, it was determined that the remediation requirement for the site was 35 mg/kg.

The levels of VOCs detected in the groundwater were relatively low. Groundwater remediation requirements for VOCs are determined relative to the MCLs established by the EPA and the State of North Carolina WQS for benzene, MTBE and EDB. The highest levels of VOCs were detected in the vicinity of MW-1, HP-2 and HP-8. Although at several sampling locations the State WQS were exceeded, the degree to which they were exceeded was not very significant. It is believed that if the source of the contamination (the soils) is removed, groundwater VOC concentrations will decrease over time.

The remediation goal is determined based on applicable regulatory requirements and availability of feasible remedial action alternatives; the proposed remediation endpoints for CSFF is reduction of TPH in the soil to 35 ppm. It is anticipated that once soil contamination is removed, groundwater concentrations will decrease to Federal MCL and State WQS. For future consideration, however, groundwater remediation alternatives will be discussed in the following sections.

10.3 Potential Remediation Alternatives

A brief description of applicable soil and groundwater remediation alternatives follows. Information regarding respective remedial technologies was obtained from documents developed by the EPA.

10.3.1 Soil

Soil remediation technologies used by themselves or in combinations are considered to be source control alternatives. Some of the commonly used alternatives for soil remediation are:

- Passive remediation
- Vacuum extraction
- Excavation followed by one of the technologies listed below:
 - ▶ Disposal at an off-site landfill
 - ▶ Bioremediation
 - ▶ Low temperature thermal treatment
 - ▶ Incineration

A brief description of these alternatives is offered in Sections 10.3.1.1 through 10.3.1.6.

10.3.1.1 Passive Remediation

This alternative means that no design or construction remedial alternative is taken and is included in this study as a baseline for comparison with the other considered alternatives. However, despite the title of "Passive Remediation," activity at the site continues as monitoring. Should the monitoring indicate a deterioration of site conditions that allow the "Passive Remediation" alternative, direct action becomes advisable.

The costs associated with this alternative are for monitoring.

10.3.1.2 Vacuum Extraction

Vacuum extraction has proven effective as a method of reducing VOCs. This method involves installing vacuum extraction wells in the contaminated soil to volatilize the VOCs from the aerated soil pores. Once the VOCs are volatilized, additional treatment may be required, depending on VOC content of the vapor stream. The vapor stream may be vented directly to the atmosphere or undergo treatment by carbon adsorption or catalytic oxidation. Field tests are needed at the facility to determine the vacuum level required for the volatilization and transport of contaminants and to measure the radius of influence of vacuum extraction wells. This technology may be enhanced through injection of volatile-free air into the zone of contamination. The time required to complete remediation varies from several months to several years, depending on site geology, hydrogeology and extent of contamination. Vacuum extraction cannot be applied to reduce heavy metal content and can only partially reduce TPHs.

Costs associated with vacuum extraction include installation of extraction wells and related pumping and treatment system, and operating costs associated over the time period required to complete remediation.

10.3.1.2 Excavation

Excavation is not a stand-alone alternative and is usually practiced in combination with another procedure or process, such as disposal at an off-site landfill, bioremediation, low temperature thermal treatment or incineration. The volume of soil to be excavated is usually estimated from sampling and analytical results. Post-excavation sampling is usually

conducted to confirm that all the contained soil has been fully excavated. The excavated area is filled with certified clean fill. Excavation poses a hazard through the release of VOCs to the atmosphere.

The costs associated with excavation include the removing of soil, the potential for shoring, post-excavation sampling and backfilling of the excavation. Additional costs are incurred for follow-up treatment or disposal of the contaminated soil.

10.3.1.3 Disposal at an Off-Site Landfill

The excavated soil is sampled and analyzed for hazardous waste characteristics prior to treatment or disposal at an appropriate landfill.

Costs associated with this alternative include transportation of the excavated material, and landfill disposal fees. Disposal fees will vary depending on the contaminants present and contaminant levels.

10.3.1.4 Bioremediation

Bioremediation is a proven technology for treating soils, sludges, and wastewater by using microorganisms to degrade organic material. An oxygen source and naturally occurring microbes are mixed with nutrients, (primarily phosphates and nitrogen) and are added to the soil or waste to be treated. Given sufficient residence time, the microbe/nutrient mixture promotes degradation of soil contaminants. Bioremediation is suitable for treatment of contamination caused by petroleum hydrocarbons, aromatics, halogenated aromatics, phenols, organophosphates, and many herbicides and pesticides. About 85% of the organic constituent can be degraded over a period of six to twelve months. This technology can be practiced in engineered land treatment cells or as landfarming. In landfarming, contaminated soil is excavated and laid in 6 to 12-inch lifts, tilled and treated with nutrients. This technology can also be practiced, in a few instances, in-situ. Bioremediation has been used by the petroleum industry for the past two to three decades to treat oily sludges. The tilling provides oxygen needed to promote the reaction. Reaction time can be reduced from months to days using a bioreactor.

Bioremediation costs vary widely depending on site geology, hydrogeology and extent of contamination, but are relatively less expensive than other alternatives.

10.3.1.5 Low Temperature Thermal Treatment

Low temperature thermal treatment (LTTT) is a demonstrated ex-situ process that provides evaporation of VOCs from contaminated soil without heating the soil matrix to combustion. Typical temperatures for LTTT are from 200°F to 1,000°F. This technology utilizes a thermal processor, an indirect heat exchanger to dry and heat contaminated soils, to strip the moisture and VOCs from the soil. Water is sprayed on the processed soil to provide cooling and to minimize dust emissions. The thermal processor is equipped with a self-contained burner which is typically fired by fuel oil. The LTTT process requires an emissions control system for the off-gas and a water treatment system for the condensate generated from cooling the off-gas. Contaminant removal efficiencies in excess of 95% can be achieved.

The costs associated with LTTT include excavation, fuel requirements, equipment, post-excavation sampling, and backfilling of the excavation. The operating cost of the thermal processor unit is relatively inexpensive relative to incineration, depending on the type and extent of contamination.

10.3.1.6 Incineration

Incineration is a proven technology that uses high temperature oxidation to destroy organic constituents in soil. The most commonly used incineration processes are liquid injection, rotary kiln, fluidized bed, and multiple hearth furnaces. Of these technologies, rotary kiln has the most experience. Rotary kiln incinerators are sloping cylindrical, refractory-lined shells, typically fired by the fuel content of the waste supplemented by natural gas or fuel oil. The waste is heated by heat transfer from the combustion gases. Kilns often contain an afterburner to ensure complete combustion of the off-gases. Wastes are fed at the higher end of the sloping cylinder. The rotation creates turbulence and moves the waste toward the discharge end. Combustion temperatures range between 1,500°F and 3,000°F with residence times for solids ranging from minutes to one hour. These units are highly efficient in destroying organic material, but usually do not treat metals. Incineration is not practical if total destruction of organics is not required, or the heating value of the waste is so low as to require too much supplemental fuel, or so high that the waste stream must be severely reduced.

Incineration can be performed on-site in a mobile incinerator or at a commercial incineration facility off-site.

The costs associated with incineration include excavation, rental of a mobile incinerator or transportation of the soil to an off-site commercial incinerator, supplemental fuel requirements, post-excavation sampling, and backfilling of the excavation. This approach is relatively expensive, depending on the type and extent of contamination.

10.3.2 Groundwater

Dissolved contamination is the main consideration used to evaluate groundwater treatment alternatives. Some of the commonly used alternatives for treating VOC groundwater remediation are:

- Passive remediation with continued monitoring
- Bioremediation
- Air stripping
- Carbon adsorption

The three technologies listed above entail groundwater pumping and subsequent treatment. The treated water may be dispersed or discharged in accordance with permit requirements. They may be used singly or can be combined. A brief description of these alternatives is offered in Sections 10.3.2.1 through 10.3.2.3.

10.3.2.1 Passive Remediation with Continued Monitoring

This alternative means that no designed or constructed remedial alternative is taken, except for the development and maintenance of a long-term monitoring program. This alternative is included in this study as a baseline for comparison with other considered alternatives. A groundwater monitoring program is recommended for several years. The monitoring program should consist of periodic sampling and analysis for the constituents of concern. The results of the monitoring program should be evaluated to track impacts to the environment and public health, and to identify whether additional remedial action may be required.

Benzene is the primary constituent of concern in the groundwater. Benzene is biodegradable in groundwater, however, the rate of biodegradation is dependent on many factors.

Temperature, pH, dissolved oxygen, nutrients, and microbial population may influence the rate or biodegradation. If the source of contamination is removed so that the benzene constituents are not replenished, natural biodegradation may remove 80 percent to 100 percent of benzene present. Recent studies have indicated that under anaerobic conditions, 99 percent biodegradation was observed after a 120 week period (U.S. Department of Health).

10.3.2.2 Bioremediation

As presented in Section 10.3.1.1, bioremediation is applicable to contaminated soil. This technology can also be used in groundwater remediation. Typically groundwater is extracted from the subsurface, mixed with microbes, nutrients and a source of oxygen, and allowed sufficient residence time to promote biodegradation of the contaminants. Bioremediation differs from air stripping and carbon absorption techniques in that contaminants are not removed from the groundwater, but are instead converted to less hazardous compounds. The type of equipment used to bioremediate the groundwater would be trickling filters, biological towers, rotating biological contractors, etc.

Groundwater bioremediation costs vary widely depending on site geology, hydrogeology and extent of contamination.

10.3.2.3 Air Stripping

Air stripping consists of contacting contaminated water with an air stream by countercurrent flow in a column. The volatile organic compounds transfer from the water into the air as the water and air make contact in the column. Air stripper columns come equipped with different types of internals designed to improve mass transfer between air and water. These include random packing, trickle trays and diffusion air strippers. Treated water leaves the column from the bottom while air containing volatile contaminants is vented out the top. The vented air may require treatment such as carbon absorption for VOC. Depending on the type of petroleum product present in the contaminated water, air stripping is capable of achieving VOC removal rates up to and greater than 95 percent. Lower reductions can be anticipated if heavier petroleum constituents associated with the USTs are present.

Costs for air stripping are relatively inexpensive.

10.3.2.4 Carbon Adsorption

Carbon adsorption consists of contacting the contaminated water stream with granular activated carbon by allowing it to flow through a series of packed carbon beds. The carbon with its large surface area acts as an adsorbent medium for VOCs and TPH in water. This technique is effective in the removal of organic compounds and many inorganic compounds. The spent carbon requires disposal or regeneration in accordance with strict regulatory procedures.

Costs for carbon adsorption are low to moderate, and depend primarily on the required frequency of carbon regeneration.

10.4 Recommended Technologies

One soil and one groundwater technologies appear applicable for remediation of the VOCs and TPH. Each option is discussed in the following sections.

10.4.1 Soil

Based on site history and results of soil sampling, it appears that soil contamination present is the result of the former pipeline, which is now abandoned. Six soil remediation alternatives were described in Section 10.3. The first alternative considered was to take no action. Five additional alternatives were briefly evaluated for their application to the site.

The passive remediation alternative was eliminated from further consideration because it does not comply with DEM objectives and does not reduce the effects of the contamination to the environment.

On-site thermal treatment utilizing LTTT or incineration technologies appear to be the most appropriate alternative for the remediation of TPH detected in the soils around MW-1. The area in the vicinity of MW-3 must also be remediated. However, since this area already is designated to be remediated, the proposed remediation activities should be expanded to include the additional area identified by Baker.

Removal of the contaminant source will accelerate the passive remediation of the groundwater. The abandoned pipeline and adjacent soils in the vicinity of MW-1 should be

removed and replaced with clean backfill. Additional costs associated with on-site thermal treatment technologies are excavation, post-excavation sampling, and backfilling. The other alternatives discussed in Sections 10.3.1.1 through 10.3.1.6 (excavation in combination with off-site disposal and bioremediation) were eliminated from further consideration, due to certain operational constraints.

The relative costs of the recommended alternatives for treating contaminated soils can be more accurately determined following further study. The adsorbed-phase soil contamination represents an ongoing source of dissolved-phase groundwater contamination. Therefore, soil remediation efforts should be completed prior to starting potential groundwater remediation efforts.

10.4.2 Groundwater

Based on site history and results of groundwater sampling, it appears that contamination migrated from the soil into the groundwater. The four technologies described in Section 10.3 were briefly evaluated for their application to the site and with respect to effectiveness, implementability and relative cost. The passive remediation alternative is recommended. This alternative is feasible if, following soil remediation, it can be demonstrated that the source of contamination was removed.

If the areas in the vicinity of Building AS-4141 and the refueling station are currently being considered for corrective action, the proposed groundwater remediation activities may be expanded to include these areas. This would reduce overall design costs for the activity and accelerate groundwater remediation in these areas.

Prior to final consideration of soil and groundwater remediation technology, results of ongoing site activities related to the area of concern should be evaluated. The following additional site activities may be required prior to remedial design:

- Additional delineation of the TPHs in the soils contained within the area of concern.
- Periodic measurements of groundwater elevation.
- Pilot- and/or bench-scale treatment testing.
- Treatment unit component evaluation.
- Required treatment efficiencies.

This information will assist in confirming the required remediation technology and the amount of material requiring remediation.

11.0 CONCLUSIONS

The following conclusions are based on the results of Site Assessment Investigation:

- The soil gas survey results and the petroleum type evaluation based on the TPH analyses, indicate that petroleum releases detected during this investigation are related to the abandoned pipeline. The current pipeline that is in use has not experienced a petroleum release.
- Two areas of the pipeline, the northern portion near Building AS-4151 and the southern end near the aircraft refueling station, had TPH concentrations that exceeded the DEHNR action level of 35 mg/kg. Maximum TPH concentrations in these two areas were 391.10 mg/kg and 893.46 mg/kg, respectively.
- If the laboratory's difficulty in evaluating EDB in the groundwater samples is not taken into consideration, none of the chemical constituents present exceeded the Federal MCLs. The State WQS for benzene (1.0 µg/L) was exceeded in 14 of the 31 groundwater samples. The maximum benzene concentration detected was 3.16 µg/L. Two groundwater samples, hydropunches HP-10 and HP-12, had MTBE concentrations of 81.98 µg/L and 194.56 µg/L, respectively. These two samples did not exceed Federal MCLs but did exceed the State WQS of 50 µg/L.
- Groundwater in some areas of the MCAS has been impacted by other contaminant sources; however, no off-site sources appear to be contributing to the groundwater contamination detected along the pipeline.
- The direction of groundwater flow in the vicinity of the site appears to be southward at a rate of approximately 0.04 ft./year.
- The average hydraulic conductivity for tests run on MW-2 and MW-3 was 1.6×10^{-2} ft./day.
- The groundwater gradient for the site (calculated from the hydraulic conductivity tests) was 0.002.
- Estimated porosity for the site was 0.28 (Fetter 1980).

- Remediation of the soils in the vicinity of Building AS-4151 and the aircraft rapid refueling station are recommended. It is anticipated that if these soils are remediated, the condition of the shallow aquifer will improve without performing active groundwater remediation. After remediation of the soils is completed, periodic monitoring of monitoring wells should be performed to evaluate groundwater conditions.
- Soils in the vicinity of Building AS-4151 should be remediated by excavating the abandoned pipeline and removing the contaminated soils.
- Because low TPH concentrations in the soil are within the limits set by the SSE and low VOC concentrations in the groundwater, it is recommended that the central area of the pipeline not be addressed at this time. The levels of contamination present indicate that this area is not a major petroleum source area.
- It is recommended that the abandoned pipeline be flushed to confirm that it is no longer a source of contamination.

REFERENCES

Bouwer, H. and R.C. Rice. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, Vol. 12, No. 3, June, 1976.

Fetter, C.W., Jr.. 1989. Applied Hydrogeology. Charles E. Merrill Publishing Company, Columbus, Ohio. p. 64, p. 75, and p. 116.

U.S. Environmental Protection Agency. 1987. Underground Storage Tank Corrective Action Technologies. Hazardous Waste Engineering Research Laboratory, Cincinnati, Ohio. EPA A/625/6-87-015.

U.S. Environmental Protection Agency. 1980. Assessing UST Corrective Action Technologies: Early Screening of Clean-up Technologies for the Saturated Zone. Risk Reduction Engineering Laboratory, Cincinnati, Ohio. EPA/600/2-90/027.

U.S. Environmental Protection Agency. 1991. "Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper." Federal Register, 56(110): 26460-26564.

Harned, Douglas A. and Lloyd, Orville B. and Treece, Jr., M.V. 1989. Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina. U.S. Geological Survey. Water Resources Investigation Report 89-4096.

North Carolina Department of Environment, Health and Natural Resources Division of Environmental Management. 1990. Guidelines for Remediation of Soil Contaminated by Petroleum. Groundwater Section.

Lyke, William L. and Winner, M.D. 1990. Hydrogeology of Aquifers in Cretaceous and Younger Rocks in the Vicinity of Onslow and Southern Jones Counties, North Carolina. U.S. Geological Survey. Water-Resources Investigations. Report 89-4128.

Cardinell, Alex P., Harned, Douglas A., and Berg, Steven A. 1990. Continuous Seismic Reflection Profiling of Hydrogeologic Features beneath New River, Camp Lejeune, North Carolina. U.S. Geological Survey. Water Resources Investigations Report 89-4195.

Department of Environment, Health and Natural Resources. 1989. Classification and Water Quality Standards Applicable to the Groundwaters of North Carolina. North Carolina Administrative Code. Title 15, Subchapter 2L.

Department of Environment, Health and Natural Resources. 1988. Well Construction Standards. North Carolina Administrative Code. Title 5, Subchapter 2C.

Department of Environment, Health and Natural Resources. 1991. Criteria and Standards Applicable to Underground Storage Tanks. North Carolina Administrative Code. Title 15A, Chapter 2.

Electric Power Research Institute (EPRI). 1989. "Summary of Remedial Technologies." In: Remedial Technologies for Leaking Underground Storage Tanks. Chelsea, Michigan: Lewis Publishers.

U. S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, October 1991, Toxicology Profile for Benzene, Clement International Corporation.

APPENDIX A
TECHNICAL METHODS/STANDARD PROCEDURES

APPENDIX A

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APPENDIX A

TECHNICAL METHODS/STANDARD PROCEDURES

A subsurface investigation was performed to evaluate the possible horizontal and vertical extent of potentially impacted soil and/or groundwater associated with the Campbell Street JP-5 Pipeline (CSJP5P). This included both the present pipeline and the former abandoned pipeline. The investigation included a reviewing relevant literature, a soil gas survey of the active pipeline, hydropunch (penetrometer) sampling of groundwater, hnu-hanby field test for aromatic hydrocarbons in groundwater, installing soil test borings, installing Type II and Type III groundwater monitoring wells, and collecting soil and groundwater samples for chemical analyses, and performing hydraulic conductivity tests. The following sections describe the technical methods and procedures that were employed.

A.1 UTILITY/PIPING CLEARANCE

Prior to subsurface investigation activities, a utility check was performed to identify nearby underground utility lines and/or pipelines. Baker Environmental, Inc., supplied Marine Corps personnel with maps indicating proposed hydropunching and drilling locations. Coordination of the utility clearance for these proposed locations was the responsibility of the Camp Lejeune point of contact.

A.2 PERMITTING

In accordance with Title 15, Subchapter 2C, Section .0105 of the North Carolina Administrative Code, a permit was obtained from the North Carolina Division of Environmental Management (DEM) prior to performing soil borings which were converted to monitoring wells. Copies of the permit applications are provided in Attachment A-1.

A.3 SOIL GAS SURVEY

A.3.1 Tracer Leak Detection Procedures

The integrity of the active CSJP5P was determined by installing a Tracer Leak Detection System (TLDS) along the pipeline. The TLDS relies upon the addition of a highly volatile

chemical tracer to the fuel in a tank. In this instance, aviation fuel at the CSFF. The chemical tracer was added at least two weeks prior to probe sampling. If a leak occurred in the underground fuel system, fuel and tracer would be released into the surrounding soil. The tracer would escape from the fuel by vaporization and disperse into the soil by molecular diffusion.

Sampling was performed by "driving" probes into the ground in the vicinity of the piping, and obtaining a soil gas sample from the probes. Each probe has an effective radius of approximately 15 feet. This means that a given probe could detect a leak anywhere within the area described by the 15-foot radius around the probe. The soil gas samples were analyzed for the inoculated chemical tracer and total volatile hydrocarbons (TVH). The TLDS was installed by Tracer Research Corporation (TRC) personnel.

A.3.2 Introduction of Tracer (Inoculation)

Type 1301 tracer was added to AST-1 and AST-4 at the CSFF on November 19, 1991. To obtain 8 to 10 parts per million (ppm) concentration of tracer, 8.5 pounds of Type 1301 tracer was added to AST-4 which contained 101,000 gallons of JP-5, and 161 pounds of Type 1301 tracer was added to AST-1 which contained 202,000 gallons of JP-5. The inoculation was done by attaching tubing to a pressurized container, inserting the tubing into the fuel, and turning the valve releasing the tracer into the fuel.

A.3.3 Installation of Sample Probes

The TLDS consisted of a series of probes placed on approximate 25-foot centers along the pipeline. Prior to installation of sample probes, it was critical to accurately locate and mark the physical location of the pipeline. Also, a utility clearance for the entire pipeline was necessary. After location of the pipeline and nearby utilities, installation of the probes was initiated on December 9, 1991 and completed on December 10, 1992.

One hundred and fifty five probes were installed on approximately 25-foot centers along the 5,200 feet of tested pipeline. The probes were installed 12 inches to the side of the pipeline and approximately three feet below grade at each sample location. Sections of the pipeline which were under the aircraft parking apron or taxiway had one probe installed at each end of the apron or taxiway. When necessary, an additional probe was installed midway along the pipeline under the apron or taxiway.

Probes were installed using two different methods, depending on the type of cover at each sample location. If the area was covered by concrete or pavement, a hole, 1.5 inches in diameter, was drilled through the concrete or pavement. A steel pilot probe, 3/4 inches in diameter, was then driven to the desired depth and removed. A Schedule 40 slotted PVC permanent probe, 3/4 inches in diameter, replaced the pilot probe. If the area was covered by soil, the probe was installed using the same procedure, except no hole was drilled. A concrete pad, 12 inches in diameter, was poured around the top of the probes installed in the areas of soil cover.

A.3.4 Sampling of Installed Probes

A sample was collected from each probe by evacuating the probe with an attached vacuum pump for 30 to 90 seconds, depending on the flow established by the vacuum. After the appropriate evacuation time, a soil gas sample was extracted with a syringe. The sample was immediately analyzed for 1301 tracer and TVH on a gas chromatograph in the TRC analytical van. A sample was collected and analyzed from each of the one hundred and fifty-five sample locations along the pipeline.

A.3.5 Analytical Data Evaluation

Field analytical data was compiled by TRC personnel. Integrity of the pipeline was determined by evaluating the concentrations (if any) of tracer chemical and TVH found in the soil gas samples. Field reports were available in order to reassesses proposed investigation locations. The final Tracer report is included in Appendix H of this Site Assessment Report.

A.4 HYDROPUNCH (PENETROMETER) PROCEDURE

A total of 20 hydropunch samples were obtained from the surficial aquifer at various locations along the CSJP5P. The Hydropunch Field User's Guide explaining the basic operating sequence and trouble shooting procedure is found in Attachment A-2 at the end of Appendix A of this report.

Each hydropunch groundwater sample was analyzed by the hnu-hanby field test for aromatic hydrocarbons to determine the presence or absence of groundwater contamination. Also, part of each sample collected was sent to a laboratory and analyzed for purgeable aromatics

(EPA Method 602). The results of field testing were utilized in the determination of the actual locations of soil borings and monitoring wells.

A.5 hnu-hanby FIELD TEST FOR AROMATIC HYDROCARBONS

The hnu-hanby Field Test is a procedure for analysis of petroleum aromatic hydrocarbons over a wide range of concentrations in groundwater. Additional information and step-by-step procedure is provided in Attachment A-3 at the end of Appendix A. The hnu-hanby test was performed on all but one groundwater sample obtained from the hydropunch procedure.

Petroleum fuel type and estimated concentration in ppm were recorded in the site geologist's notebook. The results of the hnu-hanby test, along with the chemical characteristics of the sample obtained by the laboratory analyses, were used to determine actual soil boring and monitoring well locations. Hydropunch logs depicting conditions encountered are provided in Appendix B.

A.6 SOIL BORING PROCEDURES

A total of 15 soil borings were advanced in the vicinity of the CSFF. A site plan for the CSFF area depicting locations of the 15 soil borings is shown on Figure 7 of the text. These soil boring locations were selected based on the suspected groundwater flow direction being south-southeast, and on additional information obtained from the hydropunch sampling and hnu-hanby tests performed in the field. The soil borings were performed by an all-terrain drill rig and in some cases, a truck-mounted drill rig. Soil borings B-1 through B-4 and MW-1 through MW-7 were advanced using 6-1/4-inch inside diameter (I.D.) hollow-stem augers. Soil borings DW-1 through DW-4 were initially advanced using 8-1/4-inch I.D. hollow-stem augers (Section A.7.2). A hand auger was initially advanced to check for subsurface utilities or piping. Soil cuttings obtained during drilling activities were containerized in 55-gallon steel drums and stored on site.

During drilling, Standard Penetration Tests (SPT) were conducted following ASTM 1586-D guidelines. For soil borings B-1 through B-4, and MW-1 through MW-7, the split-spoon samples were collected at consecutive intervals until the final depth of the boring. For soil borings DW-1, DW-2, DW-3 and DW-4, split-spoon samples were collected at consecutive intervals until groundwater was encountered; soil samples were then obtained at five-foot intervals for the remainder of the borehole. Two-foot length split-spoon samplers were used to

increase the likelihood that a sufficient quantity of each sample is retained for laboratory analysis.

The soil samples were visually classified by Baker's on-site geologist and recorded on a Field Test Boring Record (Appendix B). The soil descriptions included, but were not limited to, the following:

- Principal constituent type: GRAVEL, SAND, SILT, CLAY
- Color: brown, reddish brown, light gray, etc.
- Minor constituent, if present, and approximate proportion:
 - ▶ Trace (0-10 percent)
 - ▶ Little (10-20 percent)
 - ▶ Some (20-35 percent)
 - ▶ And (35-50 percent)
- Plasticity for cohesive soils: plastic (PL), nonplastic (NP)
- Relative density of noncohesive and cohesive soils: loose, dense, very dense; very soft, soft, medium stiff, respectively
- Moisture content: dry, damp, moist, wet

Drilling operations were performed using Level D personal protective clothing. Continuous air monitoring was conducted with an HNu photoionization detector (PID) during drilling activities. No volatile organic vapor concentrations exceeded 2.5 ppm in the breathing zone in the vicinity of any of the 15 soil borings. An upgrade of personal protection was not required, as discussed in the Site Health and Safety Plan (Appendix G).

A.7 MONITORING WELL INSTALLATION

A.7.1 Type II Monitoring Well

Upon completion of soil sampling and drilling to the specified depth at soil borings MW-1 through MW-7, shallow groundwater monitoring wells (Type II wells) were installed within

the borings. Each monitoring well was constructed of 2-inch I.D., flush-threaded Schedule 40 PVC. A 10-foot section of 0.010-inch slotted PVC well screen was installed in each well. The length of screen to be used was determined by the field geologist based upon site specific conditions. A sand pack was placed around the slotted well screen extending approximately 2 feet above the top of the screen. A bentonite seal (minimum thickness of 1 foot) was placed on top of the sand pack. Finally, a Portland cement/bentonite grout mixture was placed in the borehole to ground surface. Each Type II monitoring well was completed by installing a 4-inch steel protective casing over the well. A 3 foot x 3 foot concrete pad, 4-inches thick, was constructed around each well. Four protective bollards were installed within the concrete pad to add additional protection for the well. At selected monitoring well locations the wells were completed below grade and constructed beneath a flush grade manhole layer. This was to protect the monitoring well installed in vehicle or air traffic areas. Actual well construction records for each monitoring well is provided in Appendix C.

A.7.2 Type III - Monitoring Well

For use in defining the vertical extent of petroleum contamination, deep groundwater quality monitoring wells (Type III) were installed. At four locations, DW-1, DW-2, DW-3 and DW-4. Type III wells were typically installed adjacent to the Type II wells that were believed to have possible contamination. The Type III well construction was used to minimize the potential for carrying contamination down into the deeper portion of the aquifer during drilling activities.

A soil boring was advanced utilizing 8-1/4-inch I.D. hollow stem augers through the formation material to a depth of approximately 20 feet below ground surface. A 6-inch I.D. PVC outer casing was installed to the total borehole depth and grouted in place using a Portland cement/bentonite grout mixture. A pressure grouting technique was used for the grouting of the casing, this technique consisted of pumping the grout through a 6-inch packer placed near the bottom of the casing, forcing the grout out of the casing and up the borehole. The process was completed when a sufficient amount of grout was observed flowing up from the outer annulus at the ground surface. The grout seal was then allowed to cure for approximately 24 hours.

After the grout seal in the outer casing had cured, the borehole was extended through the bottom of the outer casing approximately 10 feet below the bottom of the outer casing. A five-foot long, 2-inch I.D. 0.010-inch machine-slotted PVC well screen threaded to unslotted PVC riser casing was then installed.

The filter pack material was installed between the screen and the borehole annulus to approximately 2-feet above the screen. The filter pack material consisted of a pre-washed and bagged sand. A bentonite seal approximately 2-feet thick was constructed on top of the filter pack material. A Portland cement/bentonite grout mixture was used to grout the remaining borehole annulus by tremie pipe to the ground surface. A four-inch steel protective casing was installed on the Type III well.

Similar to the Type II well completion, a three-foot by three-foot concrete pad was constructed around three of the wells. Four steel protective bollards was placed around each well for added protection. The fourth well was completed below grade and constructed beneath a flush grade manhole cover. This was to protect the monitoring well in vehicle traffic areas. Well completion diagrams depicting actual well construction details are provided in Appendix C.

A.7.3 Well Development

All monitoring wells were developed following their installation to remove fine ground materials that may have entered the well during construction and to provide a sufficient hydraulic connection between the monitoring well and the formation. This was accomplished by using a combination of bailing and continuous low yield pumping techniques. Equipment used for well development was decontaminated between each monitoring well with a high pressure steam clean wash followed by a potable supply water rinse. All fluid generated from well development and equipment decontamination was contained in 55-gallon drums and stored on site.

A.8 DECONTAMINATION PROCEDURES

Hydropunch samplers were decontaminated between samples either by steam-cleaning or by washing with a non-phosphate soap (Alconox), and rinsing with distilled water. In areas of extensive contamination, pesticide-grade hexane was applied for additional decontamination.

For performing the soil boring and monitoring well installation activities, the drilling equipment and tools (rods, augers, etc.) were steam-cleaned prior to advancing each borehole. Steam-cleaning was performed using a potable water source. A permanent containment pad/area located near Building AS-143 was used by the driller for decontamination activities.

Soils and fluids collected during decontamination activities were containerized in 55-gallon steel drums and labeled accordingly.

A.9 FLUID LEVEL MEASUREMENTS

Fluid level measurements were obtained from all newly installed monitoring wells. The depth to water was measured using an oil/water interface probe capable of detecting product layers as thin as 0.01 feet. Depths were measured to the nearest 0.01 foot. The interface probe was decontaminated between readings with an Alconox solution, hexane and distilled water.

A.10 SAMPLE COLLECTION

Soil and groundwater samples were collected for chemical analysis. The following sections describe soil and groundwater sampling activities.

A.10.1 Soil Screening

During Baker Environmental's field assessment activities at the site, soil samples from each boring, (B-1 through B-4, MW-1 through MW-7, and DW-1 through DW-4), were screened in the field for volatile organic compounds (VOCs). Each soil sample was visually classified for physical characteristics and then placed in appropriate laboratory sample containers. A portion of the sample was retained for field screening.

The retained portion of the sample was placed in plastic zip-lock bags. After allowing the soil samples to reach equilibrium, the head space was analyzed for VOCs by inserting the probe of an organic vapor analyzer (OVA) into a small opening of the plastic bag. The OVA used was a HNu PI 101 photoionization detector (PID). The purpose of screening the soil samples with an OVA was to help estimate the extent of possible hydrocarbon contamination. Soil screening results are included on each boring log provided in Appendix B.

A.10.2 Soil Sampling

In order to estimate the extent of potentially contaminated soils, two soil grab samples from each borehole (total of 30 samples) and three duplicate soil samples were collected and submitted for TPH analysis. The first soil sample was collected from between 2.0 to 4.0 feet below ground surface and a second soil sample was collected from 4.0 feet below ground surface

to the ground water table. Also, seven grab soil samples and one duplicate soil sample was collected and sent to a laboratory for flash point and pH analysis. Collection of these samples was determined by the Baker field geologist. The samples were collected via split-spoon sampling as discussed in Section A.6.

Each grab soil sample was placed into a laboratory-prepared container, stored on ice in a cooler, and sent to the laboratory for analysis. The types of sample containers used for each analytical method are provided on Table A-1. Appropriate Chain-of-Custody (COC) documentation was sent with the samples to the laboratory. Copies of the COC are provided in Appendix E.

Acceptable TPH concentrations in soils were determined by the Site Sensitivity Evaluation (SSE) form developed by the North Carolina Division of Environmental Management (DEM). Based on the SSE, the site had a ranking score of 43. This resulted in an Action Level guideline of 35 mg/kg for the site. The SSE ranking form is provided in Attachment A-4.

A.10.3 Groundwater Sampling

Groundwater samples were collected from the 20 hydropunch locations, the 7-Type II, the 4-Type III groundwater monitoring wells, to evaluate the horizontal and vertical extent of potentially contaminated groundwater. All groundwater samples were analyzed for purgeable aromatics (EPA Method 602). Selected monitoring wells were analyzed for purgeable halocarbons (EPA Method 601), and base neutral/acid extractables (EPA Method 625). Monitoring wells were allowed to stabilize for a 24-hour period prior to sampling. The following paragraphs discuss the methods which were employed during sampling activities.

Prior to performing groundwater sampling, static fluid level measurements were obtained using an oil/water interface probe. The depth to groundwater was determined in the well at the time of measurement. The water level was measured to the nearest 0.01 foot from the top of the PVC well casing. The total depth of each well was also measured to the nearest 0.01 foot using a weighted measuring tape. The water levels and well depth measurements were used to calculate the volume of water in each well and the minimum volume of water that must be purged prior to sampling. All downhole equipment was decontaminated with pesticide-grade hexane and distilled water.

TABLE A-1
SUMMARY OF ANALYTICAL PROGRAM FOR QA/QC SOIL SAMPLES

Parameter	Duplicate Samples ⁽¹⁾	Trip Blanks ⁽²⁾	Bottle Requirements	Preservation Requirements	Holding Times	Analytical Method
Total Petroleum Hydrocarbons (TPH)	3	N/A	Glass, teflon-lined septum-40 ml	Cool, 4°C	14 days	SW-846 5030/3550
Flash Point	1	N/A	Glass, 8 oz.	Cool, 4°C	None	SW1010
pH	1	N/A	Glass, 4 oz.	None	None	SW-9041

N/A - Not Applicable

Note: Information listed above taken from the following documents:

- Test Methods for Evaluating Solid Waste SW-846, 3rd Edition, November 1986.
- Method for Chemical Analysis of Water and Waste, EPA-600/14-79-020, March 1979, Revised March 1983.

- ⁽¹⁾ Bottle requirements and holding times for duplicate soil samples will be the same as those mentioned in Table A-1.
- ⁽²⁾ Trip blanks are aqueous samples.

A minimum of three well volumes was purged from the wells prior to sampling. Purged water was containerized in 55-gallon steel drums. During purging activities, three measurements of pH, specific conductance and temperature were obtained and recorded in the field log.

Groundwater samples were collected from the wells using dedicated, disposable polyethylene bailers and immediately placed into appropriate, laboratory-prepared sample containers. The types of sample containers used for each analytical method are provided on Table A-2. Samples that were analyzed for VOCs were collected by slowly pouring water from the bailer into a 40 ml vial. Each vial was completely filled to prevent volatilization. Appropriate COC documentation was sent with the samples to the laboratory. One trip blank per cooler containing VOC samples was sent with the samples to the laboratory.

A.10.4 Sample Documentation in the Field

Five kinds of documentation were used in tracking and shipping analytical samples:

- Field log book
- Sample labels
- Chain-of-custody records
- Custody seals
- Commercial carrier airbills

At a minimum, the label for each sample bottle contained the following information:

- Site name
- Sample number
- Date and time of collection
- Sampler's initials
- Sample preservation and preservative used
- General types of analyses to be conducted

The sample information, as well as the analysis to be performed on the sample, was entered in the field log book in waterproof ink for each sampling point. An error in the field log was not erased; instead a single line was drawn through the error and initialed by the person completing the log.

TABLE A-2

SUMMARY OF ANALYTICAL PROGRAM FOR QA/QC GROUNDWATER SAMPLES

Parameter	Duplicate Samples ⁽¹⁾	Trip Blanks	Bottle Requirements	Preservation Requirements	Holding Times	Analytical Method
Purgeable Halocarbons	1	1	Glass, Teflon-Lined Septum 40 ml (601 and 602);	Cool, 4°C 0.008% Na ₂ S ₂ O ₃ (601 and 625)	14 days (601 and 602)	EPA 601
Purgeable Aromatics	3	1	Glass, Teflon-Lined Septum 40 ml (601 and 602);	HCL to pH < 2 (602)	14 days (601 and 602)	EPA 602
Base Neutral/Acid Extractables	1	1	Amber Glass, Teflon-Lined Cap, 1 liter (625)	Cool, 4°C 0.008% Na ₂ S ₂ O ₃ (601 and 625)	7 days (625) ⁽²⁾	EPA 625

N/A - Not Applicable

Note: Information listed above taken from the following documents:

- Test Methods for Evaluating Solid Waste SW-846, 3rd Edition, November 1986.
- 40 CFR 136, Appendix A.

⁽¹⁾ Bottle requirements and holding times for duplicate soil samples will be the same as those mentioned in Table A-2

⁽²⁾ Seven days until extraction, 40 days after extraction.

Additionally, the following items were entered:

- Dates and times of entry
- Sample depth and number
- Names of field personnel on site
- Names of visitors on site
- Field conditions
- Description of activities
- Sampling remarks and observations
- QA/QC samples collected
- List of photographs taken
- Sketch of site conditions

Sample numbers were designated by site code name ("PL"), matrix ("S" for soil and "W" for groundwater), borehole number, and sample number taken from a particular borehole (example: PL-S-1-01 would represent the first soil sample collected from soil boring number 1). For duplicate samples an arbitrary sample number was chosen.

Custody of the samples was maintained by Baker personnel from the time of sampling until the time of shipment to the analytical laboratory.

Baker field personnel completed a COC record, in waterproof ink, to accompany each cooler forwarded from the site to the laboratory. Errors on the COC records were not erased; instead, a line was drawn through the error and initialed by the person completing the form. The original copy was placed in a sealable bag inside the appropriate cooler, secured to the cooler's lid.

When the sample cooler was shipped by commercial air carrier, the cooler was secured with custody seals so that the seals would be broken if the cooler was opened. The commercial carrier was not required to sign the COC record as long as the custody seals remained intact and the COC record stayed in the cooler. The only other documentation required was the completed airbill.

A.11 HYDRAULIC CONDUCTIVITY TESTS

Slug tests were conducted on two monitoring wells, MW-2 and MW-3, to estimate the horizontal hydraulic conductivity (K) of the shallow aquifer at the site. Slug tests achieve this by measuring the rate at which water flows from a well into the surrounding formation when the elevation of water in the well casing is suddenly increased or decreased. This flow rate, the difference in elevation between initial water level in the formation and the displaced level, the length of well screening and other information on the well configuration, are utilized to calculate the K of the surrounding formation.

Prior to the initiation of each test, all equipment inserted into the well casing was decontaminated. The total depth of the well was measured to the nearest 0.01 foot with a steel tape. The static water depth from the top of the well casing was then measured to the nearest 0.01 foot using an oil/water interface probe. A known volume of water was then displaced within the well casing using a solid cylinder (slug) with a known volume. This raised the elevation of water within the casing above the natural groundwater elevation, causing water to flow from the well back into the surrounding formation. As the water flowed back, the elevation change within the casing was measured to the nearest 0.001-foot with a pressure transducer and recorded on an In-Situ, Inc., HERMIT 1000C™ Data Logger. These measurements were taken at pre-determined time intervals using the logarithmic sampling schedule of the HERMIT 1000C™ until the elevation returned to a minimum of 90 percent of the original water level, prior to withdrawing the slug.

The solid cylinder (slug) was then removed from the well to perform a second test. This lowered the elevation of water within the casing below the natural groundwater elevation, causing water to flow into the well from the surrounding soil. As the water flowed back, the elevation change within the casing was again measured as before.

The estimates of K were prepared using the Bouwer-Rice method (Bouwer, 1976). The AQTESOLV™ program (Geraghty and Miller, 1989) was utilized to calculate and present the data collected in the field. Appendix D provides the AQTESOLV™ program output and the printouts of the actual field data.

A.12 LABORATORY QA/QC

To evaluate Laboratory Quality Assurance/Quality Control (QA/QC) performance and field sampling procedures, duplicate soil and groundwater samples were collected. The duplicate samples were generally collected at a ratio of one duplicate sample for every 10 actual samples (10 percent frequency). In the event that fewer than ten samples for a particular parameter were collected, one duplicate sample was still obtained.

To evaluate transportation and laboratory methods, one trip blank accompanied each shipment of samples to be analyzed for VOCs. Tables A-1 and A-2 summarize the QA/QC program for soil and groundwater samples, respectively.

The laboratory performing the analytical procedures, Solutions Laboratories, Inc, of Chesapeake, Virginia, also performed internal QA/QC tests. The results of these QA/QC tests are included with the analytical data provided in Appendix F.

ATTACHMENT A-1
WELL CONSTRUCTION PERMITS

NORTH CAROLINA
ENVIRONMENTAL MANAGEMENT COMMISSION
DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
RALEIGH, NORTH CAROLINA

PERMIT FOR THE CONSTRUCTION OF A WELL OR WELL SYSTEM

In accordance with the provisions of Article 7, Chapter 87, North Carolina General Statutes, and other applicable Laws, Rules and Regulations.

PERMISSION IS HEREBY GRANTED TO

United States Marine Corps

FOR THE CONSTRUCTION OF twenty Type II and ten Type III monitor wells, which will be exposed to the Surficial Aquifer, and which will be located at White and Campbell Streets, Camp Lejeune, Onslow County, in accordance with the application dated November 23, 1991, and in conformity with specifications and supporting data, all of which are filed with the Department of Environment, Health and Natural Resources and are considered a part of this Permit.

This Permit is for well construction only, and does not waive any provisions or requirements of the Water Use Act of 1967, or any other applicable laws or regulations. Well construction shall be in compliance with the North Carolina Well Construction Regulations and Standards.

This Permit will be effective from the date of its issuance until June 6, 1992, and shall be subject to other specified conditions, limitations, or exceptions as follows:

1. The well(s) shall be located and constructed as shown on the attachments submitted as part of the permit application.

If any requirements or limitations of this Permit are unacceptable, you have the right to an adjudicatory hearing upon written request within 30 days. The request must be in the form of a written petition, conforming to Chapter 150B of the North Carolina General Statutes, and filed with the Office of Administrative Hearings, Post Office Drawer 27447, Raleigh, North Carolina 27611-7447. Unless such demand is made, this permit is final and binding.

Permit issued this the 5th day of December 1991.

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION

Dick Shivers
A. Preston Howard, Jr., P.E., REGIONAL SUPERVISOR
Division of Environmental Management

By Authority of the Environmental Management Commission

PERMIT NO. 66-0251-WM-0536

APH/RSS/CDR/lfc

cc: Jim Mann

Perry Nelson

W1RO-OWS

1955-12-18

ATTACHMENT A-2
HYDROPUNCH USERS GUIDE

HYDROPUNCH II® HOW IT WORKS

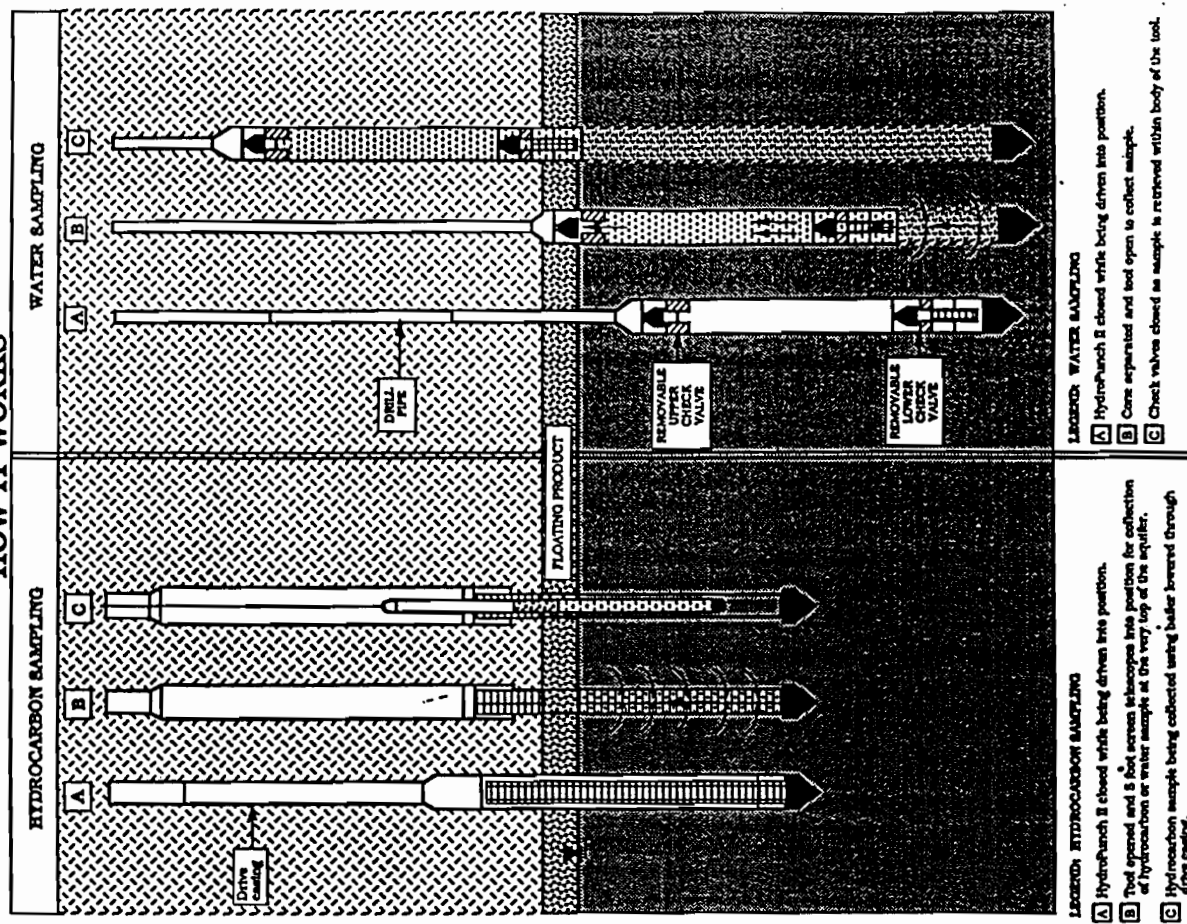
When the desired depth for collection of a sample is reached, the HydroPunch II is opened by pulling back on the body of the tool. Soil friction holds the drive cone in place as the body is pulled back. Once the HP-II is open and the O-ring seal between the drive cone and the body of the tool is broken, the tool fills from the bottom with no aeration and minimal agitation of the sample.

- if the sample can be collected from 5 feet or more below the top of the water table, and if 1.2 liters of sample volume is adequate.

THE HYDROPUNCH II IS USED IN THE HYDROCARBON SAMPLING MODE:

- primarily, if a sample of floating product is needed; in special cases: if a ground water sample must come from the uppermost portion of the aquifer; if the water bearing strata are very thin; or if a large volume of sample is required.

When the HP-II is used in the hydrocarbon sampling mode the tool is connected to the surface using a hollow drive pipe of large enough inside diameter to permit the passage of a thin bailer. The sample is collected by lowering the bailer from the surface through the drive pipe and retrieving the sample. This configuration permits sampling of floating contaminants and also allows an unlimited quantity of sample to be collected. However, in this mode the sample is exposed to potential debris and water leakage from the entire length of drive pipe above it, making the procedure less suitable for low-level, sensitive sampling.



HYDROPUNCH II[®]—BASIC OPERATING SEQUENCE

WATER SAMPLING MODE		
STEP	PROCEDURE	COMMENTS
1	Drill to a point just above the desired sample depth.	If site conditions permit pushing the tool from the surface to the sample point, go to Step #3.
2	Attach assembled HP-II to the drive rod or downhole hammer.	Be sure to use the rubber retainer sleeve to hold the cone onto the drive shoe if the tool is lowered downhole.
3	Lower the tool to the bottom of the borehole.	Once on the bottom of the hole, DO NOT PICK UP THE TOOL. (Driller's Rule 1)
4	Drive or push the HP-II a minimum of one foot past the bottom of the borehole to the final sample point.	1. If pushing or driving the HP-II from the surface, advance the tool directly to the selected sample depth. 2. Remember that when sampling in the water mode, the bottom of the HP-II must be at least 5 feet below the water table to collect a full sample. 3. WHEN DRIVING OR PUSHING, CAREFULLY COUNT AND MARK THE ROD OR CABLE SO YOU KNOW EXACTLY WHERE THE END OF THE TOOL IS.
5	When the final depth has been achieved, pull back on the drive rods or hammer to pull the cone out of the body of the tool, permitting ground water to enter the HP-II.	DO NOT PULL THE TOOL BACK FURTHER THAN IT HAS BEEN DRIVEN (Driller's Rule 3). For example, if the tool is driven or pushed 2-1/2 feet, do not pull the tool back more than 3 feet. A minimum of 6 inches of the body of the tool needs to be in the driven hole to provide a good annular seal.
6	Clamp the drive casing at the surface.	This prevents the body of the HP-II from sliding back down to the bottom of the hole and plugging with soil.
7(a)	If hollow drive rods are used to advance the tool, a water level indicator can be lowered down the rods to determine when the tool is full.	The rods must be watertight.
7(b)	If hollow drive rods are not used, wait approximately 20 minutes for the first sample.	Adjust the fill time based on the quantity of sample and the estimated permeability of the formation.
8	Pull the HP-II to the surface, unthread the upper subassembly and replace it with the thread retainer cap.	
9	Unthread the upper check valve and replace it with the teflon stopcock and tubing.	Flush or wipe away external water or soil.
10	Invert the tool, open the stopcock and decant the sample.	
11	Disassemble the HP-II while it is wet.	Water lubricates the parts which reduces the potential for galling.
12	Decontaminate the tool according to your cleaning protocol.	

HYDROCARBON SAMPLING MODE*		
STEP	PROCEDURE	COMMENTS
1	Drill to a point just above the desired sample depth. If sampling floating product, be sure to stop drilling above the top of the aquifer.	If site conditions permit pushing the tool from the surface to the sample point, go to Step #3.
2	Attach assembled HP-II to the drive casing.	Be sure to use the rubber retainer sleeve to hold the cone onto the drive shoe if the tool is lowered downhole.
3	Lower the tool to the bottom of the borehole.	Once on the bottom of the hole, DO NOT PICK UP THE TOOL. (Driller's Rule 1)
4	Drive or push the HP-II a minimum of one foot (3 to 5 feet is better) past the bottom of the borehole to the final sample point.	1. If pushing or driving the HP-II from the surface, advance the tool directly to the selected sample depth. 2. When driving or pushing, carefully count and mark the casing so you know exactly where the end of the tool is.
5	When the final depth has been achieved, pull back on the drive casing to pull the cone and screen out of the body of the tool, permitting ground water to enter the HP-II.	1. DO NOT PULL THE TOOL BACK FURTHER THAN IT HAS BEEN DRIVEN (Driller's Rule 3). For example, if the tool is driven or pushed 3-1/2 feet, do not pull the tool back more than 3 feet. 2. A minimum of 6 inches of the body of the tool needs to be in the driven hole to provide a good annular seal. 3. Additionally, since the screen is 5 feet long, the tool cannot be pulled back more than 5 feet without separating the screen from the body.
6	Clamp the drive casing at the surface.	This prevents the body of the HP-II from sliding back down over the exposed screen.
7	Disconnect the drive casing from the hammer (or push adapter) and check to see if tool is filling.	A mirror to reflect light down the casing or a water level indicator can be used.
8	When an adequate volume of water has filled the tool, lower a small diameter bailer through the drive casing to collect the sample.	There is no need for development or purging prior to sample collection.
9	After completing sample collection, pull the drive casing and the HP-II to the surface. The cone and screen will normally stay downhole.	Should the screen be recovered, do not attempt to reuse it. It cannot be decontaminated and, if reused, will likely affect the integrity of subsequent samples.
10	Disassemble the HP-II while it is still wet.	Water lubricates the parts which reduces the potential for galling.
11	Decontaminate the tool according to your cleaning protocol.	In the Hydrocarbon mode, the drive pipe as well as the tool and bailer need to be thoroughly decontaminated.

*Prior to using HP-II in the hydrocarbon mode, be sure the drive casing is thoroughly decontaminated. In this mode, the casing contacts the sampling bailer and is in communication with the sample chamber.

HYDROPUNCH II[®] TIP SHEET

Because the HydroPunch must be pushed into undisturbed material in the zone to be sampled, the drilling procedure must stop somewhere above the sample point. Consequently, it is very helpful to have some idea of the depth at which the sample is to be collected. If little is known of the site hydrogeology, it is often a very good idea to use the initial boring as a pilot boring to determine: 1) exactly where the water bearing zones are, 2) the permeability of the sample zone, 3) the density of the soil, and 4) other relevant factors

Pilot Boring

TIP 2: Flowing Sand

If the HydroPunch is used in a sand formation and the material has a tendency to flow into the augers, always sound the interior prior to lowering the tool into the augers. Driving the HydroPunch through a sand plug in the bottom of the augers is almost impossible. As the tool is driven the sand is compressed into the space between the HydroPunch and the inside wall of the augers, greatly increasing the resistance to driving. This sometimes results in damage to the tool and will occasionally lock the HydroPunch inside of the augers.

Solutions to this problem include: 1) the use of one way sand catchers or trap valves in the bottom of the augers, 2) filling the augers with drilling mud, and 3) drilling using mud rotary drilling techniques. A simple method that can be used at most sites is to drill to just above the sample zone with the augers and then back the augers out to a point where the sand is no longer inside. The HydroPunch can often be easily driven or pushed through the zone disturbed by the drilling process and then an additional distance into the undisturbed formation to the sample point. HydroPunches have been pushed through as much as 35 feet of collapsed sand in a borehole to collect a sample from the undisturbed material below the drilled portion.

TIP 3: Cone Separation, Loose Formation

If the aquifer material is very loose and does not pull the cone from the drive shoe during retraction, it is helpful to use the drive hammer to backhammer for the initial pull back. The upward snap on the tool during the backhammering process is often enough to separate the cone and pull the screen from the body.

TIP 4: Pushing the HydroPunch

Where soil conditions permit, it is preferable to push, rather than drive, the tool into position. Pushing allows very accurate control of the depth the tool is advanced and retracted, is easier on the driller, and is frequently quicker than driving. If the tool is to be pushed into position, it is best to make sure that the driller has an adapter which will enable him to push and retract the drive pipe before he gets into the field.

Pushing the HydroPunch from the Surface

If soils are soft enough to enable the HP-II to be pushed from the surface into the sample zone, a considerable amount of time can be saved. When the HP-II is used in this manner, no drill cuttings are generated and there is no handling of the augers, etc. The only major activity is to add casing as the tool is being rapidly pushed into the ground. If pushed from the surface, sampling time can often be cut in half.

TIP 5: Drilling Past Drive Cones & Screens

Prior to drilling through the polypropylene screen and drive cone left from the previous sample, pull the cutter head of the auger to a point above the top of the screen, then lower the center bit into position and drill through the screen and cone. This procedure ensures that the screen and cone are drilled to the side, carried up the flights of the augers, and do not become jammed in the hollow stem of the lead auger.

TIP 6: Drive Casing

It is very helpful to have lengths of the drive pipe in 2 foot and 3 foot sections, as well as standard 5 foot sections. The short sections enable the driller to have a manageable casing height above the top of the augers after the tool has been driven into place and opened.

TIP 7: Monitoring Filling

When used in the hydrocarbon sampling mode, the filling process of the HydroPunch can be closely monitored. At shallow depths this can be done using a bright flashlight or a mirror to shine light down into the casing. At greater depths an electronic water level indicator can be used.

TIP 8: Disassembly

Always attempt to disassemble the HydroPunch while it is still wet. The water serves as a lubricant and prevents damage to the stainless steel parts. For decontamination, saw horses or some similar supports help make cleaning easier. Also, a plastic bucket and a mesh basket, such as a fry basket, can retain small parts during steam cleaning and prevent them from flying all over when subjected to the high pressure steam.

TIP 9: Cone Separation — Hydrocarbon Mode

With HP-II there is rarely a problem with the cone detaching and the screen not being exposed to the formation. Should the tool be used in a formation where there is a problem, it is helpful to measure the internal length of the casing and the tool just prior to pull back and then immediately after pull back is completed. The distance measured inside the tool should increase by whatever the distance pulled back. Example: Distance to cone from top of drive casing as measured inside the casing with tape prior to pull back is 13.5 feet. Pull back three feet. Distance to cone immediately after pull back is 16.5 feet from top of drive casing, indicating cone has telescoped out of the HydroPunch body three feet.

HYDROPUNCH II® TROUBLESHOOTING GUIDE

MECHANICAL PROBLEMS

PROBLEM	CAUSE	SOLUTION
Drive Cone Does Not Separate from Body	1) Very fine sand has worked its way between cone and drive shoe as tool is being driven.	a) Make sure the rubber exterior sleeve is used over the cone and drive shoe. b) Make sure tool is not lifted or accidentally backhammered as it is being advanced.
	2) In very loose formations there may not be enough soil friction to separate the cone as it is pulled back.	a) Initiate pull back by a sharp backhammer. The sudden shock and upward motion will cause separation.
	3) Utilizing a "homemade" sleeve instead of the sleeve provided with the HydroPunch.	a) Use the sleeves provided with the tool.
Drive Cone Separates Too Soon	1) Tool is pulled back prematurely or was picked up after being placed on bottom of borehole.	a) Driller's Rule #1 (Sheet 4-B).
	2) Rubber friction sleeve was not used.	a) Always use rubber sleeves provided with the tool.
Leaking Check Valve	1) Sediment clogs on check valve.	a) Retrieve tool and decant sample as rapidly as possible.

HYDROGEOLOGY RELATED PROBLEMS

PROBLEM	CAUSE	SOLUTIONS
No Sample Due to Low Permeability Conditions	In some fine-grained silts and clays, or formations with very thin water bearing zones, the compression of soil particles may lower permeability of the saturated zone, causing the collection of ground water samples to take a longer period of time than "normal" (>1 hour). In some low permeability conditions, sample collection may not be possible.	Many low permeability conditions occur in fine-grained cohesive soils. Often these soils will "stand open" after the drilling tools are removed. If the HydroPunch hole stands open, it is possible to use the tool in the HydroCarbon mode without a screen attached to the cone. This permits the open area to be as long as possible—not limited to the 5-foot screen length. The long open hole provides a greater intake area and a collection sump for the sample. The increased intake reduces the time required for the tool to fill.
Intrusion of Drilling Mud or Outside Ground Water	If the HydroPunch is used in the water sampling mode in a mud filled hole, or is retrieved through a zone with a higher head than the sample zone, the foreign fluid will displace the sample in the HydroPunch.	1. Vent tubing can be run from the top check valve of the HydroPunch to the surface. The tubing vents the tool while filling. After the tool is filled, gas pressure is applied to the tube which seats the check valves. This prevents outside fluid from entering as the tool is withdrawn. 2. Use the tool in the HydroCarbon mode and collect the sample before the tool is withdrawn through the fluid.



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In California 415/930-7610

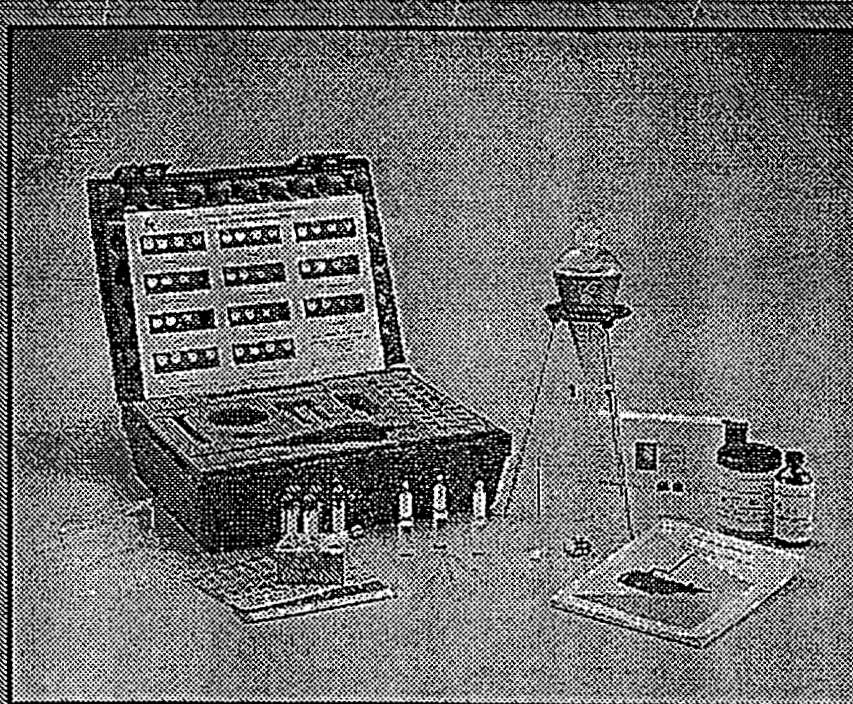
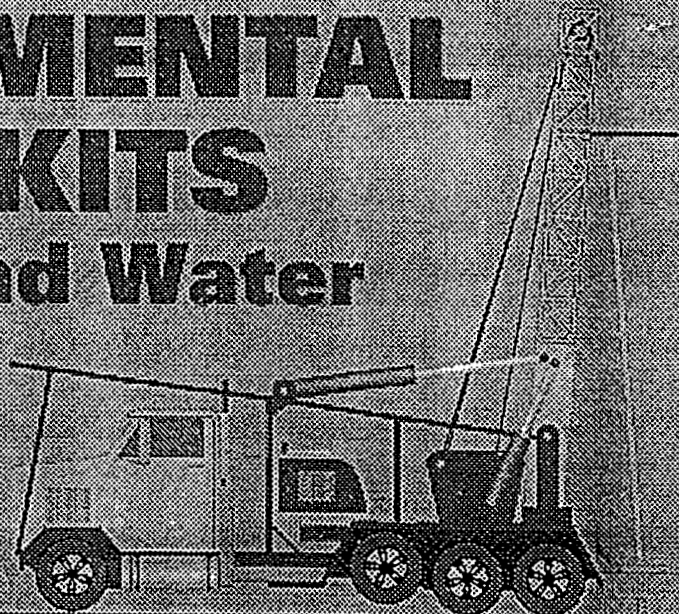
Field User's Guide 2-D

ATTACHMENT A-3

Hnu-Hanby FIELD TESTING PROCEDURES

ENVIRONMENTAL TEST KITS for Soil and Water

Oil, Gasoline, Diesel
Chlorinated Hydrocarbons
DDT, PCBs



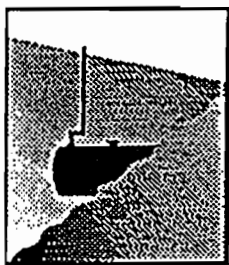
hnu-hanby

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New Product News

Brochure ☐

Handbook ☒

Video ☐

Other ☐

A new guide to field measurements. . .

Field Measures: Dependable Data When You Need It

Field measurements are essential to our LUST investigations.

Peter Zack, Connecticut LUST Unit

Field measurements are critical to making timely corrective action decisions and are standard procedures for our investigators. They enable us to identify emergencies quickly.

Tito Madrid, New Mexico UST Bureau

In many situations, field measurement techniques can be used instead of laboratory analyses to provide quicker corrective action decisions, hence better protection of public health. *Field Measures: Dependable Data When You Need It* describes several commonly used field measurement techniques and explains how you can use them to make decisions.

The guide contains:

- ☐ An overview comparing common field measurement procedures
- ☐ Descriptions of several procedures, including
 - Headspace methods
 - Polyethylene bag sampling systems
 - Dräger liquid extraction method
 - * —Hanby method
 - Soil vapor surveying
- ☐ Descriptions of the field instruments used with these procedures
- ☐ A list of manufacturers and distributors
- ☐ A glossary of terms

Field Measures: Dependable Data When You Need It is intended for State regulators and field personnel who are interested in using field measurement techniques in their programs. Consultants and contractors who perform site assessments will also find the guide of interest.

Copies of the guide are available from the U.S. Government Printing Office. Ordering information is as follows:

Field Measures: Dependable Data When You Need It

Stock Number: 055-000-00368-8

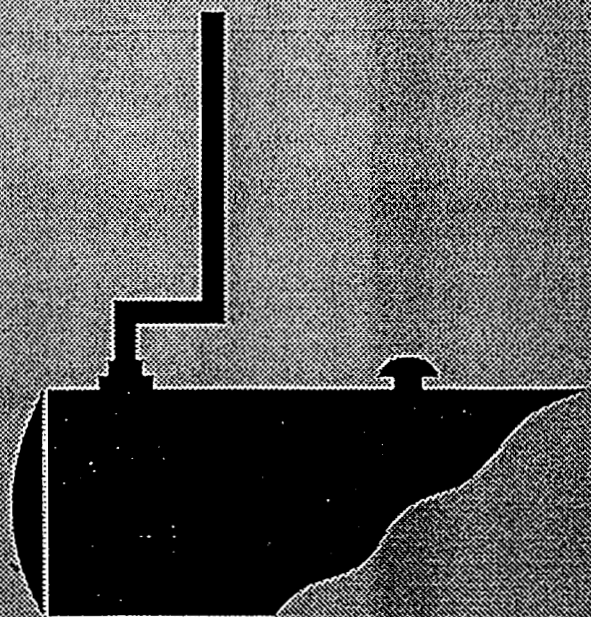
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Hanby Method Kits

for

- Oil & Gasoline
- Chlorinated Hydrocarbons
in Soil and Water

NEW

US PATENT

4992379

Granted February 12, 1991

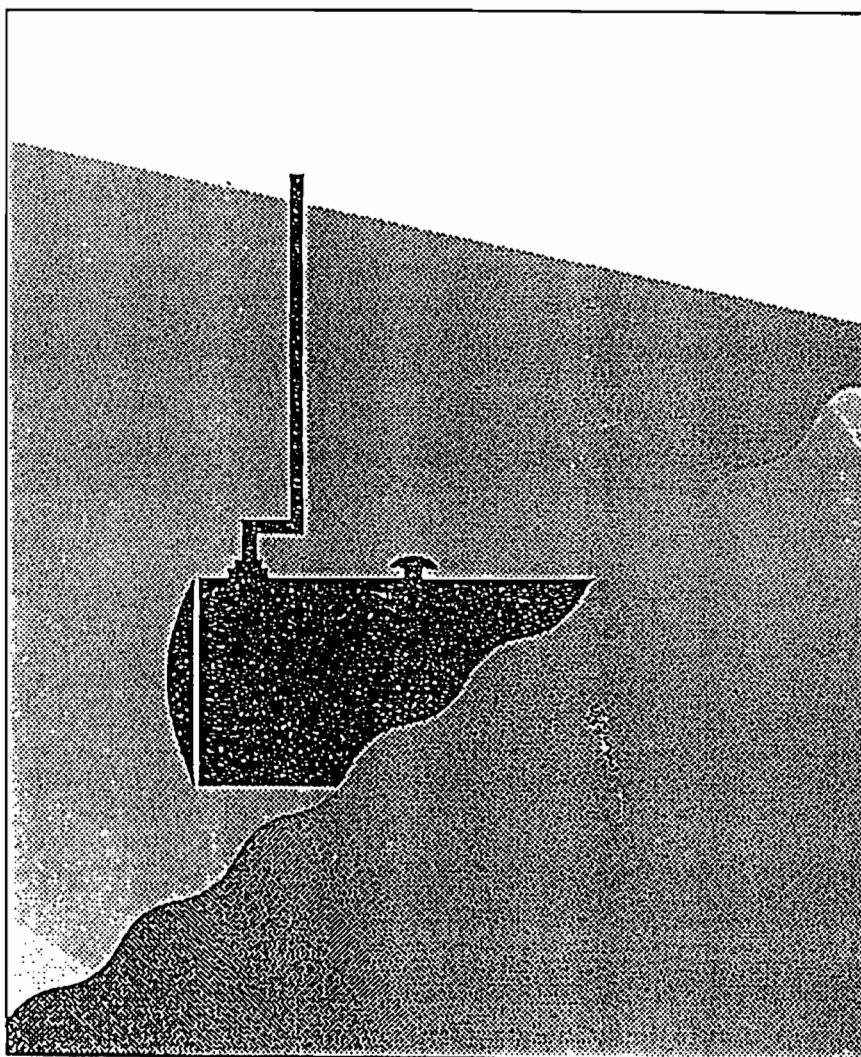
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Environmental Kits



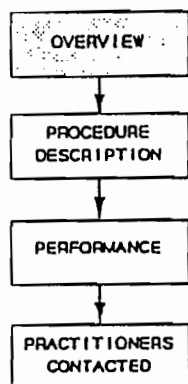
Field Measurements

Dependable Data When
You Need It



Hanby Procedure for Soil and Water Analysis

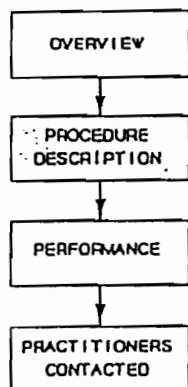
Overview



The Hanby Field Test Kit is a procedure for analysis of petroleum aromatic hydrocarbons over a wide range of concentrations in water and soil. The Hanby procedure provides a colorimetric indication of the presence of aromatic compounds (BTEX, gasoline, diesel, etc.). The soil procedure requires two extraction steps; whereas the water procedure involves one extraction step. Figures 8 and 9 show the process of sample preparation and analysis for soil and water, respectively.

This field procedure is being used by investigators to assess the presence of contamination during tank removals and to quantify levels of contamination to determine the extent of contaminant plumes. As noted in Table 1, this procedure can be used in other applications, including selecting locations for installation of ground-water monitoring wells, determining limits of soil excavation, and measuring progress of ground-water remediation.

Procedure Description



SAMPLE COLLECTION - Soil and Water

1. Samples may be collected by a number of conventional methods. Soil samples can be obtained using a trowel, backhoe, auger, or split spoon sampler. Water samples may be obtained using pumps, bailers, or sample bottles.
2. Minimize mixing, aerating, heating, or otherwise disturbing the sample to prevent loss of any volatile organic compounds.
3. Decontaminate sampling and testing equipment between each sample analysis to prevent cross-contamination. This can be accomplished using clean water to thoroughly rinse all apparatus.

Analytic technique measures aromatics in soil and water

By Kimberly A. Roy

The simplicity of a colorful new field technique for detecting aromatic compounds in soil and water belies its accuracy, asserts inventor John Hanby.

The technique traces its roots to a chemical reaction discovered in 1877 by Charles Friedel, a Frenchman, and James Mason Crafts, an American. Known as Friedel-Crafts alkylation chemistry, the reaction is an organic synthesis process that has been harnessed for the production of high-octane gasoline, synthetic rubber, plastics and synthetic detergents. "It certainly is one of the most important reactions ever discovered," says Hanby, president of Houston-based Hanby Analytical Laboratories Inc. (HAL). "It has resulted in more chemical products than any other reaction."

More than a century later, Hanby used the same chemistry as the basis for an analytical technique that quantifies contamination caused by products of the Friedel-Crafts reaction. The "discovery," which Hanby describes as "serendipitous," occurred March 6, 1986.

"It (the realization) really was a matter of minutes," Hanby recalls. "I ran out to the lab, conducted a test, and it was obviously a huge success." That success led to the development of a field test kit. Hanby filed patents on the kit and its use Feb. 7, 1987, and received a notice of allowance Aug. 20. "This, for the first time, gives researchers the field capability to do quantitative analysis of soil samples," he says. "We're looking for this to have an extremely significant impact."

The test. Once a sample is collected, the entire analytic procedure takes five to seven minutes for water and four to five minutes for soil using the direct-extraction method. Soil also can be washed first in a TCLP-like fashion, Hanby says, but this method takes about 80 minutes and is no more accurate than direct extraction.

Water analysis basically involves three steps. First, 500 milliliters (ml) of water are placed in a separatory funnel, and 5 ml of a proprietary alkyl halide

reagent are added. The reagent, which is heavier than water, sinks. A sample size of 500 ml is preferred, but tests have been conducted successfully with as little as 40 ml, Hanby relates.

The sample then is agitated vigorously for two minutes. During this time, the reagent extracts contaminants from the water. The sample then sits for five minutes, allowing the extraction phase to sink to the bottom.

Once a sample is collected, the entire analytic procedure takes five to seven minutes for water and four to five minutes for soil using the direct-extraction method.

After phase separation is complete, the extraction phase is drained into a test tube, where it is mixed with a catalyst — a white, powdered Lewis acid. (A Lewis acid is one that readily accepts a pair of electrons.) The user must be sure not to drain water into the test tube, Hanby cautions, because it will consume the catalyst.

The catalyst is pre-measured to work best with 4.2 ml of the extraction phase. According to an EPA report, "Because the method is calibrated to draining exactly 4.2 ml, the amount drained in the first analysis step must be measured and corrected (if not 4.2 ml) by using the worksheet with the kit. If this correction is not made, the contamination may be overstated by as much as 16 percent." According to Hanby, this applies to water samples and wash-water extraction for soil, where turbidity can cause an emulsion during extraction that inhibits phase separation. EPA's report, *Field Measurements: Dependable Data When*

You Need It, was published in June by the Agency's Office of Underground Storage Tanks (OUST). It describes several alternatives to fixed-facility laboratories and is based on interviews with users of the various techniques discussed.

The test tube is shaken for two minutes to ensure good dispersal of the catalyst and uniform color, Hanby explains. The alkyl halide reagent, Lewis-acid catalyst and aromatic compounds undergo several chemical substitutions that produce large, intensely colored molecules. (Color, Hanby says, results from the electrons shifting orbits during reactions.) Reaction products are prone to photochemical oxidation and should be kept out of direct sunlight to prevent degradation, he adds.

Hue and color intensity of the catalyst are compared to a chart of standards to determine contaminant concentrations. At press time, standards were available for "all types of fuels, some pure PNAs . . . (the pesticide) DDT, most of the simple aromatics and PCBs, including two Aroclor mixtures," Hanby relates.

"The colors depend on the aromatics you're looking at," Hanby explains. For example, he continues, water containing between 5 ppm and 10 ppm benzene will turn the catalyst "a nice yellow color," while toluene shows up as orange.

Colors and concentrations for various classes of compounds are:

- Benzene: yellow (1 ppm) to orange (10 ppm);
- Toluene, ethylbenzene and xylenes: orange-yellow (1 ppm) to burnt orange (10 ppm);
- Gasoline: beige (5 ppm) to rust, red-brown (20 ppm);
- Diesel: beige (5 ppm) to green (20 ppm);
- PCBs: light pink (0.05 ppm) to coral (0.2 ppm); and
- Naphthalene: light violet (0.2 ppm) to violet (2 ppm).

Soil samples are extracted directly or washed. Washing is more effective for fresh gasoline and requires 100 grams of soil, Hanby relates. Once the soil is

Analytic technique measures aromatics in soil and water

By Kimberly A. Roy

Reprinted from the December 1990 issue of Hazmat World.
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in the parts-per-billion range, and the Hanby test is only accurate down to parts per million.

"It definitely has a place in the market," Lewis continues. "It's cheaper than having a mobile gas chromatograph onsite." Potential applications, he says, include use as a preliminary screening device to determine whether contamination exists and for establishing the location of an upgradient well. "But if you're really trying to find the outer bounds of a contaminant plume," he says, "it's not sensitive enough."

According to Hanby, size of the newly formed molecules dictates the test's sensitivity; the larger they are, the more sensitive the technique. The test, he says, results in a noticeable coloration for PNA concentrations as low as 2 ppm, while "with gasoline in soil, you really can't get below 1 ppm." Also, he notes, detection limits for soil are 10 times higher, or less sensitive, than for water samples. Soil tests show the same sensitivity for both the wash water and direct-extraction methods, he adds.

"The accuracy of the method has been proven to far exceed that of direct injection gas chromatography," which, according to EPA, has a 10 percent mar-

gin of error, states company literature. "The only interference for the . . . test we've encountered," Hanby says, "is from humic material in soil samples. These naturally occurring aromatics sometimes cause slight interference." According to EPA's report, users generally agree with Hanby's assessment but some also said they experienced "moderate interference from high-clay-content soils." They also said moderate skills are needed to perform the test.

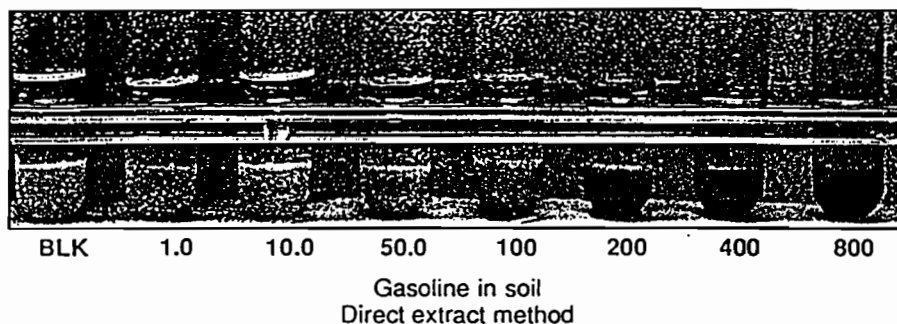
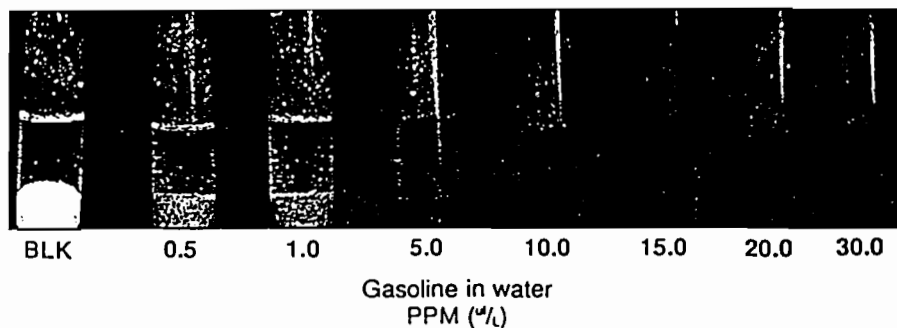
Accuracy is somewhat subjective, Hanby concedes, because each user must exercise judgment when matching test results to the standard color chart. "You have to train your eye," he says. "An obvious development that is just around the corner is a colorimeter, which will eliminate the subjectivity." Conventional colorimeters, Hanby says, are inadequate, because they rely on transmitting light through a substance, which is impossible with an opaque catalyst. An appropriate instrument, which would measure reflected light bounced off the catalyst, is under development, he adds.

In March 1987, Hanby demonstrated the technique at EPA's Environmental Monitoring Systems Laboratory in Las Vegas, Nev. The results, based on 40-

ml samples were "extremely impressive," Hanby asserts, and "launched us into EPA's good graces." Since then, he says, he has given demonstrations for about 30 state agencies, and has received "the same reaction" from state officials.

Because of the test's warm reception from the regulatory community, HAL expects to "do quite well," Hanby says. EPA, he continues, estimates there are more than 3 million USTs in the United States. Based on this figure and the "good opinions" of several marketing experts, HAL estimates the potential market for the field kits has a value between \$5 million and \$10 million, Hanby says.

Besides a large domestic market, Hanby says he expects to see some international interest as well, and has sent kits to "at least a dozen foreign countries," including Holland, Canada and England. To date, HAL has relied on word of mouth, personal contact (the company employs about eight people) and a smattering of advertisements to spread the word about its innovation. However, the company is "just about to launch a big concerted marketing effort," Hanby says. ▼



Hanby Analytical Laboratories Inc.

washed, the resulting water undergoes the same procedures as for other water samples. This method, he says, "is more time-consuming than direct extraction, which is used more frequently, especially with UST work, to speed up tank removal." Also, he notes, direct extraction "gives a more quantitative extraction and, therefore, a more quantitative analysis."

Direct extraction is more effective for older gasoline contamination and for diesel and other fuel oils, where the components are fairly insoluble, Hanby explains. In this method, 5 grams of soil and 10 ml of extraction reagent are mixed, and the soil is "chopped" until its particles are smaller than 3 millimeters. The soil and extraction agent then are stirred for five minutes. Next, 4.2 ml are measured into a test tube, and the catalyst is added. The two are mixed for one minute.

The converse chemical reaction — using an aromatic reagent to extract alkyl halides — also works but has more limitations, Hanby says. It yields the same color results, but "there are a number of negative interferences that exist and limit its applicability."

Applications. According to Hanby, numerous applications exist, including:

- Determining whether contamination exists;
- Estimating degree of contamination;
- Determining lateral and vertical extent of a contamination plume;
- Isolating the source of a leak;
- Monitoring groundwater contamination;
- Monitoring the effectiveness of biological treatment systems;

One purchaser said he was going to use the kit to prospect for oil, Hanby relates.

- Selecting remedial technologies for site cleanup; and
- Monitoring the toxicity of spills on marine and other life.

One purchaser said he was going to use the kit to prospect for oil, Hanby relates, "but I haven't got the full story on (the results) of that yet."

The test kits "have been called in on most of the more recent major oil spills," Hanby says, including the collapse of an Ashland Chemical Co. tank near Pittsburgh, the Megaborg incident off the Texas coast and the Exxon Valdez spill in Alaska's Prince William Sound.

Recently, Hanby relates, an accident caused a barge carrying about 1 million gallons of oil to dump part of its load into the warm waters (about 90 degrees Fahrenheit) of Galveston Bay. Hanby transported HAL's mobile lab to the scene and analyzed about 40 samples over a three-day period. "The area looked fairly clean," he recalls, but tests revealed "the levels of dissolved oil were 10 to 20 times the toxic level for fish." A typical lethal level for marine life is 20 to 30 ppm, he continues, but "we were finding levels greater than 100 ppm. The real significance in this case was the toxicity. . . . Oil spills are

generally bad . . . for marine life in the short term, but the human impact was huge," because fishing and shrimping operations were shut down.

In Alaska, Hanby performed a similar task — sampling water near several of the area's fish hatcheries.

Of all possible applications, Hanby says, the "biggest immediate and ongoing market is for UST work." In these situations, he continues, the kit not only saves time, which is money, but costs less to perform.

Conventional tests to determine concentrations of total petroleum hydrocarbons and simple aromatics cost, on average, \$175 per sample, Hanby says. Each UST site typically requires six samples, bringing total analytical costs to more than \$1,000. This, he notes, does not include the cost of down time while the crew waits for lab results. HAL's field kits for soil analysis cost \$800 and come with enough reagent for 30 tests, which works out to about \$27 per sample. After the initial expenditure, users can purchase enough reagent for 30 more samples for \$350, or about \$12 per sample. These costs, however, will increase in 1991, Hanby says.

Field techniques for UST work are important, because lab analysis often is expensive and can delay projects for up to two months, agrees Kimberly Green, an environmental protection specialist with OUST. For this reason, OUST decided to publish its first manual on field techniques, she relates. It contains "a lot of (scientific) data gaps, but we felt it was such an important issue that we wanted to get out the information we have," she explains. The manual does not endorse the techniques' validity, but the Agency hopes it will help convince regulators that viable options exist, she says. "Regulators," she says, "have depended on lab analysis from the beginning" and often erroneously view the results as incontrovertible.

Evaluation. According to users interviewed by EPA for its report, the field test kit is "highly suitable" for confirming contamination, quantifying contamination level, determining limits for soil excavation and measuring the progress of groundwater remediation. Users classified it as "moderately suitable" for tracing the source of highest concentration and determining the placement of monitoring wells.

According to Scott Lewis, a staff engineer with Inberg-Miller Engineers (Riverton, Wyo.), his company uses the field test kit when time is a factor. "Otherwise, we still use traditional labs, because the Hanby technique is not sensitive enough. Some wells still are considered contaminated with concentrations

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FIELD TEST FOR AROMATICS IN WATER



Step 1: Pour 500 ml. sample into separatory funnel.



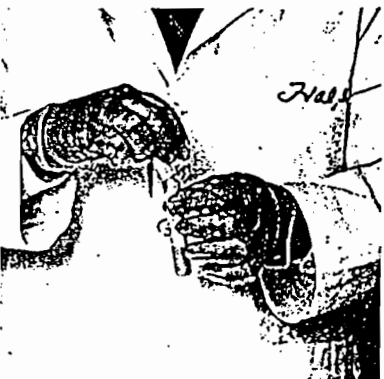
Step 2:
Pour the extractant reagent from one of the 5 ml. ampules into the separatory funnel.



Step 3: Extract sample for two minutes.



Step 4: After sample has settled for 2-3 minutes drain extractant layer into test tube. *Don't allow water into test tube.*



Step 5: Empty contents of one catalyst vial into test tube.



Step 6: Shake test tube for 30 seconds and compare to color chart.

DIRECT EXTRACTION METHOD

CAUTION: WEAR GLOVES, SAFETY GLASSES AVOID FUMES. KEEP WORK AREA CLEAN, BELOW BREATHING ZONE AND VERY WELL VENTILATED. CAUTION:

1. Place beaker on balance and tare.
2. Quickly add 5 grams of soil sample (about 2 ml) to beaker.
3. Hold 10 ml ampoule upright firmly with one hand on a flat surface and with the other hand quickly snap off the top of the ampoule and pour into beaker covering soil. AVOID FUMES KEEP DOWN AT ARMS LENGTH.
4. Chop sample with clean spatula or knife blade until soil is very small (<3mm) pieces. (Note 1)
5. Stir soil in extraction reagent for three minutes. (Note 2)
6. Pour Solvent from the beaker into one of the screw top test tubes up to the black line on the tube.
7. CAUTION: AVOID CONTACT WITH SKIN, EYES AND WATER! Add one catalyst vial to the tube, firmly screw on the cap and shake well for two minutes.
8. Compare color of catalyst at bottom of tube to photograph of standard results, e.g. gasoline in soil, diesel in soil, etc.
9. Pour excess solvent from beaker into waste solvent bottle (if not needed for dilution in the case of high concentration samples.)
10. Beakers can be placed in a hood or in an open outside (unoccupied) area until solvent has evaporated, or the soil can be cleaned from the beaker into a waste soil container.
11. Place screw cap tubes into original foam container and ship back to HAL, Inc. for disposal/recycling.

Note 1. While doing this procedure keep the beakers well below breathing zone level (i.e. at waist level while standing. The solvent fumes having a vapor density of 5.5, will sink.)

Note 2. Samples in beakers should be covered with aluminum foil while doing multiple analyses to keep solvent vapor exposure minimized.

400 South Wayside, Suite 106
Houston, Texas 77087
(713) 649-0131
Fax: (713) 649-6237

FIELD TEST FOR AROMATICS IN GROUNDWATER

I. SUMMARY OF METHOD:

This is a field method contained in a rugged, lightweight case. All of the necessary reagents and glassware to perform thirty tests of water samples are contained in the kit. Different types of aromatic contaminants in water are indicated by the type of color. Color intensity relates directly to concentration of contaminant in the water sample.

II. EQUIPMENT

500 ml. liter separatory funnel, 10 ml. graduated cylinder, 6 test tubes, test tube rack, ring stand, safety glasses, disposable gloves, color chart.

III. REAGENTS

Extraction reagent (30 ampoules), color development reagent (30 vials).

IV. PROCEDURE

- A. Pour 500 ml. water sample into separatory funnel.
- B. Snap the top off of one of the 5 ml ampoules of extraction reagent and pour it into the separatory funnel. CAUTION: WEAR GLOVES AND AVOID BREATHING VAPORS OF EXTRACTION REAGENT.
- C. Shake vigorously, with inversion of funnel, for two minutes. CAUTION: RELEASE PRESSURE ON FUNNEL, after first few shakes by inverting it and opening stopcock.
- D. Place separatory funnel in ring stand. Let sit five minutes.
- E. Withdraw extraction layer (bottom) into test tube, being careful to stop before water layer enters stopcock.
- F. Carefully shake contents of powder vial (color development reagent) into test tube. CAUTION: REAGENT REACTS VIOLENTLY WITH MOISTURE; will burn skin.
- G. Shake tube vigorously for thirty seconds and compare color to colors on the chart.

Note: Dispose of extraction solvent in waste bottle. Flush out catalyst powder from test tubes under copious running cold water or immerse in bucket of water until catalyst has dissolved completely.

Preparation of Aromatic Standards in Water

I. To prepare standards of benzene* in water:

A. Preparation of methanol stock solution (soln. A)

1. Fill 100 ml. volumetric flask to within 2 cm of mark with reagent grade methanol.
2. Pipette 1.0 ml. Benzene into methanol.
3. Fill to mark with methanol. Stopper.
4. Stir with wrist-action inversion for one (1) minute.

B. Preparation of water stock standard (10.0 ppm)

1. Fill 1-liter volumetric flask to within 2 cm of mark with de-ionized water.
2. Pipette 1.0 ml of Benzene/Methanol stock (soln. A) into flask.
3. Fill to 1 liter mark with D.I. water.
4. Stir with glass magnetic stir bar for five (5) minutes.

II. Successive dilutions can be made using either the methanol stock solution or portion of the final water (10 ppm) stock standard. If using the latter method be careful to avoid turbulence in the pouring of the water stock in order to minimize volatile losses.

* Or other aromatics, gasoline, diesel, etc.

ATTACHMENT A-4
SITE SENSITIVITY EVALUATION FORM

Site Sensitivity Evaluation (SSE)

Guidelines for Remediation of Soil Contaminated by Petroleum
North Carolina Division of Environmental Management

Characteristic	Condition	Rating	
Soil pH	pH < 5.0 or pH > 9.0	4	4
	8.0 < pH < 9.0	2	
	5.0 ≤ pH < 6.0	2	
	6.0 ≤ pH ≤ 8.0	0	
Grain Size* Udden-Wentworth Scale	Contains >2/3, Gravel to Coarse Sand (>1/2mm)	10	4
	Contains >2/3, Medium to Fine Sand (<1/2mm - 1/8mm)	7	
	Contains >2/3, Very Fine Sand to Coarse Silt (<1/8mm - 1/32mm)	4	
	Contains >2/3, Medium Silt and Clay (<1/32mm)	0	
Are Relict Structures, Sedimentary Structures, and/or Textures present in the zone of contamination & underlying "soils"	Present and Intersecting the Seasonal High Water Table	10	0
	Present but not Intersecting the Seasonal High Water Table	5	
	None Present	0	
Contaminant Class	I Low to Medium Boiling Point Hydrocarbons [C1-C15] and "some military jet fuels"	10	5
	II High Boiling Hydrocarbons [C12-C20] and "other jet fuels"	5	
Distance from Location of Deepest Contaminated Soil (>10 ppm TPH) to Seasonal High Water Table	5 - 10 feet	10	10
	>10-40	5	
	>40 feet	0	
Is the Top of Bedrock located above the Seasonal Low Water Table ?	Yes	5	0
	No	0	
Is a Confining Layer present between bottom of contaminated soil and water table ?	No	5	5
	Yes	0	
Time since release of contaminant has occurred	>1 yr. or unknown	10	10
	6 months-1 year	5	
	<6 months	0	
Artificial Conduits present within the zone of contamination	Present & Intersecting the Seasonal High Water Table	10	5
	Present but not Intersecting the Seasonal High Water Table	5	
	Not Present	0	

TOTAL
SCORE

43

	Site Sensitivity Evaluation Score	Maximum Soils Cleanup Level ppm of TPH
Very Sensitive	>44	10
.	36-43	35
.	21-35	60
Least Sensitive	5-20	85

APPENDIX B

FIELD TEST BORING RECORDS/PENETROMETER RECORDS

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-SI-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 19.2

BORING NO.: MW-1

NORTH: _____

TOP OF STEEL CASING: 21.84

PVC

RIG: B-57

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-8-92</u>	<u>14'</u>	<u>CLEAR + COLD</u>	<u>6'</u>	<u>1030</u>
LENGTH	<u>2.0'</u>		<u>5.0'</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 14' TAKING CONTINUOUS 2' SPT SPOON SAMPLES.

MONITORING WELL INSTALLED USING 2" PVC SCH 40

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		<u>1.83</u> <u>2</u>	<u>5</u> <u>8</u> <u>9</u>		<u>0</u>	<u>6" TOP SOIL</u> <u>SAND - MED-FINE</u>	<u>BLACK</u> <u>BROWN</u>	<u>MED STIFF</u> <u>STIFF</u>	<u>DRY</u>		<u>18.7</u>
2			<u>92%</u>	<u>12</u>								
3	S2		<u>2</u> <u>2</u>	<u>5</u> <u>5</u> <u>5</u>		<u>300</u>	<u>4" SAND MED-FINE</u> <u>CLAY</u>	<u>GRAY</u>	<u>MED STIFF</u>	<u>DRY</u>		<u>16.7</u>
4			<u>100%</u>	<u>7</u>								
5	S3		<u>2</u> <u>2</u>	<u>3</u> <u>2</u> <u>2</u>		<u>350</u>	<u>6" SAND SOME CLAY</u> <u>WATER</u>	<u>BROWN</u>		<u>WET</u>		<u>14.2</u>
6			<u>100%</u>	<u>4</u>			<u>SILT TRACE CLAY</u>	<u>GRAY</u>	<u>SOFT</u>			<u>13.2</u>
7	S4		<u>2</u> <u>2</u>	<u>2</u> <u>2</u> <u>2</u>		<u>250</u>	<u>6" GRAVEL - COARSE</u> <u>SILT</u>	<u>DARK GRAY</u> <u>GRAY</u>		<u>WET</u>		<u>12.5</u>
8			<u>100%</u>	<u>1</u>								<u>11.2</u>
9	S5		<u>1.83</u> <u>2</u>	<u>1</u> <u>1</u> <u>1</u>		<u>200</u>	<u>4" GRAVEL - COARSE</u> <u>SILT</u>	<u>GRAY</u> <u>GRAY</u>	<u>VERY SOFT</u>	<u>WET - SHEEN NOTICED</u>		<u>10.7</u>
10			<u>92%</u>	<u>W&H</u> <u>W&H</u>								

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-1

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-SI-SRNBORING NO.: MW-1

DRILL RECORD							VISUAL DESCRIPTION					SOIL ROCK	ELEVATION
DEPTH	SOIL ROCK	Sample ID ----- Type-No. (N = No Samp.)	Samp. Rec. (Ft. & %)	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations			
				RQD (FL & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations			
11	SC		$\frac{2}{2}$	WOH		16	SILT AND GRAVEL - COARSE	GRAY	VERY SOFT	WET			
12			100%										
13	S7		$\frac{2}{2}$	WOH		5	2" SILT AND GRAVEL - COARSE			WET		6.	
							2" SILET	GRAY	VERY SOFT			6.1	
14			100%				SILT AND FINE SAND	BROWN	VERY SOFT			5.	
							END OF BORING 14'						
5													
6													
7													
8													
9													
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
0													

DRILLING CO.: ATECDRILLER: TIM WILLIAMSBAKER REP.: KENNETH A. TUABORING NO.: MW-1SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SAN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 25.0

BORING NO.: 1W-2

NORTH: _____

TOP OF STEEL CASING: 25.5
PVC

RIG: B-57

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-8-92</u>	<u>16'</u>	<u>CLEAR + COLD</u>	<u>8</u>	<u>1300</u>
LENGTH	<u>2.0'</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 16' TAKING CONTINUOUS 2' SPLIT-SPOON SAMPLES

MONITORING WELL INSTALLED USING 2" PVC SCH 40

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)		RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
1	S1		<u>2/2</u>	<u>3</u>		<u>0</u>	<u>3" TOP SOIL</u>	<u>BROWN</u>	<u>SOFT</u>	<u>DRY</u>	22.8
2			<u>100%</u>	<u>10</u>			<u>5" CLAY AND SAND - FINE</u>	<u>BLACK GRAY</u>		<u>DRY</u>	
3	S2		<u>1.41/2</u>	<u>7</u>		<u>0</u>	<u>" " " "</u>	<u>YELLOW</u>	<u>MED STIFF</u>		
4			<u>71%</u>	<u>10</u>							
5	S3		<u>2/2</u>	<u>7</u>		<u>0</u>	<u>CLAY</u>	<u>GRAY WITH YELLOW STREAKS</u>	<u>MED STIFF</u>	<u>DRY</u>	19.0
6			<u>100%</u>	<u>13</u>							
7	S4		<u>2/2</u>	<u>7</u>		<u>0</u>	<u>6" FINE SAND</u>	<u>WHITE</u>	<u>MED STIFF</u>	<u>DRY</u>	17.0
8			<u>100%</u>	<u>5</u>			<u>4" FINE SAND</u>	<u>YELLOW</u>	<u>MED STIFF</u>		
9	S5		<u>1.16/2</u>	<u>2</u>		<u>0</u>	<u>CLAY & SAND - FINE</u>	<u>YELLOW</u>	<u>MED STIFF</u>		16.2
10			<u>58%</u>	<u>2</u>			<u>WATER</u>	<u>WHITE</u>	<u>SOFT</u>	<u>MOIST</u>	15.0
				<u>2</u>			<u>FINE SAND SAME CLAY</u>			<u>MOIST</u>	

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: 1W-2

SHEET 1 OF 2

FIELD TEST BORING RECORD

PROJECT: PIPE LINE

S.O. NO.: 19013-SI-SRN

BORING NO.: MW-2

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11	S6		$\frac{2}{2}$	17			CLAY AND FINE SAND	GRAY	VERY STIFF	MOIST	
12			100%	18			4" SAND - MED	WHITE		WET	
13	S7		$\frac{2}{2}$	9			SAND - MED		STIFF		
14			100%	16							
15	S8		$\frac{2}{2}$	6			SAND - MED	WHITE	STIFF	WET	
16			100%	15							
16							END OF BORING 16'				
7											
8											
9											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
0											

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-2

SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 22.6

BORING NO.: MW-3

NORTH: _____

TOP OF STEEL CASING: 22.4

PVC

RIG: B-57

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>1 7/8" ID</u>		<u>6 1/4" ID</u>		<u>1-11-92</u>	<u>16'</u>	<u>SUNNY COLD</u>	<u>6-7'</u>	<u>1050</u>
LENGTH	<u>2.0'</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 14' TAKING CONTINUOUS 2' SPLIT-SPOON SAMPLES

MONITORING WELL INSTALLED TO 16' USING 2" PVC SCH 40 - FLOSH MOUNT

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		1.3 2	2			4" Top Soil CLAY	Black BROWN	neo STIFF	DRY		22.3
2			66%	9								20.6
3	S2		2 2	5			SAND-FINE CLAY SOME SAND FINE	LT GRAY GRAY	SOFT	DRY		20.1
4			100%	4								
5	S3		1.3 2	3			6" CLAY AND SAND-FINE SAND-FINE	LT GRAY WHITE		DAMP		
6			66%	3								16.6
7	S4		2 2	2			WATER CLAY AND SAND-FINE	BROWN	SOFT	DAMP		
8			100%	2			2" SAND-FINE	WHITE		DAMP		15.1
9	S5		3 2	2			CLAY AND SAND-FINE	GRAY	SOFT	DAMP		14.6
10			100%	4								

DRILLING CO.: ATEC

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-3

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-51-SRNBORING NO.: MW-3

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11	56		$\frac{2}{2}$	2		800	SILT AND SAND-FINE	GRAY	SOFT	MOIST	
12			100 %	2							
13	57		$\frac{2}{2}$	2		1000	CLAY AND SAND-FINE	GRAY	SOFT	MOIST	
14			100 %	1							
15	58						NOT SAMPLED				
16							END OF BORING 16'				
7											
8											
9											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
0											

DRILLING CO.: AT&CDRILLER: LEWIS LEFEVERBAKER REP.: KENNETH A. TUABORING NO.: MW-3SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 23.1

BORING NO.: MW-4

NORTH: _____

TOP OF STEEL CASING: 22.82
PVC

RIG: <u>B-61</u>									
	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-11-92</u>	<u>14'</u>	<u>SUNNY + COID</u>	<u>6'</u>	<u>1444</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 14' TAKING CONTINUOUS 2' SPLIT-SPOON SAMPLES
MONITORING WELL INSTALLED USING 14' OF 2" PVC SCH 40 - FLUSH MOUNT

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec. (Ft. & %)	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)		RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		1.3/2	5		0	TOP SOIL	BLACK	MED	DRY		22.6
				6			7" CLAY	BROWN	STIFF			
2			66%	12						DRY		21.7
3	S2			10			CLAY AND SAND-FINE	YELLOW GRAY	STIFF			
4				8								
5	S3		2/2	5		0	CLAY AND SAND-FINE		MED STIFF	MOIST		
6			100%	5								
7	S4		2/2	3		0	CLAY AND SAND-FINE		SOFT	WET		
8			100%	2								
9	S5		2/2	4		15	CLAY AND SAND FINE	GRAY	SOFT			
				4				6" YELLOW				
10			100%	3				14" GRAY				

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-4

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-51-SRWBORING NO.: MW-4

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
11	56		$\frac{8}{2}$	2		10	SAND - MED TO FINE	GRAY	SOFT	MOIST		
12			100 %	2								
13	57		$\frac{8}{2}$	10		7-8		GRAY	STIFF	MOIST		
14			100 %	14								
14			100 %	16			END OF BORING 14'					9.1
5				20								
6												
7												
8												
9												
0												
1												
2												
3												
4												
5												
6												
7												
8												
9												
0												

DRILLING CO.: ATECDRILLER: TIM WILLIAMSBAKER REP.: KENNETH A. TUABORING NO.: MW-4SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 23.9

BORING NO.: MW-5

NORTH: _____

TOP OF STEEL CASING: 23.85
PVC

RIG: <u>B-61</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-12-92</u>	<u>14</u>	<u>MID</u>	<u>7</u>	<u>1343</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 14' TAKING CONTINUOUS SPLIT-SPOON SAMPLES

MONITORING WELL INSTALLED USING 14' 2" PVC - SCH 40 - FLARE MOUNT

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	P.D.	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		<u>2/2</u>	<u>5</u>		<u>0</u>	<u>1" TOP SOIL</u> <u>CLAY TRACE SAND-FINE</u>	<u>BROWN</u> <u>BROWN</u>	<u>SOFT</u>	<u>DRY</u> <u>DRY</u>		<u>23.8</u>
2			<u>100%</u>	<u>5</u>			<u>CLAY TRACE SAND-FINE</u>	<u>BROWN</u>	<u>SOFT</u>			
3	S2		<u>2/2</u>	<u>10</u>		<u>0</u>						
4			<u>100%</u>	<u>7</u>								
5	S3		<u>2/2</u>	<u>7</u>		<u>0</u>	<u>CLAY TRACE SAND-FINE</u>	<u>YELLOW</u>				
6			<u>100%</u>	<u>6</u>								
7	S4		<u>2/2</u>	<u>4</u>		<u>0</u>	<u>CLAY</u>	<u>GRAY</u>	<u>VERY SOFT</u>	<u>DAMP</u>		<u>17.9</u>
8			<u>1/2</u>	<u>2</u>			<u>WATER</u>					<u>16.9</u>
9	S5		<u>50%</u>	<u>2</u>		<u>0</u>						<u>16.6</u>
10			<u>2/2</u>	<u>1</u>			<u>CLAY AND SAND-FINE</u>	<u>YELLOW</u>	<u>VERY SOFT</u>	<u>WET</u>		
			<u>100%</u>	<u>2</u>			<u>2" CLAY AND SAND-FINE</u>	<u>GREEN</u>				

DRILLING CO.: ATEL

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-5

SHEET 1 OF 2

FIELD TEST BORING RECORD

PROJECT: PIPE LINE

S.O. NO.: 19013-51-SAN

BORING NO.: MW-5

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11	56		$\frac{2}{2}$	2			SAND - MED	BROWN	VERY SOFT	MOIST	
12			100%	1			SAND - MED 6"	GREEN			
13	57		$\frac{2}{2}$	2			SAND - MED	BROWN	VERY SOFT	MOIST	
14			100%	7			SAND - MED 7"	GREEN			
5											
6											
7											
8											
9											
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
0											

DRILLING CO.: ATEC

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-5

SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19018-SI-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 22.5

BORING NO.: MW-6

NORTH: _____

TOP OF STEEL CASING: 25.55
PVC

RIG: <u>B-57</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-14-92</u>	<u>16'</u>	<u>SUNNY</u>	<u>7</u>	<u>0842</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 16' TAKING CONTINUOUS 2' SPLIT-SPOON SAMPLES

MONITORING WELL INSTALLED USING 2" SCH 40 PVC - STAND UP

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type-No. (N = No Samp.)		RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
1	<u>S1</u>		<u>2/2</u>	<u>2</u>			<u>4" Top Soil</u>	<u>BROWN</u>	<u>DRY</u>		<u>22.6</u>
2			<u>100%</u>	<u>8</u>			<u>CLAY</u>		<u>MED STIFF</u>		
3	<u>S2</u>		<u>2/2</u>	<u>7</u>			<u>CLAY</u>	<u>BROWN Yellow</u>		<u>DRY</u>	
4			<u>100%</u>	<u>8</u>			<u>CLAY</u>				
5	<u>S3</u>		<u>2/2</u>	<u>5</u>			<u>CLAY</u>	<u>GRAY</u>	<u>MED STIFF</u>	<u>DRY</u>	
6			<u>100%</u>	<u>6</u>							
7	<u>S4</u>		<u>2/2</u>	<u>4</u>			<u>CLAY</u>	<u>YELLOW</u>		<u>DAMP</u>	
8			<u>100%</u>	<u>9</u>			<u>WATER</u>		<u>MED STIFF</u>		<u>15.5</u>
9	<u>S5</u>		<u>2/2</u>	<u>8</u>			<u>SAND-MED</u>	<u>WHITE</u>		<u>WET</u>	
10			<u>100%</u>	<u>4</u>							

DRILLING CO.: ATEC

DRILLER: SANDFORD SWEENEY

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-6

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19012-SI-SRNBORING NO.: MW-6

DRILL RECORD							VISUAL DESCRIPTION					SOIL ROCK	ELEVATION
DEPTH	SOIL ROCK	Sample ID Type - No. (N = No Samp.)	Samp. Rec. (Ft. & %)	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations			
				RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations			
11	SL		$\frac{2}{2}$	4		0	SAND-MED	BROWN	MED STIFF	MOIST			
12			100%	10									
13	S7		$\frac{2}{2}$	4		0	SAND-MED	BROWN	MED STIFF	MOIST			
14			100%	13									
15	S8		$\frac{2}{2}$	12		0	SAND-MED	BROWN	STIFF	MOIST			
16			100%	14									
16							END OF BORING 16'					6.1	
7													
8													
9													
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
0													

DRILLING CO.: ATECDRILLER: SANFORD SWEENEYBAKER REP.: KENNETH A. TUABORING NO.: MW-6SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-SI-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 21.9

BORING NO.: MW-7

NORTH: _____

TOP OF STEEL CASING: 24.78
PVC

RIG: <u>B-61</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u>		<u>1-14-92</u>	<u>16'</u>	<u>SUNNY</u>		<u>1030</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 16' TAKING CONTINUOUS SPLIT-SPOON SAMPLES

MONITORING WELL INSTALLED USING 2" SCH 40 PVC - SAND UP

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type-No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
1	<u>S1</u>		<u>1.5/2</u>	<u>5</u>			<u>3" TOP S&L CLAY</u>	<u>BROWN GRAY</u>	<u>SOFT</u>	<u>DRY</u>	<u>21.5</u>
2			<u>75%</u>	<u>2</u>			<u>CLAY</u>	<u>YELLOW</u>			
3	<u>S2</u>		<u>1.75/2</u>	<u>5</u>							
4			<u>.85%</u>	<u>5</u>							
5	<u>S3</u>		<u>1.58/2</u>	<u>6</u>			<u>CLAY</u>	<u>YELLOW</u>	<u>SOFT</u>	<u>DRY</u>	<u>17.4</u>
6			<u>79%</u>	<u>4</u>			<u>2" SAND-MED</u>				
7	<u>S4</u>		<u>2/2</u>	<u>6</u>			<u>12" CLAY</u>	<u>YELLOW</u>	<u>SOFT</u>		<u>15.9</u>
8			<u>100%</u>	<u>5</u>			<u>WATER SAND-MED</u>	<u>WHITE</u>		<u>WET</u>	<u>14.9</u>
9	<u>S5</u>		<u>2/2</u>	<u>4</u>			<u>CLAY</u>	<u>BROWN</u>	<u>SOFT</u>	<u>DAMP</u>	<u>13.9</u>
10			<u>100%</u>	<u>10</u>			<u>16" SAND</u>	<u>WHITE</u>			<u>13.9</u>
							<u>4" CLAY</u>	<u>BROWN</u>			<u>12.9</u>

DRILLING CO.: ATEC

DRILLER: SANFORD SWEENEY

BAKER REP.: KENNETH A. TUA

BORING NO.: MW-7

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-51-SRNBORING NO.: MW-7

DRILL RECORD							VISUAL DESCRIPTION					SOIL ROCK	ELEVATION
DEPTH	SOIL ROCK	Sample ID Type - No. (N = No Samp.)	Samp. Rec. (Ft. & %)	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations			
				RQD (Ft. & %)	Pen. Rate		Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations			
11	56		$\frac{2}{2}$	4 10 12 14		1	SAND-MED	WHITE		WET			
12			100%										
13	57		$\frac{2}{2}$	12 14 17		1	SAND-MED	WHITE		WET			
14			100%	13									
15	58		$\frac{2}{2}$	8 11 14		1	SAND-MED	WHITE		WET			
16			100%	16			END OF BORING					4.	
7													
8													
9													
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
0													

DRILLING CO.: ATELDRILLER: SANFORD SWEENEYBAKER REP.: KENNETH A. TUABORING NO.: MW-7SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 19.4

BORING NO.: DW-1

NORTH: _____

TOP OF STEEL CASING: 22.17
PVC

RIG: <u>B-57</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>8" ID</u>		<u>1-8-92</u>	<u>30'</u>	<u>COLD</u>	<u>5</u>	
LENGTH	<u>2.0</u>		<u>5.0</u>		<u>1-10-92</u>				
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 lb</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED 20' USING 8" AUGERS TAKING CONTINUOUS 2' SPLIT SPOON SAMPLES, ADVANCED 20'-3' USING ROTARY DRILL SAMPLING EVERY 5' GROUTED 20' 8" PVC THEN 30' 2" PVC 5/8" 40

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type - No. (N = No Samp.)	(Ft & %)	RQD (Ft & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		<u>1.5</u> <u>2</u>	<u>2</u> <u>7</u> <u>14</u>			<u>2" TOP SOIL</u> <u>CLAY AND SAND - FINE</u>	<u>BROWN</u> <u>LT yellow</u>	<u>STIFF</u>	<u>DRY</u> <u>DRY</u>		<u>18.9</u>
2			<u>75%</u>	<u>14</u>								
3	S2		<u>1.6</u> <u>2</u>	<u>5</u> <u>6</u> <u>6</u>		<u>350</u>	<u>CLAY AND SAND - FINE</u>	<u>LT yellow</u>	<u>MOD STIFF</u>	<u>DRY</u>		
4			<u>33%</u>	<u>5</u>								
5	S3		<u>2</u> <u>2</u>	<u>2</u> <u>2</u> <u>3</u> <u>4</u>		<u>400</u>	<u>CLAY</u>	<u>GRAY</u>	<u>SOFT</u>	<u>WET</u>		<u>15.4</u>
6			<u>100%</u>									
7												
8												
9												
10												

DRILLING CO.: AT&C

DRILLER: SANFORD SWEENEY

BAKER REP.: KENNETH A. TUA

BORING NO.: DW-1

SHEET 1 OF 2

Baker

Baker Environmental, Inc.

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-S1-SRNBORING NO.: DW-1

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	P.D	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11											
12											
13											
14			2/2	1			SILT				5.4
15	54		100%	2		NA	2" SILT TRACE SAND-FINE	GRAY	VERY SOFT	WET	
16								BROWN		WET	
17											
18			2/2	1			SILT				1.9
19	55		100%	2		NA		GRAY	VERY SOFT	WET	
20											
21											
22											
23											
24			3/2	2			SILT AND SAND-FINE	GRAY	SOFT	WET	-7
25	56		16%	5		NA					
26				5							
27				7							
28											
29	57		6/2	5		NA	GRAVEL - FINE	WHITE	LOOSE	WET	-8
30			33%	3							

DRILLING CO.: ATECDRILLER: SANFORD SWEENEYBAKER REP.: KENNETH A. TVABORING NO.: DW-1SHEET 2 OF 2

FIELD TEST BORING RECORD



PROJECT: PIPE LINE

CTO NO.: 19013-S1 SAN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 23.1

BORING NO.: DN-2

NORTH: _____

TOP OF STEEL CASING: 25.79
PVC

RIG: <u>B-57</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>8" ID</u> <u>6 1/4" ID</u>		<u>1-9-92</u>	<u>30'</u>	<u>WARM</u>	<u>6'</u>	<u>1253</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED 0-20" USING Hollow STEM AUGERS. 8" PVC SET AND GROUTED.
20'-30' ADVANCED BY ROTARY DRILL AND 30' OF 2" PVC SET AND GROUTED.

20-30 ADVANCED BY ROTARY DRILL AND 30 OF 2 FUL SET AND GROVED

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		<u>1.5</u> <u>2</u>	<u>2</u> <u>2</u> <u>1</u>		<u>0</u>	<u>TOP SOIL</u> <u>CLAY</u>	<u>BLACK</u>	<u>SOFT</u>	<u>DRY</u>		<u>22.6</u>
2			<u>75%</u>	<u>1</u>								
3	S2		<u>1.5</u> <u>2</u>	<u>2</u> <u>3</u> <u>5</u>		<u>0</u>	<u>CLAY + SAND - FINE</u>	<u>PATE</u> <u>YELLOW</u>	<u>MED</u> <u>-STIFF</u>	<u>DRY</u>		<u>21.1</u>
4			<u>75%</u>	<u>6</u>								
5	S3		<u>1.6</u> <u>2</u>	<u>4</u> <u>4</u> <u>7</u>		<u>0</u>	<u>CLAY + SAND - MED</u>					
6			<u>83%</u>	<u>8</u>								
7	S4		<u>2</u> <u>2</u>	<u>11</u> <u>9</u> <u>8</u>		<u>0</u>	<u>SAND - MED</u>	<u>5" GRAY</u> <u>4" LT GRAY</u> <u>YELLOW</u>	<u>MED</u> <u>STIFF</u>	<u>DAMP</u>		<u>17.1</u>
8			<u>100%</u>	<u>7</u>								
9	S5		<u>2</u> <u>2</u>	<u>8</u> <u>8</u> <u>8</u>		<u>0</u>	<u>CLAY WITH SAND - MED</u>	<u>LT GRAY</u> <u>WHITE</u>		<u>MOIST</u>		<u>15.1</u>
10			<u>100%</u>	<u>10</u>								

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: DN-2

SHEET 1 OF 2

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-51-SRNBORING NO.: DW-2

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	P.D.	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11											
12											
13											
14											
15	SG		$\frac{3}{2}$	13 25 23		0	SAND - FINE	2" WHITE YELLOW	VERY STIFF	WET	
16			100%	21							
17											
18											
19	SG		$\frac{12}{2}$	10 9 15 13		0	SAND - MED	GRAY YELLOW	STIFF	WET	
20			100%								
21											
22											
23											
24											
25	SG		$\frac{8}{2}$	3 3 4 3		0	GRAVEL - FINE 6" SAND - MED 8" SAND WITH GRAVEL 5" SILT 5"	GRAY GRAY GRAY GRAY	SOFT	WET	
26			100%								
27											
28											
29	SG		$\frac{8}{2}$	10 16 18 25		0	GRAVEL - FINE GRAVEL - SAND	GRAY WHITE	MED DENSE	WET	
30			100%				END OF BORING 30"				

DRILLING CO.: ATECDRILLER: TIM WILLIAMSBAKER REP.: KENNETH A. TUABORING NO.: DW-2SHEET 2 OF 2

FIELD TEST BORING RECORD



PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 22.8

BORING NO.: DW-3

NORTH: _____

TOP OF STEEL CASING: 22.81
PVC

RIG: <u>B-61</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>6 1/4" ID</u> <u>5" ID</u>		<u>1-11-92</u>	<u>30</u>	<u>COLD</u>	<u>6'-7'</u>	<u>1030</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED 0-20' USING Hollow STEM AUGERS. 2" PVC SET AND GROUTED. 20'-30'
ADVANCED BY ROTARY DRILL. 30' 2" PVC SET AND GROUTED

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL ELEVATION
	ROCK	Type No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	P.D	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
1	S1		<u>1.3</u> <u>2</u>	<u>7</u> <u>7</u> <u>6</u> <u>4</u>		<u>700</u>	<u>7" TOP SOIL</u>	<u>Black</u>	<u>MED</u> <u>STIFF</u>	<u>DRY</u>	<u>22.3</u>
2			<u>66%</u>								
3	S2		<u>.83</u> <u>2</u>	<u>4</u> <u>3</u> <u>2</u> <u>1</u>		<u>500</u>	<u>SAND + CLAY</u> <u>FINE</u>	<u>Black</u>	<u>SOFT</u>	<u>DRY</u>	
4			<u>72%</u>								
5	S3		<u>.6</u> <u>2</u>	<u>2</u> <u>2</u> <u>1</u>		<u>400</u>	<u>CLAY AND SAND-FINE</u>	<u>Black</u>	<u>SOFT</u>	<u>MOIST</u>	
6			<u>32%</u>	<u>20</u>							
7	S4		<u>.58</u> <u>2</u>	<u>50</u> <u>3</u> <u>2</u> <u>2</u>		<u>400</u>	<u>CLAY AND SAND-FINE</u>	<u>GRAY</u>	<u>HARD</u>	<u>MOIST</u>	
8			<u>27%</u>	<u>2</u>							
9											
10											

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: DW-3

SHEET 1 OF 2

FIELD TEST BORING RECORD

PROJECT: PIPE LINES.O. NO.: 19013-51-SRNBORING NO.: DW-3

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (FL & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11											
12											
13											
14											
15	SS		$\frac{2}{2}$	4		400	SILT WITH SAND - FINE CLAY WITH SAND - FINE	GRAY	SOFT	MOIST	
16			100%	2							
17											
18											
19	SC		$\frac{2}{2}$	4		500	CLAY AND SAND - FINE	GRAY	60FT	MOIST	
20			100%	5							
21											
22											
23											
24											
25	S7		$\frac{2}{2}$	2		1000	CLAY AND SAND - FINE GRAVEL - FINE	GRAY GRAY	HRD STIFF	MOIST	-1-
26			100%	12							
27											
28											
29	S8		$\frac{2}{2}$	2		200	GRAVEL - FINE CLAY TRACE SAND - FINE	GRAY	VERY SOFT	WET	
30			100%	1			END OF BORING 30'				-7-

DRILLING CO.: ATECDRILLER: Tim WilliamsBAKER REP.: KENNETH A. TUABORING NO.: DW-3SHEET 2 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19018-51-SRW

COORDINATES: EAST: _____

ELEVATION: SURFACE: 21.8

BORING NO.: DW-4

NORTH: _____

TOP OF STEEL CASING: 25.4

RIG: <u>B-61</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>		<u>1 1/4" ID 8" OD</u>		<u>1-14-92</u>	<u>30'</u>	<u>MILD</u>	<u>6'</u>	<u>1201</u>
LENGTH	<u>2.0</u>		<u>5.0</u>						
TYPE	<u>STD</u>		<u>HSA</u>						
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED 0-20' USING Hollow STEM AUGERS. 8" PVC SET AND GROUTED. 20'-30' ADVANCED USING ROTARY DRILL. 30' 2" PVC SET AND GROUTED.

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec. (Ft. & %)	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type- No. (N = No Samp.)		RQD (Ft. & %)	Pen. Rate	PiD	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		2/2	5			4" T.S. CLAY	BLACK BROWN	MED STIFF	DRY		21.
2			100%	9			CLAY					
3	S2		2/2	4				YELLOW	SOFT	DRY		
4			100%	7								
5	S3		2/2	4			CLAY WITH SAND-FINE	YELLOW	SOFT	DRY		
6			100%	3						MOIST		
7												
8												
9												
10												

DRILLING CO.: ATEC

DRILLER: TIM WILLIAMS

BAKER REP.: KENNETH A. TUA

BORING NO.: DW-4

SHEET 1 OF 2

FIELD TEST BORING RECORD

PROJECT: DW-4S.O. NO.: 19013-51-SRWBORING NO.: DW-4

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PiP	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
11											
12											
13											
14			$\frac{2}{2}$	7			SAND-MED	WHITE	MED DENSE	WET	
15	54			9		1					
16			100%	14							
17				16							
18			$\frac{2}{2}$	4			SAND-MED	WHITE	LOOSE	WET	
19	55			3		0					
20			100%	5							
21				6							
22											
23											
24			$\frac{2}{2}$	1			SAND-MED	BROWN	VERY LOOSE	WET	
25	56			1		0					
26			100%	1							
27											
28			$\frac{2}{2}$	5			SAND-MED	WHITE	LOOSE	WET	
29	57			6		0	GRAVEL				
30			100%	7							
				9			END OF BORING 30'				

DRILLING CO.: ATECDRILLER: TIM WILLIAMSBAKER REP.: KENNETH A. TUABORING NO.: DW-4SHEET 1 OF 2

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-SI-SRW

COORDINATES: EAST: _____

ELEVATION: SURFACE: 22.3

BORING NO.: B-1

NORTH: _____

TOP OF STEEL CASING: _____

RIG: B-57

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>1 3/8" ID</u>				<u>1-11-92</u>	<u>8'</u>	<u>MID</u>	<u>8'</u>	<u>1325</u>
LENGTH	<u>2.0</u>								
TYPE	<u>STD</u>								
HAMMER WT.	<u>140 #</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO WATER TABLE THEN BROUGHT TO SURFACE, SPLIT SPOON SAMPLING
only

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL
	ROCK	Type - No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate		Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK
1	<u>51</u>			<u>3</u> <u>7</u> <u>6</u> <u>8</u>		<u>50</u>	<u>3" TOP SOIL CLAY</u> <u>2" SAND</u>	<u>BLACK</u> <u>4" BROWN</u> <u>4" GRAY</u>		<u>DRY</u>	
2			<u>2</u> <u>2</u>	<u>7</u> <u>7</u> <u>6</u>		<u>300</u>	<u>CLAY AND SAND - FINE</u>	<u>GRAY</u>			
3	<u>52</u>		<u>100%</u>	<u>5</u>							
4			<u>2</u> <u>2</u>	<u>6</u> <u>4</u> <u>5</u>		<u>1200</u>	<u>CLAY AND SAND - FINE</u>			<u>DAMP</u>	
5	<u>53</u>		<u>100%</u>	<u>1</u>							
6			<u>2</u> <u>2</u>	<u>2</u> <u>1</u> <u>1</u>		<u>1400</u>	<u>CLAY AND SAND - FINE</u>			<u>DAMP</u>	
7	<u>54</u>		<u>100%</u>	<u>1</u>							
8							<u>END OF BORING 8'</u>				
9											
10											

DRILLING CO.: ATEC

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: B-1

SHEET 1 OF 1

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: QO 19018-S1-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 23.5

BORING NO.: B-2

NORTH: _____

TOP OF STEEL CASING: _____

RIG: <u>B-57</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 3/8" ID</u>				<u>1-11-92</u>	<u>8'</u>	<u>M110</u>	<u>7'</u>	<u>1410</u>
LENGTH	<u>2.0</u>								
TYPE	<u>STD</u>								
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 8' USING SPIT SPOON ONLY.

DRILL RECORD						VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)		(Ft. & %)	RQD (Ft. & %)	Pen. Rate	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	
1	S1		2 1/2	11		4" TOP SOIL	BLACK	VERY	DRY		23.0
				21		10" CLAY	LT. YELLOW	STIFF			
2			100 %	11	40	SAND-FINE	BLACK		DRY		22.0
3	S2		2 1/2	9		SAND-FINE	GRAY	STIFF			
				7							
4			100 %	8	200						
				7							
5	S3		3 1/2	4		CLAY	YELLOW		MOIST		19.5
				3		6" SAND-FINE	GRAY	SOFT			19.0
6			100 %	2	350				WET		
				3							
7	S4		9 1/2	1		SAND					17.0
				1		CLAY WITH SAND-FINE	GRAY	VERY SOFT	WET		
				1	300						
8			100 %	2							15.5
						END OF BORING 8'	GRAY		WET		
9											
10											

DRILLING CO.: ATEC

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: B-2

SHEET 1 OF 1

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-51-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 24.3

BORING NO.: B3

NORTH: _____

TOP OF STEEL CASING: _____

RIG: B-61

	SPLIT SPOON	CASING	AUGERS	CORE BARREL	DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
SIZE (DIAM.)	<u>1 3/8" ID</u>				<u>1-12-92</u>	<u>8'</u>	<u>MLD</u>	<u>6-2'</u>	<u>1248</u>
LENGTH	<u>2.0</u>								
TYPE	<u>STD</u>								
HAMMER WT.	<u>140#</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 8' USING ONLY HAMMERED SPLIT-SPOONS.

DRILL RECORD							VISUAL DESCRIPTION					
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL	ELEVATION
	ROCK	Type-No. (N = No Samp.)	(Ft. & %)	RQD (Ft. & %)	Pen. Rate	PID	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	ROCK	
1	S1		<u>1.6</u> <u>2</u>	<u>4</u> <u>7</u> <u>6</u>		<u>0</u>	<u>3" TOP SOIL</u> <u>CLAY TRACE SAND-FINE</u>	<u>BLACK</u> <u>BLACK</u>	<u>MO</u> <u>STIFF</u>	<u>DRY</u>		<u>23.8</u>
2			<u>83%</u>	<u>7</u>								
3	S2		<u>2</u> <u>2 1/2</u>	<u>6</u> <u>6</u> <u>6</u>		<u>3</u>	<u>SAND-FINE</u>	<u>BROWN</u>	<u>MO</u> <u>STIFF</u>	<u>DAMP</u>		<u>22.3</u>
4			<u>100%</u>	<u>5</u>								
5	S3		<u>2</u> <u>2 1/2</u>	<u>3</u> <u>3</u> <u>2</u>		<u>250</u>	<u>SAND-FINE</u>		<u>SOFT</u>			
6			<u>100%</u>	<u>3</u>			<u>CLAY 4"</u>	<u>GRAY</u>	<u>VERY</u> <u>SOFT</u>	<u>DAMP</u>		<u>18.8</u>
7	S4		<u>2</u> <u>2</u>	<u>3</u> <u>1</u> <u>1</u>		<u>700</u>	<u>CLAY AND SAND-FINE</u>			<u>WET</u>		
8			<u>100%</u>	<u>1</u>			<u>END OF BORING 8'</u>					<u>15.3</u>
9												
10												

DRILLING CO.: ATEC

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: B-3

SHEET 1 OF 1

FIELD TEST BORING RECORD

Baker

Baker Environmental, Inc.

PROJECT: PIPE LINE

CTO NO.: 19013-S1-SRN

COORDINATES: EAST: _____

ELEVATION: SURFACE: 23.3

BORING NO.: B-4

NORTH: _____

TOP OF STEEL CASING: _____

RIG: <u>B-61</u>					DATE	PROGRESS (FT)	WEATHER	WATER DEPTH (FT)	TIME
	SPLIT SPOON	CASING	AUGERS	CORE BARREL					
SIZE (DIAM.)	<u>1 7/8" ID</u>				<u>1-12-92</u>	<u>8'</u>	<u>mid</u>	<u>6'</u>	<u>1515</u>
LENGTH	<u>2.0</u>								
TYPE	<u>STD</u>								
HAMMER WT.	<u>140 lb</u>								
FALL	<u>30"</u>								
STICK UP									

REMARKS: BORING ADVANCED TO 8' USING ONLY HAMMERED SPLIT SPOON.

DRILL RECORD							VISUAL DESCRIPTION				
DEPTH	SOIL	Sample ID	Samp. Rec.	SPT Blows Per 0.5'	Lab. Class	Lab. M.C. %	Classification (Grain Size, Principal Constituents, Etc.)	Color	Consist. or Density	Moisture Content, Organic Content, Plasticity, and Other Observations	SOIL ELEVATION
	ROCK	Type No. (N = No Samp.)		RQD (Ft & %)	Pen. Rate	P: D	Classification (Name, Grain Size, Principal Constituents, Etc.)	Color	Hardness	Weathering, Bedding, Fracturing, and Other Observations	
1	S1		<u>.9</u> <u>2</u>	1			<u>4" Top Soil</u>	<u>BROWN</u>	<u>SOFT</u>	<u>DRY</u>	<u>22.8</u>
2			<u>46%</u>	4			<u>CLAY</u>	<u>BROWN</u>		<u>DRY</u>	
3	S2		<u>1.16</u> <u>2</u>	4			<u>CLAY</u>				
4			<u>58%</u>	3					<u>SOFT</u>		<u>19.3</u>
5	S3		<u>2</u> <u>2</u>	3			<u>SAND - FINE</u>	<u>BROWN</u>	<u>MED</u>	<u>WET</u>	<u>18.8</u>
6			<u>100%</u>	3			<u>2" CLAY</u>	<u>YELLOW</u>	<u>ST.FE</u>	<u>WET</u>	<u>18.8</u>
7	S4		<u>2</u> <u>2</u>	2			<u>SAND - FINE</u>	<u>BROWN</u>	<u>SOFT</u>	<u>WET</u>	
8			<u>100%</u>	3			<u>SAND - FINE</u>	<u>YELLOW</u>			<u>15.3</u>
9							<u>END OF BORING 8'</u>				
10											

DRILLING CO.: ATEL

DRILLER: LEWIS LEFEVER

BAKER REP.: KENNETH A. TUA

BORING NO.: B-4

SHEET 1 OF 1

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>15'</u>
Hydropunch No.	<u>HP-1</u>	Elevation: Surface	<u>18.7</u>
Date	<u>12-17-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1010</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT BEWIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>22'</u>
Hydropunch No.	<u>HP-2</u>	Elevation: Surface	<u>18.7</u>
Date	<u>12-17-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1055</u>		

SAMPLING

Amount of Sample Collected	<u>2 LITER</u>		
Visual Appearance	<u>SLIGHTLY CLOUDY</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>TEST NOT PERFORMED</u>
Concentration (PPM)	<u> </u>
Type of Hydrocarbon Source	<u> </u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

HANBY NOT PERFORMED TO LACK OF SAMPLE RECOVERED

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-3</u>	Elevation: Surface	<u>19.2</u>
Date	<u>12-17-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1415</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>HEAVY SEDIMENT</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-4</u>	Elevation: Surface	<u>17.4</u>
Date	<u>12-17-91</u>		

INSTALLATION

Drilling Co.	<u>ATEL</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1530</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>
Visual Appearance	<u>SLIGHTLY CLOUDY</u>
Odor Detected	<u> </u> Yes <u>X</u> No
Product Detected	<u> </u> Yes <u>X</u> No
Time Sampled	<u> </u>

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVLİK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>18'</u>
Hydropunch No.	<u>HP-5</u>	Elevation: Surface	<u>23.9</u>
Date	<u>12-18-98</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1130</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>HEAVY SEDIMENT</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Product Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVLIC</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-6</u>	Elevation: Surface	<u>25.3'</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1255</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Product Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-7</u>	Elevation: Surface	<u>22.6'</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1255</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>SLIGHTLY CLOUDY</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Product Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-8</u>	Elevation: Surface	<u>23.1</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1350</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>
Visual Appearance	<u>HEAVY SEDIMENT</u>
Odor Detected	<u> </u> Yes <u>X</u> No
Product Detected	<u> </u> Yes <u>X</u> No
Time Sampled	<u> </u>

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-9</u>	Elevation: Surface	<u>23.3</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEL</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1455</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>
Visual Appearance	<u>HEAVY SEDIMENT</u>
Odor Detected	<u>Yes</u> <u>X</u> No
Product Detected	<u>Yes</u> <u>X</u> No
Time Sampled	<u> </u>

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-10</u>	Elevation: Surface	<u>23</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1530</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Product Detected	<u> </u> Yes	<u>X</u>	<u> </u> No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-11</u>	Elevation: Surface	<u>22.5</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1600</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-12</u>	Elevation: Surface	<u>22.1</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1715</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-13</u>	Elevation: Surface	<u>21.8'</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1640</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>ROBERT SEVCIK</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-14</u>	Elevation: Surface	<u>21.2</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-57</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1645</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-15</u>	Elevation: Surface	<u>22.8</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1105</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-16</u>	Elevation: Surface	<u>24.1'</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1135</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>CLEAR</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-17</u>	Elevation: Surface	<u>25.3</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1230</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER +</u>		
Visual Appearance	<u>HEAVY SEDIMENT</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20'</u>
Hydropunch No.	<u>HP-18</u>	Elevation: Surface	<u>23.7</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1313</u>		

SAMPLING

Amount of Sample Collected	<u>< LITER</u>
Visual Appearance	<u>HEAVY SEDIMENT</u>
Odor Detected	<u> </u> Yes <u> X </u> No
Product Detected	<u> </u> Yes <u> X </u> No
Time Sampled	<u> </u>

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>20</u>
Hydropunch No.	<u>HP-19</u>	Elevation: Surface	<u>23.9</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1440</u>		

SAMPLING

Amount of Sample Collected	<u>1 LITER</u>		
Visual Appearance	<u>HEAVY SEDIMENT</u>		
Odor Detected	<u> </u> Yes	<u>X</u>	No
Product Detected	<u> </u> Yes	<u>X</u>	No
Time Sampled	<u> </u>		

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PENETROMETER RECORD

Project No.	<u>19013-51-SRN</u>	Baker Representative	<u>KENNETH A. TUA</u>
Project Name	<u>PIPE LINE</u>	Total Depth of Probe	<u>22'</u>
Hydropunch No.	<u>HP-20</u>	Elevation: Surface	<u>22, 8'</u>
Date	<u>12-18-91</u>		

INSTALLATION

Drilling Co.	<u>ATEC</u>		
Type of Rig	<u>B-61</u>		
Method:	<u>X</u>	Pushed	<u> </u> Hammered
Sampling Mode:	<u>X</u>	Hydrocarbon	<u> </u> Groundwater
Time Installed	<u>1515</u>		

SAMPLING

Amount of Sample Collected	<u>< .5 LITER</u>
Visual Appearance	<u>HEAVY SEDIMENT</u>
Odor Detected	<u> </u> Yes <u> X </u> No
Product Detected	<u> </u> Yes <u> X </u> No
Time Sampled	<u> </u>

HANBY RESULTS

Color of Precipitate	<u>WHITE</u>
Concentration (PPM)	<u>0</u>
Type of Hydrocarbon Source	<u>UNDETERMINED</u>

COMMENTS

HYDRO-PUNCH USED IN HYDROCARBON SAMPLING MODE DUE TO THE
INSUFFICIENT AMOUNT OF SAMPLE RECOVERED USING GROUND WATER
MODE. EACH HYDRO-PUNCH WAS SAMPLED APPROXIMATELY 30 TO 40 MINUTES
AFTER INSTALLATION TO ALLOW FOR RECOVERY AND SETTLING OF SEDIMENT.

PRODUCT AND ODOR WAS OBSERVED WHEN HYDRO-PUNCH WAS REMOVED.

APPENDIX C
WELL CONSTRUCTION RECORDS

ABOVE GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-51-SRN

PROJECT NAME: PIPE LINE

WELL No.: Mw-1

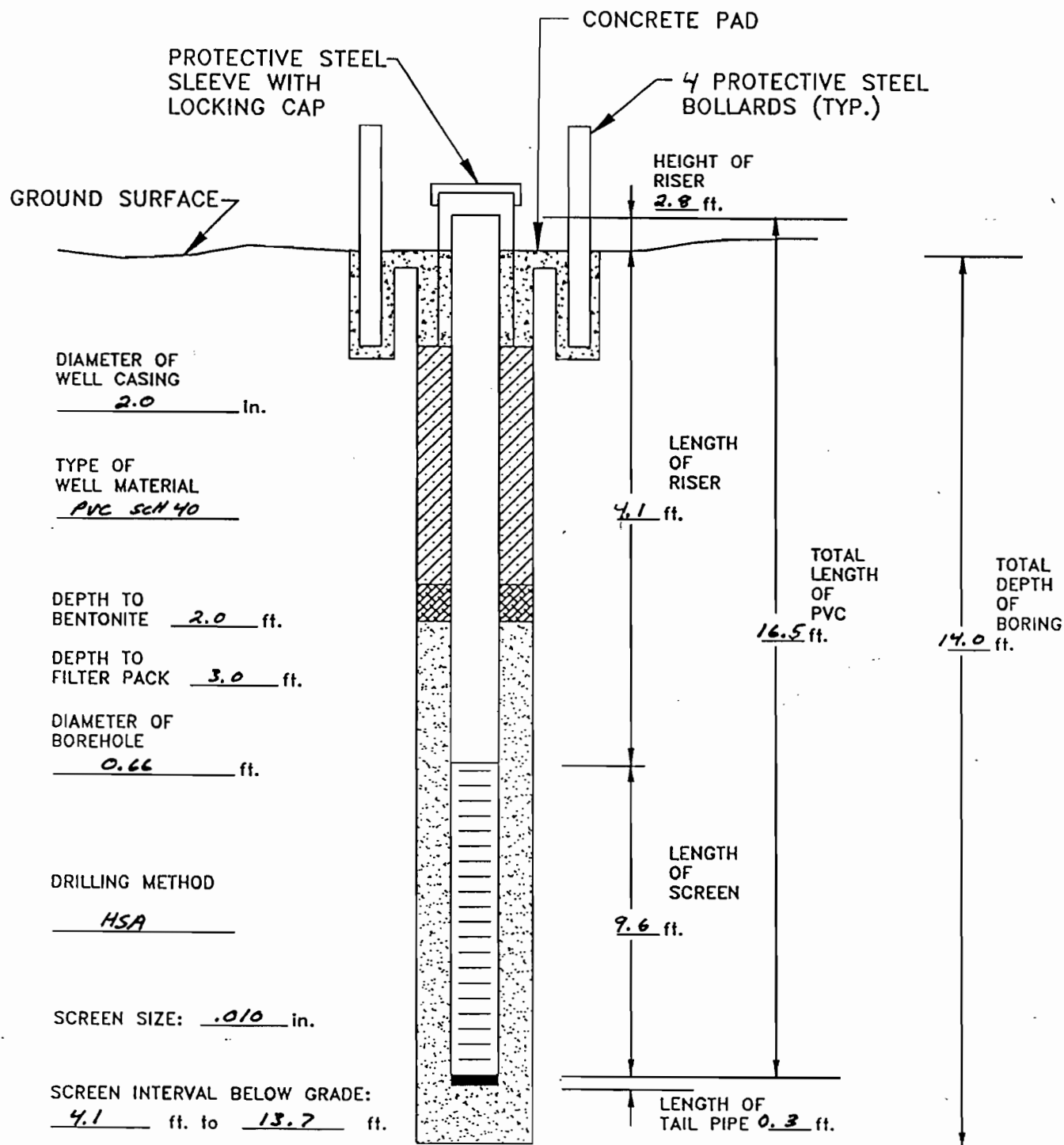
DRILLING CO.: ATEC

DATE STARTED: 1-8-92

DATE COMPLETED: 1-8-72

DATE DEVELOPED: 1-18-92

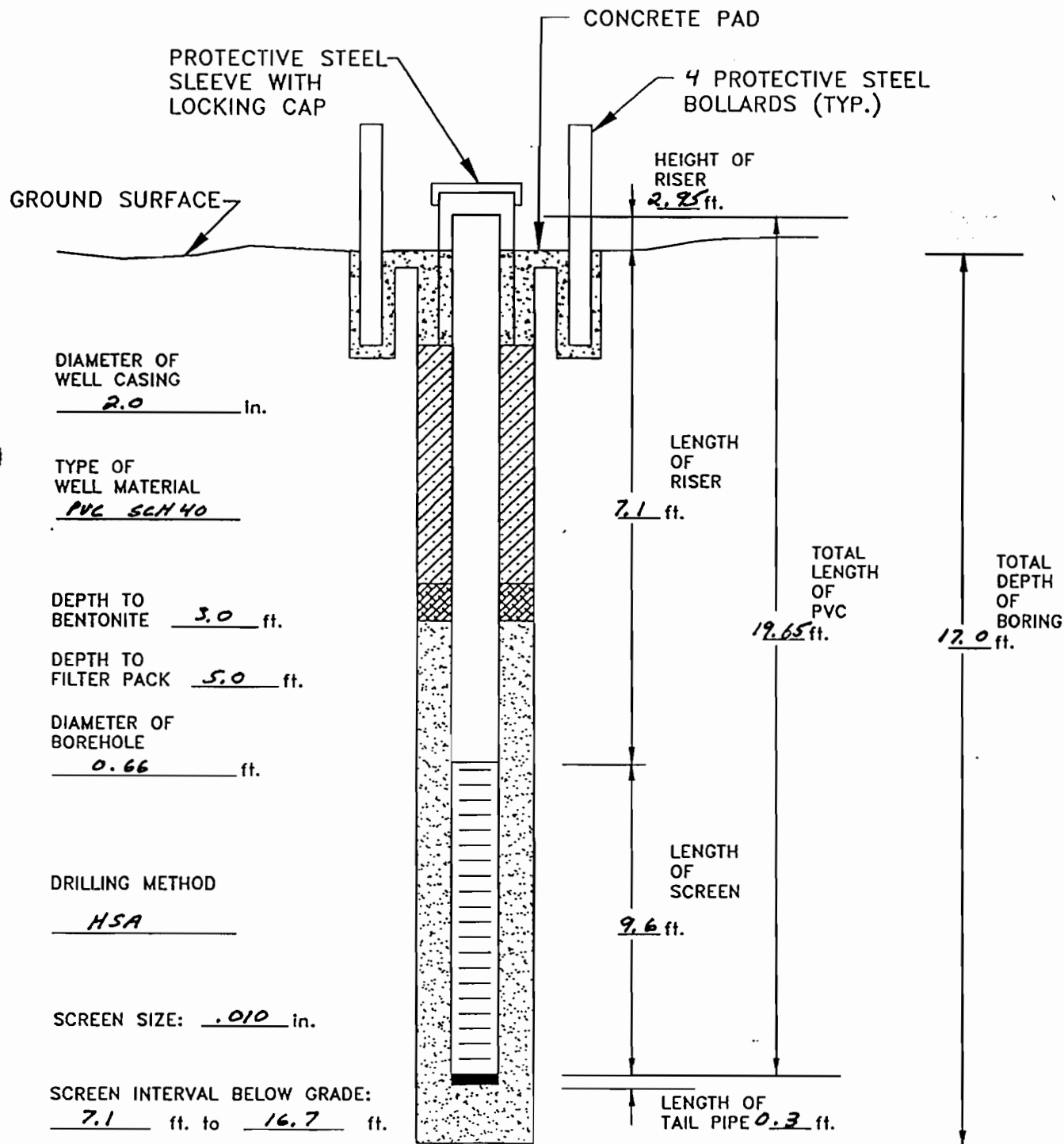
DEVELOPMENT METHOD: PUMP

BAKER ENVIRONMENTAL REPRESENTATIVE: *KENNETH A. TUA*

Baker

Baker Environmental, Inc.

ABOVE GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-SI-SRNPROJECT NAME: PIPE LINEWELL No.: MW-2DRILLING CO.: ATECDATE STARTED: 1-8-92DATE COMPLETED: 1-8-92DATE DEVELOPED: 1-12-92DEVELOPMENT METHOD: PUMPBAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

BELOW GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-51-SRN

PROJECT NAME: PIPE LINE

WELL No.: MW-3

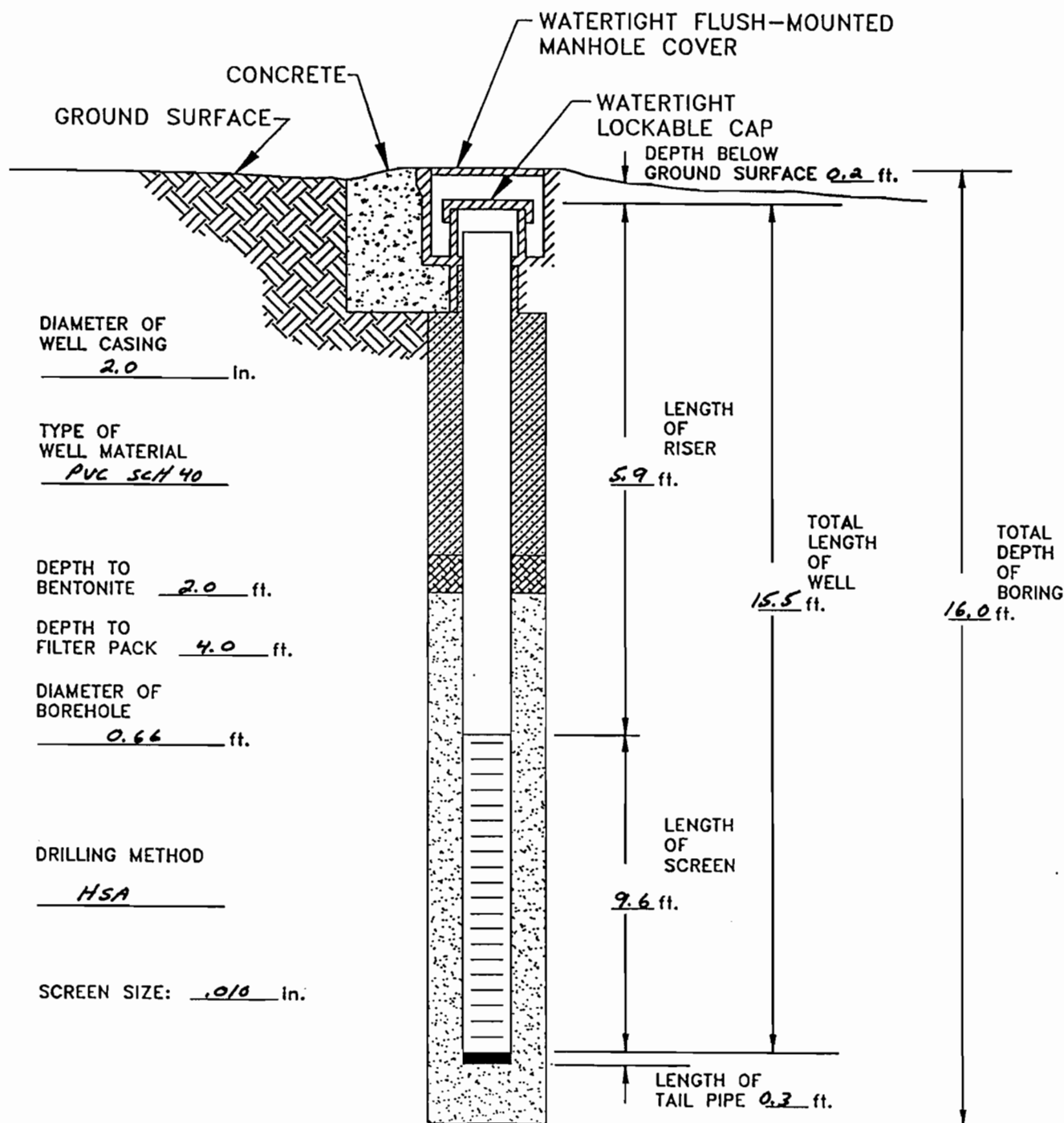
DRILLING CO.: ATEL

DATE STARTED: 1-11-92

DATE COMPLETED: 1-11-92

DATE DEVELOPED: 1-15-92

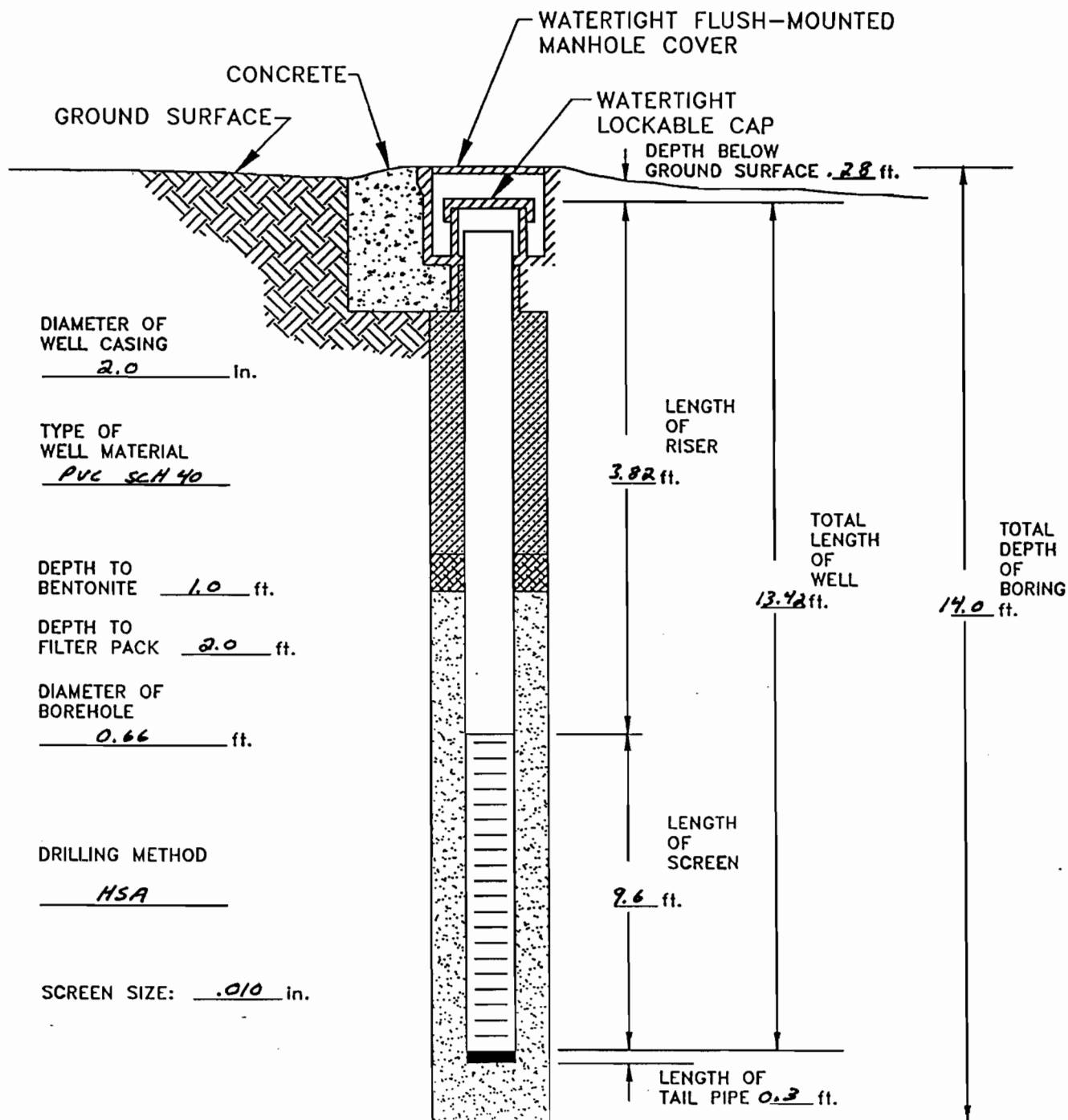
DEVELOPMENT METHOD: PUMP



BELOW GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-51-SRN
 PROJECT NAME: PIPE LINE
 WELL No.: MW-4
 DRILLING CO.: ATEC

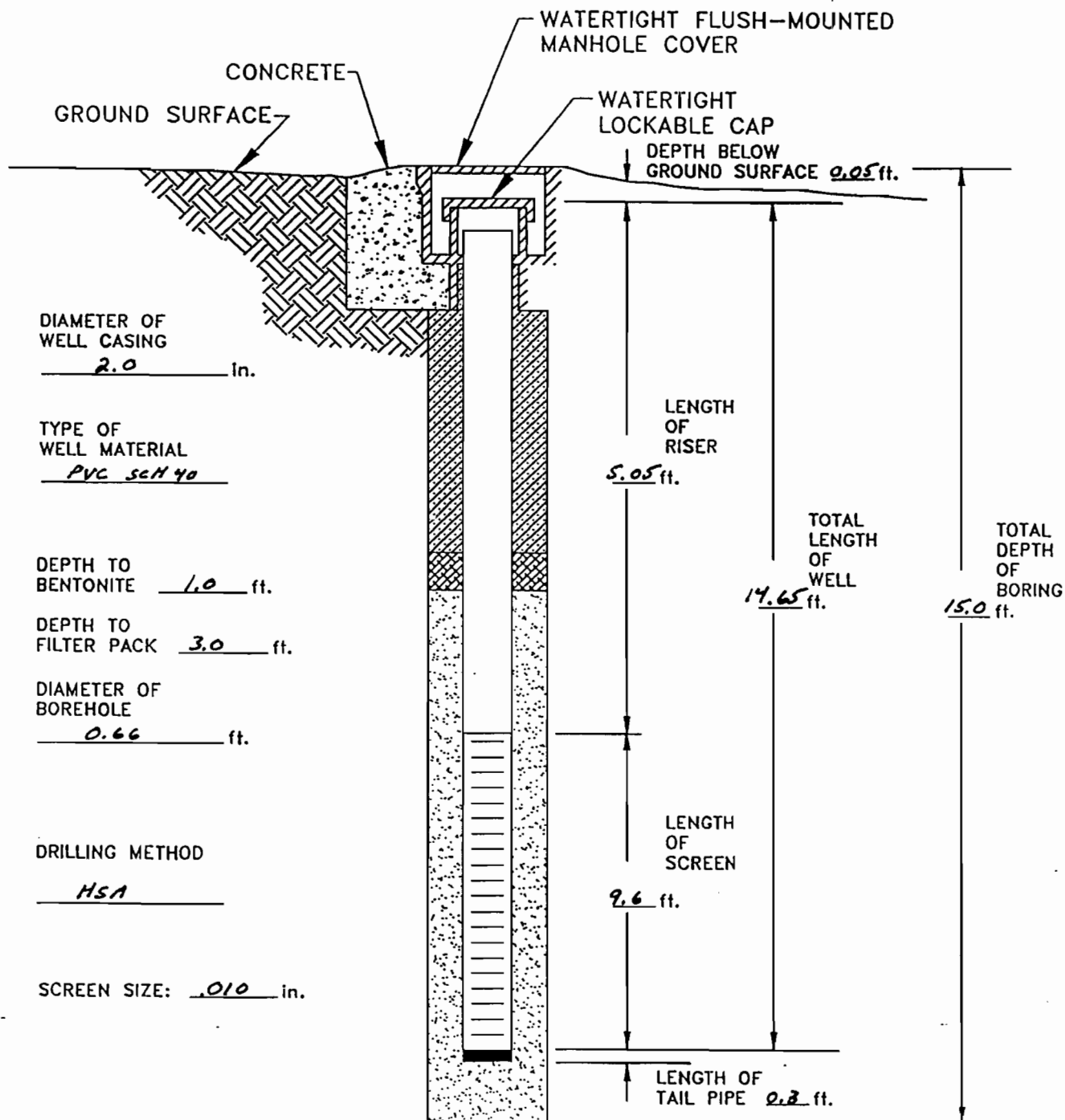
DATE STARTED: 1-11-92
 DATE COMPLETED: 1-11-92
 DATE DEVELOPED: 1-15-92
 DEVELOPMENT METHOD: PUMP



BELOW GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-51-SRN
 PROJECT NAME: PIPE LINE
 WELL No.: MW-5
 DRILLING CO.: ATEC

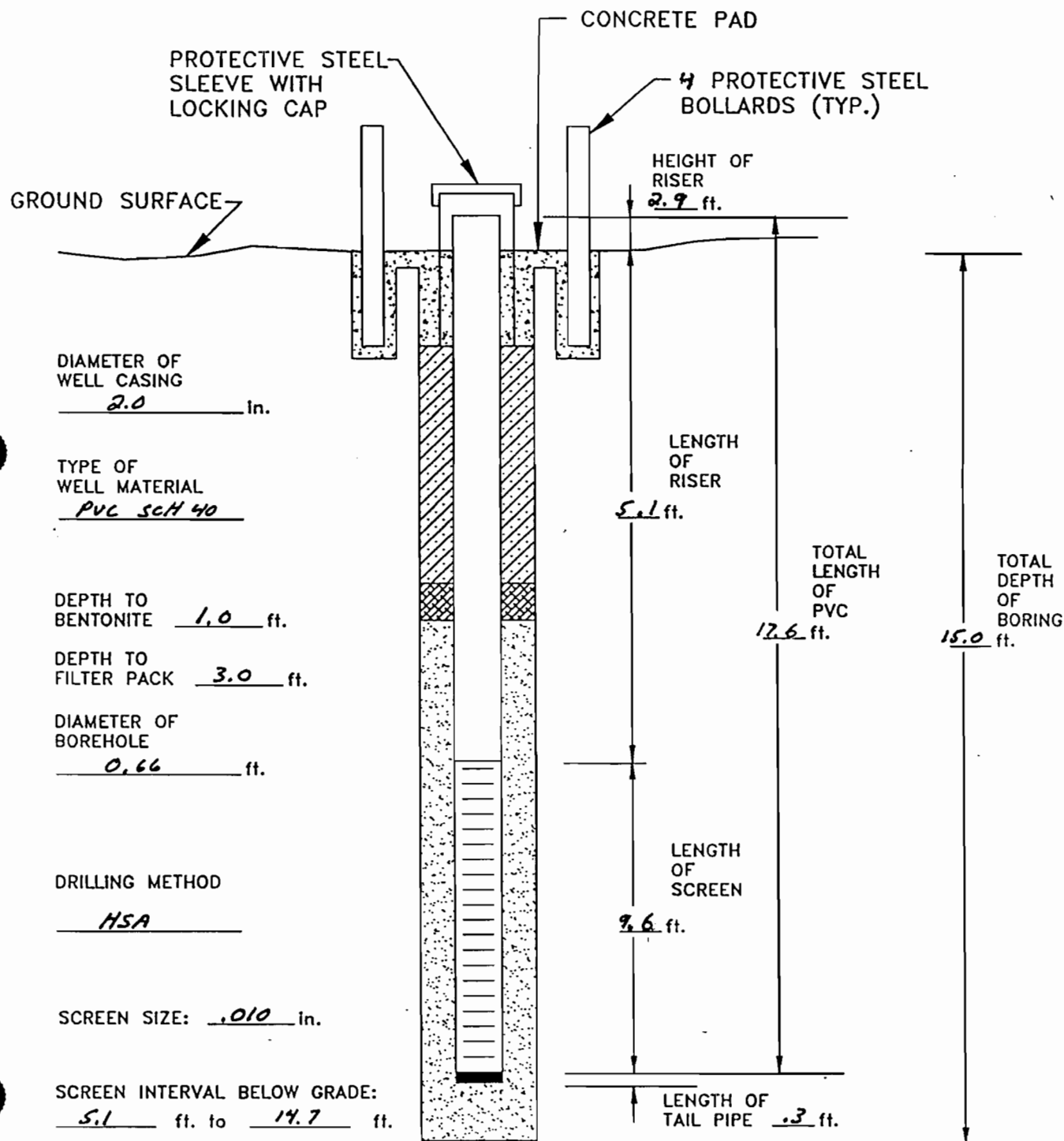
DATE STARTED: 1-12-92
 DATE COMPLETED: 1-12-92
 DATE DEVELOPED: 1-15-92
 DEVELOPMENT METHOD: PUMP



Baker

Baker Environmental, Inc.

ABOVE GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-S1-SRNDATE STARTED: 1-14-92PROJECT NAME: PIPE LINEDATE COMPLETED: 1-14-92WELL No.: MW-6DATE DEVELOPED: 1-15-92DRILLING CO.: ATECDEVELOPMENT METHOD: PUMPBAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

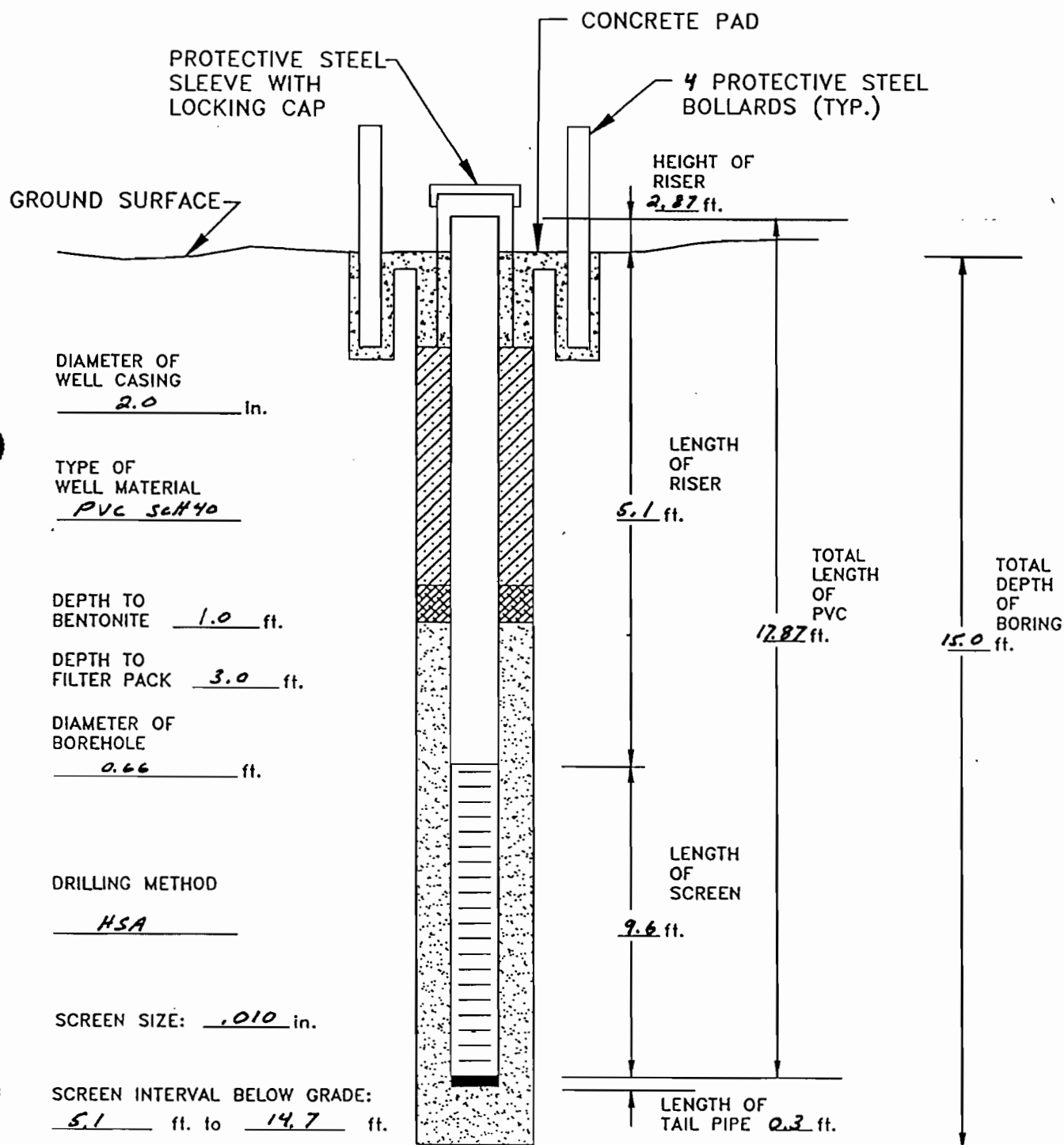
Baker

Environmental, Inc.

ABOVE GRADE TYPE II MONITORING WELL

PROJECT No.: 19013-SI-SRN
PROJECT NAME: PIPE LINE
WELL No.: MW-7
DRILLING CO.: ATEC

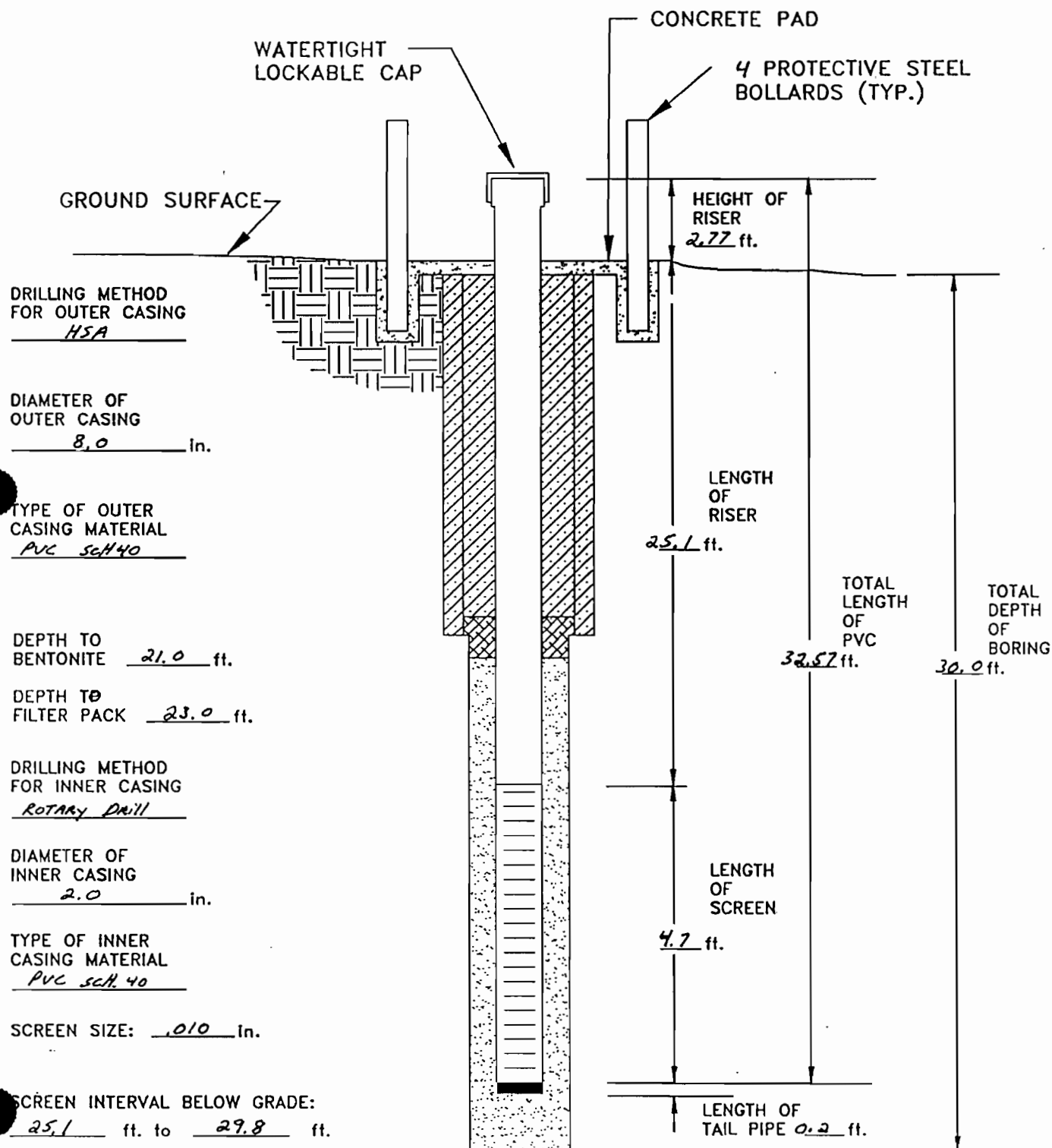
DATE STARTED: 1-14-92
DATE COMPLETED: 1-14-92
DATE DEVELOPED: 1-15-92
DEVELOPMENT METHOD: PUMP

BAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

Baker

Baker Environmental, Inc.

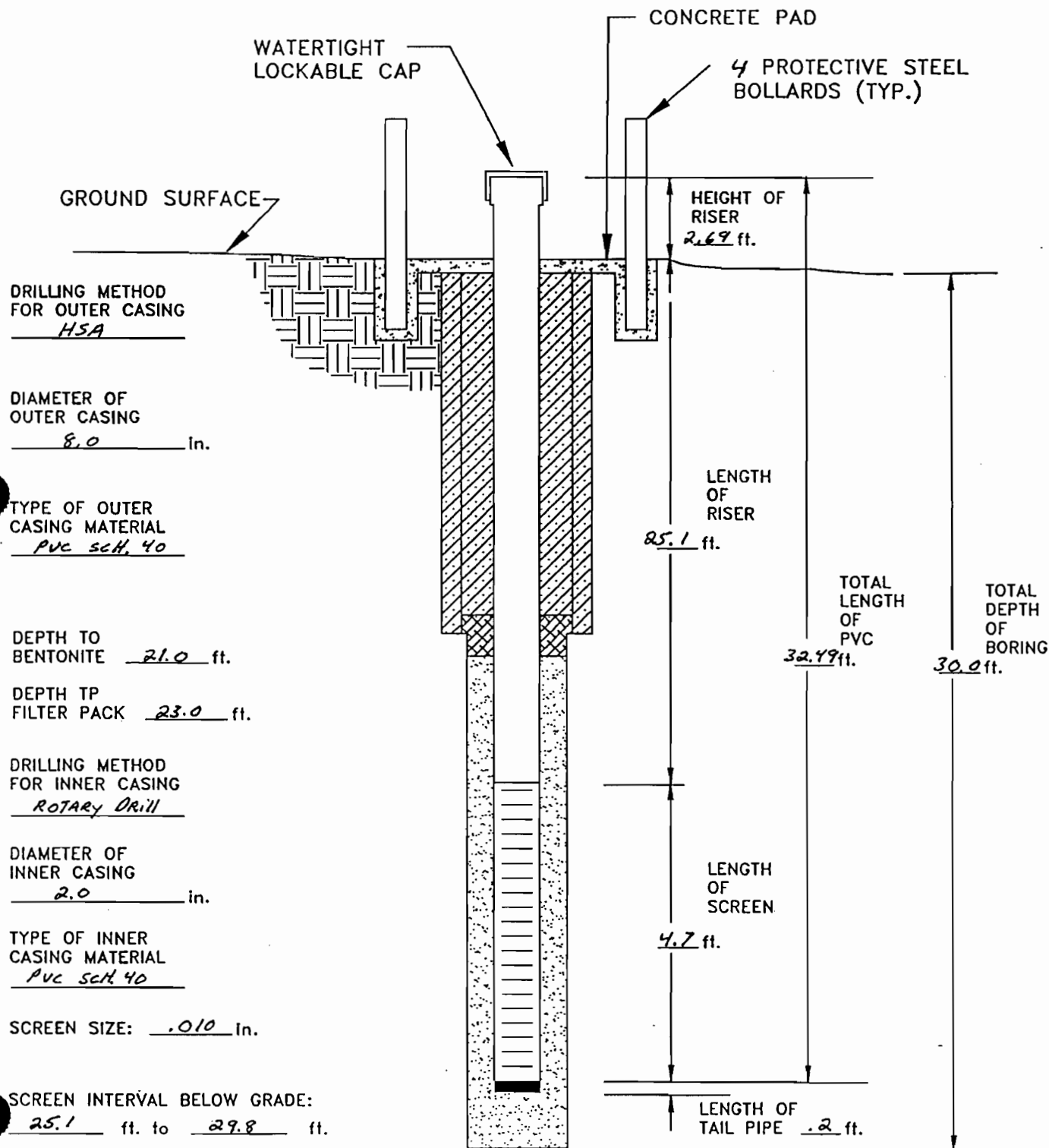
ABOVE GRADE TYPE III MONITORING WELL

PROJECT No.: 19013-S1-SRNPROJECT NAME: PIPE LINEWELL No.: DW-1DRILLING CO.: ATECDATE STARTED: 1-8-92DATE COMPLETED: 1-10-92DATE DEVELOPED: 1-11-92DEVELOPMENT METHOD: PUMPBAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

Baker

Baker Environmental, Inc.

ABOVE GRADE TYPE III MONITORING WELL

PROJECT No.: 19013-51-SRNPROJECT NAME: PIPE LINEWELL No.: DW-2DRILLING CO.: ATECDATE STARTED: 1-9-92DATE COMPLETED: 1-10-92DATE DEVELOPED: 1-11-92DEVELOPMENT METHOD: PUMPBAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

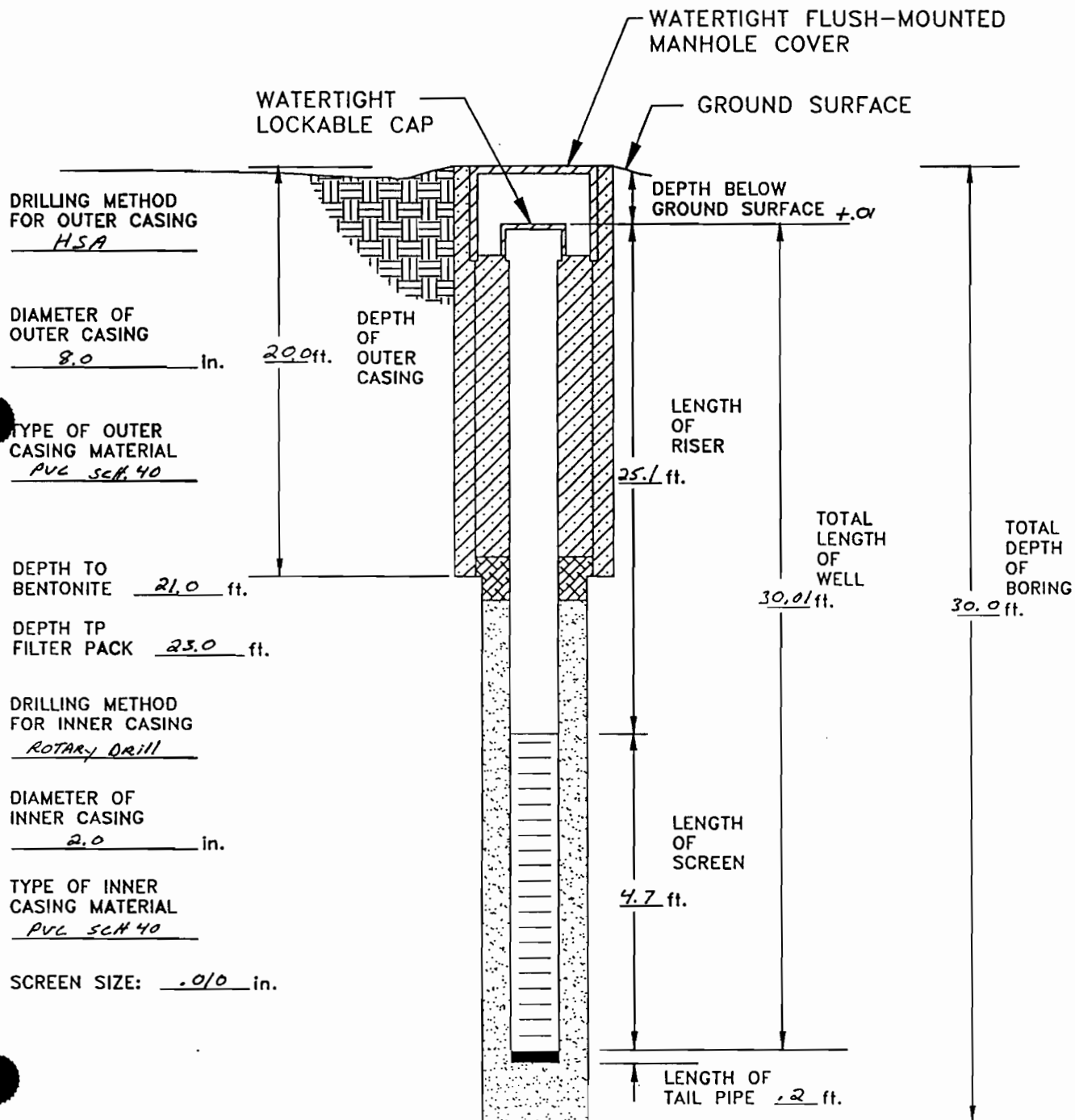
Baker

Baker Environmental, Inc.

BELOW GRADE TYPE III MONITORING WELL

PROJECT No.: 19013-51-SRN
PROJECT NAME: PIPE LINE
WELL No.: DW-3
DRILLING CO.: ATEC

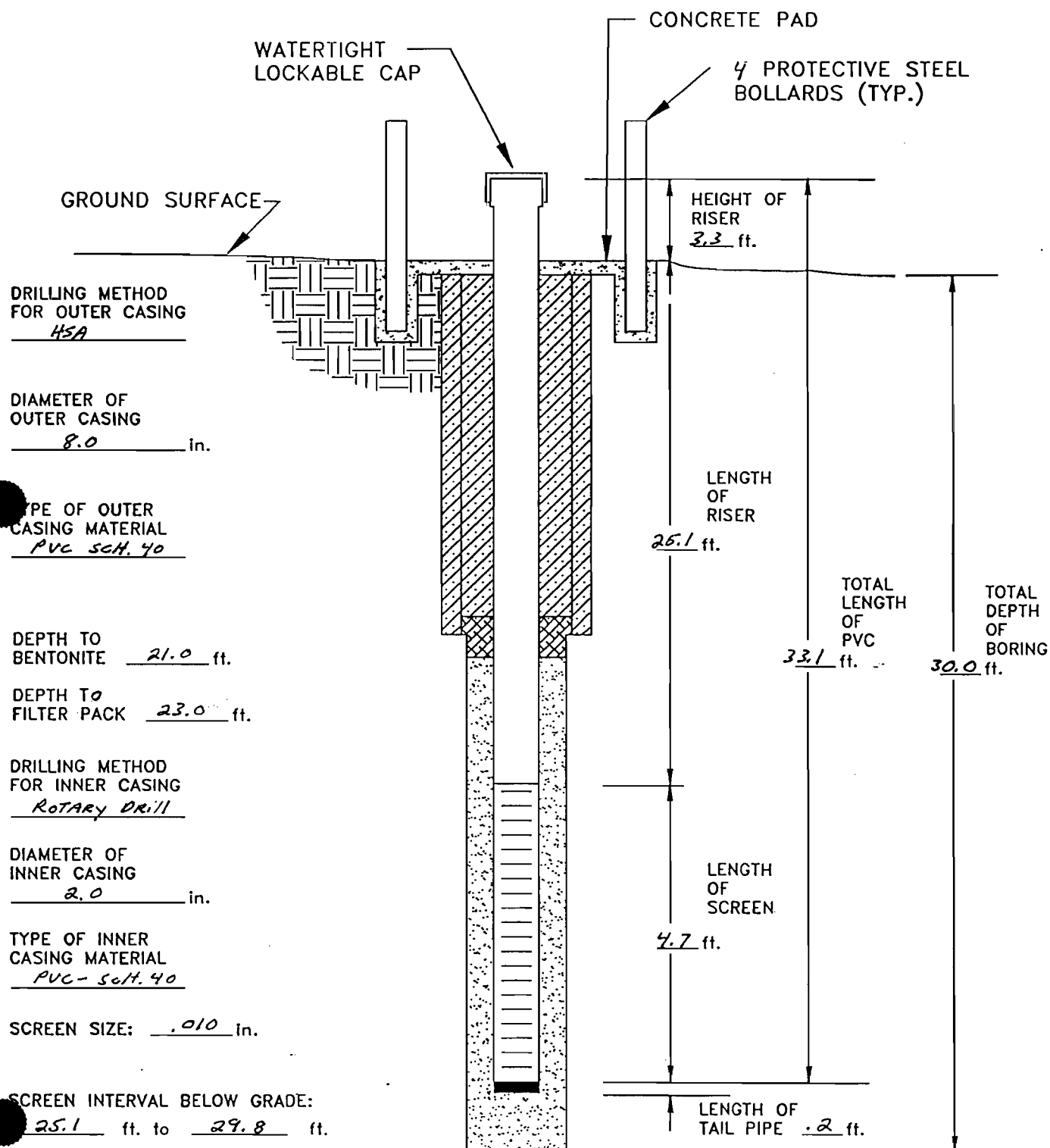
DATE STARTED: 1-11-92
DATE COMPLETED: 1-12-92
DATE DEVELOPED: 1-15-92
DEVELOPMENT METHOD: PUMP

BAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

Baker

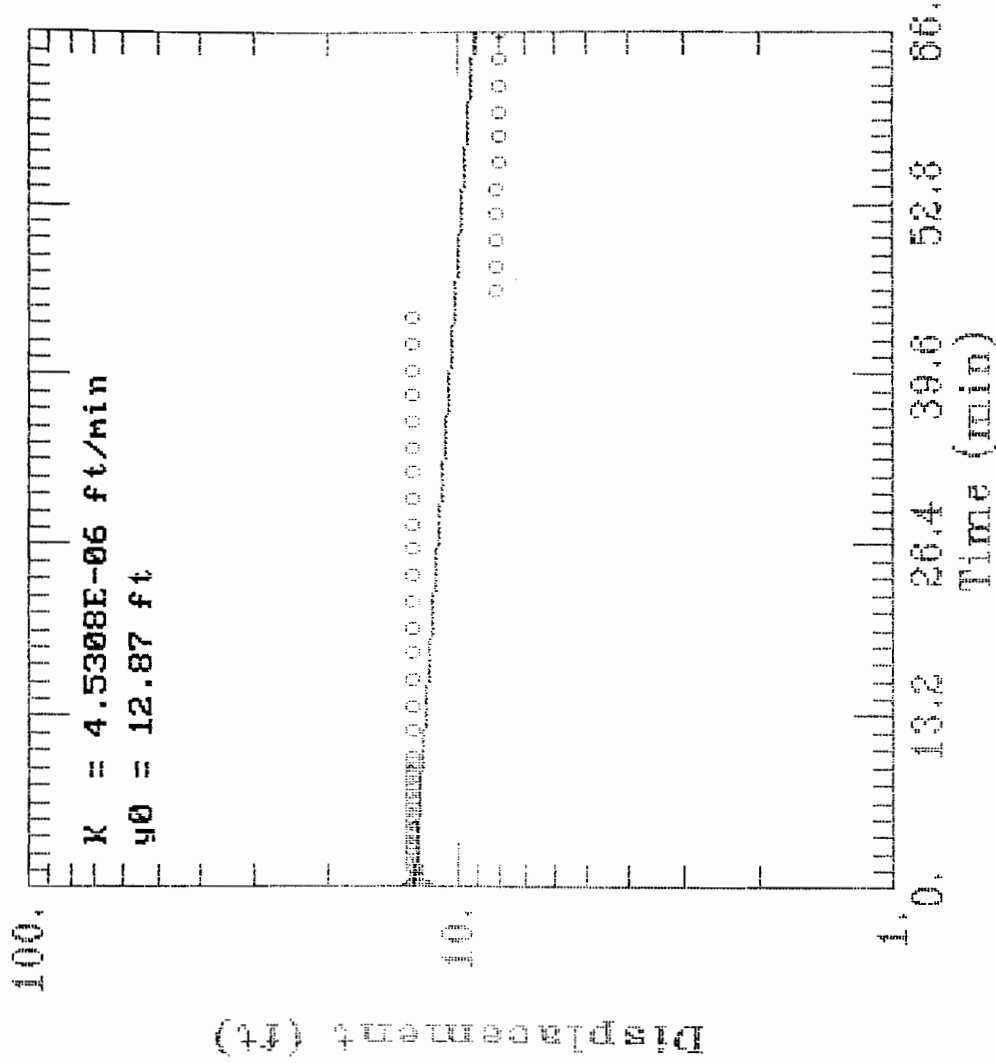
Baker Environmental, Inc.

ABOVE GRADE TYPE III MONITORING WELL

PROJECT No.: 19013-51-SRNPROJECT NAME: PIPE LINEWELL No.: DW-4DRILLING CO.: ATECDATE STARTED: 1-14-92DATE COMPLETED: 1-15-92DATE DEVELOPED: 1-15-92DEVELOPMENT METHOD: PUMPBAKER ENVIRONMENTAL REPRESENTATIVE: KENNETH A. TUA

APPENDIX D
HYDRAULIC CONDUCTIVITY DATA

MW-2 FALLING



AQTESOLV

GERAGHTY
& MILLER, INC.

Modeling Group

AGTESOLV RESULTS

Version 1.10

02/10/92

16:53:08

TEST DESCRIPTION

Data set..... b:MW-2F.DAT

Data set title..... MW-2 FALLING

Knowns and Constants:

No. of data points..... 92
 Radius of well casing..... 0.08
 Radius of well..... 0.33
 Aquifer saturated thickness..... 12.77
 Well screen length..... 9.75
 Static height of water in well..... 12.77
 Log(R_e/R_w)..... 2.724
 A, B, C..... 0.000, 0.000, 1.955

ANALYTICAL METHOD

Bouwer and Rice (unconfined aquifer slug test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate	Std. Error
X =	4.5308E-006 +/-	4.4571E-007
y0 =	1.2875E+001 +/-	1.2450E-001

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed

weighted residual = residual * weight

Weighted Residual Statistics:

Number of residuals..... 92
 Number of estimated parameters.... 2
 Degrees of freedom..... 90
 Residual mean..... -0.002709
 Residual standard deviation..... 0.9668
 Residual variance..... 0.9346

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	12.763	12.875	-0.11152	1
0.0066	12.7	12.874	-0.1743	1
0.01	12.713	12.974	-0.16108	1
0.0133	12.574	12.874	-0.29986	1
0.0166	12.247	12.874	-0.62665	1
0.02	12.071	12.873	-0.80243	1
0.0233	12.103	12.873	-0.77021	1
0.0266	12.656	12.873	-0.217	1
0.03	12.184	12.873	-0.68878	1
0.0333	11.939	12.873	-0.93356	1
0.05	12.902	12.671	0.030529	1
0.0666	12.512	12.87	-0.35839	1
0.0833	12.562	12.869	-0.3073	1
0.1	12.486	12.868	-0.38221	1
0.1166	12.505	12.867	-0.36213	1
0.1333	12.505	12.866	-0.36104	1
0.15	12.518	12.865	-0.34695	1
0.1666	12.518	12.864	-0.34587	1
0.1833	12.524	12.863	-0.33878	1
0.2	12.53	12.862	-0.33169	1
0.2166	12.537	12.861	-0.32361	1
0.2333	12.537	12.86	-0.32252	1
0.25	12.543	12.858	-0.31543	1
0.2666	12.549	12.857	-0.30835	1
0.2833	12.549	12.856	-0.30726	1
0.3	12.556	12.855	-0.29918	1
0.3166	12.562	12.854	-0.29209	1
0.3333	12.562	12.853	-0.29101	1
0.4166	12.574	12.848	-0.27358	1
0.5	12.587	12.842	-0.25516	1
0.5833	12.6	12.837	-0.23674	1
0.6666	12.606	12.831	-0.22532	1
0.75	12.612	12.826	-0.2139	1
0.8333	12.619	12.82	-0.20149	1
0.9166	12.625	12.815	-0.19007	1
1	12.631	12.81	-0.17866	1
1.0933	12.637	12.804	-0.16661	1
1.1666	12.637	12.799	-0.16185	1
1.25	12.644	12.793	-0.14944	1
1.3333	12.65	12.788	-0.13805	1
1.4166	12.65	12.783	-0.13265	1
1.5	12.656	12.777	-0.12125	1
1.5833	12.663	12.772	-0.10886	1
1.6666	12.663	12.766	-0.10347	1
1.75	12.669	12.761	-0.092073	1
1.8333	12.669	12.756	-0.086688	1
1.9166	12.675	12.75	-0.075305	1
2	12.675	12.745	-0.069918	1
2.5	12.688	12.713	-0.024669	1
3	12.7	12.681	0.019498	1
3.5	12.713	12.648	0.064583	1
4	12.719	12.616	0.10259	1
4.5	12.726	12.584	0.14151	1
5	12.732	12.553	0.17935	1
5.5	12.744	12.521	0.22312	1
6	12.744	12.489	0.2543	1
6.5	12.744	12.458	0.2864	1
7	12.751	12.426	0.32492	1

8	12.757	12.363	0.39372	1
8.5	12.757	12.332	0.42501	1
9	12.757	12.301	0.45621	1
9.5	12.757	12.27	0.48734	1
10	12.763	12.239	0.52438	1
12	12.776	12.115	0.66078	1
14	12.776	11.993	0.78294	1
16	12.776	11.872	0.90386	1
18	12.776	11.752	1.0236	1
20	12.776	11.634	1.1421	1
22	12.776	11.517	1.2594	1
24	12.776	11.401	1.3755	1
26	12.776	11.286	1.4904	1
28	12.776	11.171	1.6042	1
30	12.776	11.059	1.7169	1
32	12.776	10.948	1.8284	1
34	12.776	10.837	1.9388	1
36	12.776	10.726	2.048	1
38	12.726	10.62	2.1062	1
40	12.726	10.513	2.2133	1
42	12.726	10.407	2.3193	1
44	12.719	10.302	2.4172	1
46	8.105	10.198	-2.0929	1
48	8.099	10.095	-1.9961	1
50	8.099	9.9933	-1.8943	1
52	8.105	9.8925	-1.7875	1
54	8.086	9.7928	-1.7068	1
56	8.08	9.6941	-1.6141	1
58	8.08	9.5963	-1.5163	1
60	8.067	9.4996	-1.4326	1
62	8.074	9.4038	-1.3298	1
64	8.074	9.309	-1.235	1
66	8.055	9.2151	-1.1601	1

=====

RESULTS FROM VISUA

SE1000C
Environmental Logger
01/22 15:28

Unit# 01606 Test 5

INPUT 1: Level (F) TOC

Reference 12.770
Linearity 0.120
Scale factor 19.890
Offset -0.140
Delay mSEC 50.000

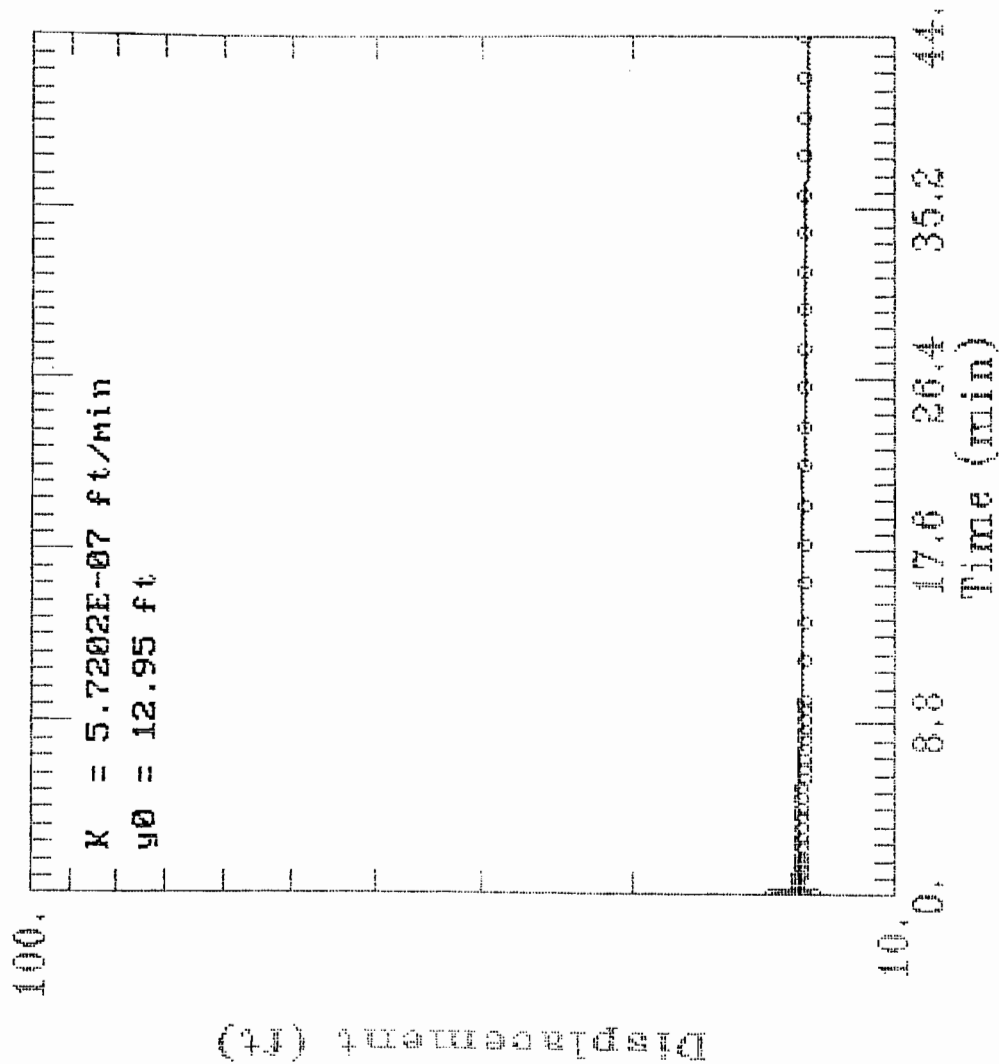
Step 0 01/15 10:09:54

Elapsed Time	INPUT 1
0.0000	12.763
0.0033	12.763
0.0066	12.700
0.0100	12.713
0.0133	12.574
0.0166	12.247
0.0200	12.071
0.0233	12.103
0.0266	12.656
0.0300	12.184
0.0333	11.939
0.0500	12.902
0.0666	12.512
0.0833	12.562
0.1000	12.486
0.1166	12.505
0.1333	12.505
0.1500	12.518
0.1666	12.518
0.1833	12.524
0.2000	12.530
0.2166	12.537
0.2333	12.537
0.2500	12.543
0.2666	12.549
0.2833	12.549
0.3000	12.556
0.3166	12.562
0.3333	12.562
0.4166	12.574
0.5000	12.587
0.5833	12.600
0.6666	12.606
0.7500	12.612
0.8333	12.619
0.9166	12.625
1.0000	12.631
1.0833	12.637
1.1666	12.637
1.2500	12.644
1.3333	12.650

1.4166	12.650
1.5000	12.656
1.5833	12.663
1.6666	12.663
1.7500	12.669
1.8333	12.669
1.9166	12.675
2.0000	12.675
2.5000	12.688
3.0000	12.700
3.5000	12.713
4.0000	12.719
4.5000	12.726
5.0000	12.732
5.5000	12.744
6.0000	12.744
6.5000	12.744
7.0000	12.751
7.5000	12.751
8.0000	12.757
8.5000	12.757
9.0000	12.757
9.5000	12.757
10.0000	12.763
12.0000	12.776
14.0000	12.776
16.0000	12.776
18.0000	12.776
20.0000	12.776
22.0000	12.776
24.0000	12.776
26.0000	12.776
28.0000	12.776
30.0000	12.776
32.0000	12.776
34.0000	12.776
36.0000	12.776

CTO 0013
Pipe Line MW 2
Falling Test

MW-2 RISING



AQTESOLV

GERAGHTY
& MILLER, INC.

Modeling Group

16:40:55

Data set..... R:NW-2R.DAT

Data set title..... KW-2 RISING

No. of data points.....	81
Radius of well casing.....	0.08
Radius of well.....	0.33
Aquifer saturated thickness.....	12.77
Well screen length.....	9.75
Static height of water in well.....	12.77
Log(Re/Rw).....	2.724
A, B, C.....	0.000, 0.000, 1.955

Bouwer and Rice (unconfined aquifer slug test)

	Estimate	Std. Error
K =	5.7202E-007 +/-	1.4402E-007
y0 =	1.2946E+001 +/-	2.8562E-002

```
residual = calculated - observed
weighted residual = residual * weight
```

Number of residuals.....	81
Number of estimated parameters....	2
Degrees of freedom.....	79
Residual mean.....	1.939E-006
Residual standard deviation.....	0.2167
Residual variance.....	0.04698

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	13.116	12.946	0.16991	1
0.0066	12.7	12.946	-0.24606	1
0.01	12.386	12.946	-0.56003	1
0.0133	13.613	12.946	0.667	1
0.0166	13.843	12.946	0.89902	1
0.02	12.889	12.946	-0.056947	1
0.0233	13.204	12.946	0.25808	1
0.0266	13.518	12.946	0.57211	1
0.03	13.449	12.946	0.50314	1
0.0333	13.336	12.946	0.39016	1
0.05	13.524	12.946	0.5783	1
0.0666	13.304	12.946	0.35844	1
0.0833	13.178	12.945	0.23258	1
0.1	13.122	12.945	0.17672	1
0.1166	13.034	12.945	0.088833	1
0.1333	13.009	12.945	0.063991	1
0.15	12.99	12.945	0.045129	1
0.1666	12.983	12.945	0.038267	1
0.1833	12.971	12.945	0.026405	1
0.2	12.965	12.944	0.020543	1
0.2166	12.958	12.944	0.013681	1
0.2333	12.952	12.944	0.0078189	1
0.25	12.946	12.944	0.0019572	1
0.2666	12.939	12.944	-0.0049054	1
0.2833	12.939	12.944	-0.0047671	1
0.3	12.933	12.944	-0.010629	1
0.3166	12.933	12.943	-0.010491	1
0.3333	12.927	12.943	-0.016353	1
0.4166	12.908	12.943	-0.034663	1
0.5	12.895	12.942	-0.046973	1
0.5833	12.883	12.941	-0.058283	1
0.6666	12.87	12.941	-0.070594	1
0.75	12.87	12.94	-0.069903	1
0.8333	12.858	12.939	-0.081214	1
0.9166	12.851	12.939	-0.087524	1
1	12.851	12.938	-0.086834	1
1.0933	12.839	12.937	-0.098062	1
1.1666	12.832	12.936	-0.10446	1
1.25	12.832	12.936	-0.10376	1
1.3333	12.826	12.935	-0.10908	1
1.4166	12.826	12.934	-0.10839	1
1.5	12.82	12.934	-0.1137	1
1.5833	12.814	12.933	-0.11901	1
1.6666	12.814	12.932	-0.11832	1
1.75	12.807	12.932	-0.12463	1
1.8333	12.807	12.931	-0.12394	1
1.9166	12.801	12.93	-0.12925	1
2	12.801	12.93	-0.12856	1
2.5	12.782	12.925	-0.14343	1
3	12.77	12.921	-0.15129	1
3.5	12.763	12.917	-0.15416	1
4	12.751	12.913	-0.16203	1
4.5	12.744	12.909	-0.1649	1
5	12.744	12.905	-0.16077	1
5.5	12.738	12.901	-0.16264	1
6	12.732	12.897	-0.16452	1
6.5	12.732	12.892	-0.16039	1
7	12.726	12.888	-0.16227	1
7.5	12.721	12.884	-0.16315	1

8	12.726	12.88	-0.15403	1
8.5	12.726	12.876	-0.14991	1
9	12.726	12.872	-0.14579	1
9.5	12.726	12.868	-0.14167	1
10	12.719	12.864	-0.14456	1
12	12.732	12.847	-0.11511	1
14	12.732	12.831	-0.098685	1
16	12.732	12.814	-0.08228	1
18	12.732	12.798	-0.065895	1
20	12.732	12.782	-0.049532	1
22	12.726	12.765	-0.039189	1
24	12.732	12.749	-0.016868	1
26	12.726	12.733	-0.0065667	1
28	12.726	12.716	0.0097133	1
30	12.732	12.7	0.031973	1
32	12.726	12.684	0.042211	1
34	12.726	12.668	0.058429	1
36	12.726	12.651	0.074625	1
38	12.726	12.635	0.090802	1
40	12.726	12.619	0.10696	1
42	12.726	12.603	0.12309	

SE1000C
Environmental Logger
01/22 15:29

Unit# 01606 Test 5

INPUT 1: Level (F) TOC

Reference 12.770
Linearity 0.120
Scale factor 19.890
Offset -0.140
Delay mSEC 50.000

Step 1 01/15 10:47:40

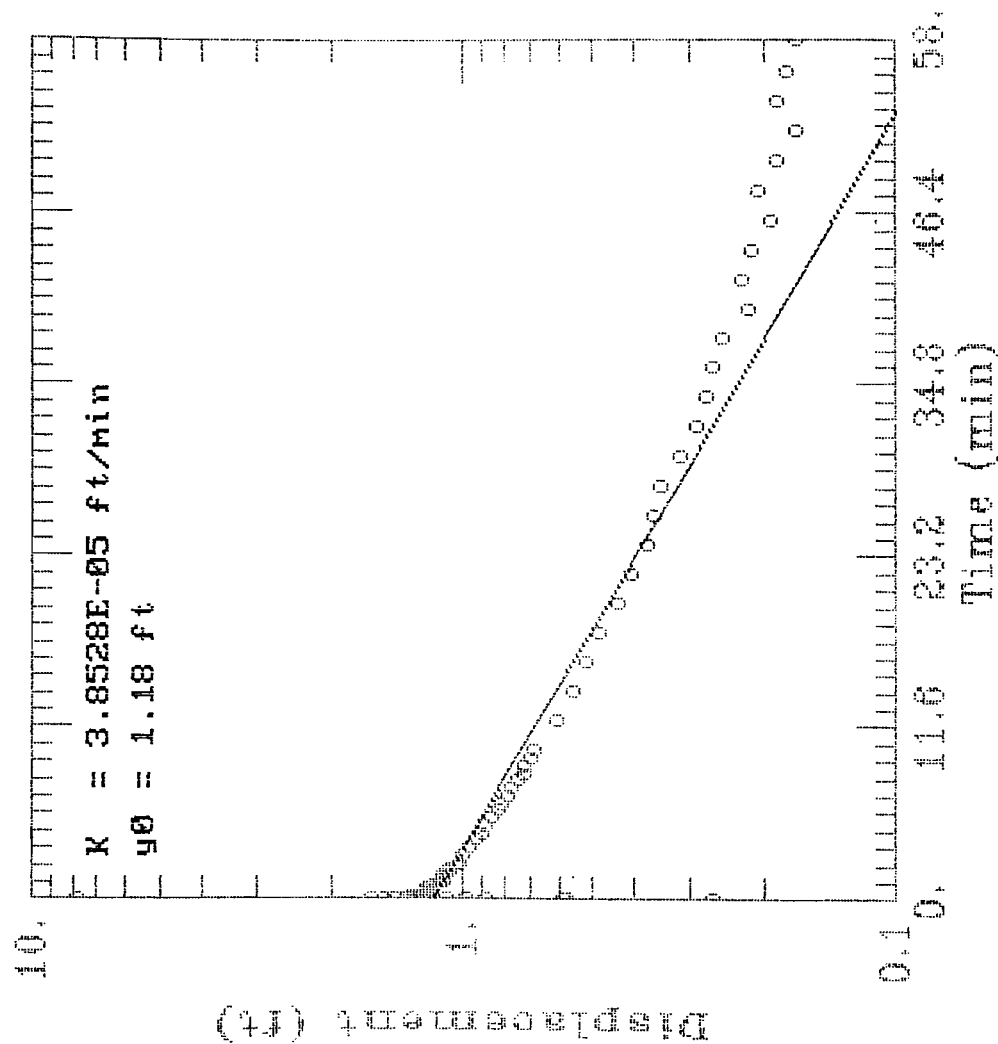
Elapsed Time INPUT 1

0.0000	13.078
0.0033	13.116
0.0066	12.700
0.0100	12.386
0.0133	13.613
0.0166	13.845
0.0200	12.889
0.0233	13.204
0.0266	13.518
0.0300	13.449
0.0333	13.336
0.0500	13.524
0.0666	13.304
0.0833	13.178
0.1000	13.122
0.1166	13.034
0.1333	13.009
0.1500	12.990
0.1666	12.983
0.1833	12.971
0.2000	12.965
0.2166	12.958
0.2333	12.952
0.2500	12.946
0.2666	12.939
0.2833	12.939
0.3000	12.933
0.3166	12.933
0.3333	12.927
0.4166	12.908
0.5000	12.895
0.5833	12.883
0.6666	12.870
0.7500	12.870
0.8333	12.858
0.9166	12.851
1.0000	12.851
1.0833	12.839
1.1666	12.832
1.2500	12.832
1.3333	12.826

1.4166	12.826
1.5000	12.820
1.5833	12.814
1.6666	12.814
1.7500	12.807
1.8333	12.807
1.9166	12.801
2.0000	12.801
2.5000	12.782
3.0000	12.770
3.5000	12.763
4.0000	12.751
4.5000	12.744
5.0000	12.744
5.5000	12.738
6.0000	12.732
6.5000	12.732
7.0000	12.726
7.5000	12.726
8.0000	12.726
8.5000	12.726
9.0000	12.726
9.5000	12.726
10.0000	12.719
12.0000	12.732
14.0000	12.732
16.0000	12.732
18.0000	12.732
20.0000	12.732
22.0000	12.726
24.0000	12.732
26.0000	12.726
28.0000	12.726
30.0000	12.732
32.0000	12.726
34.0000	12.726
36.0000	12.726
38.0000	12.726
40.0000	12.726
42.0000	12.726
44.0000	12.719

CTO-0013
PIPE LINE MW 2
Rising Test

MW-3 FALLING



AQTESOLV

GERAGHTY
& MILLER, INC.
Modeling Group

ADTESOLV RESULTS
Version 1.10

02/10/92

17:05:58

TEST DESCRIPTION

Data set..... b:MW-3F.DAT
Data set title.... MW-3 FALLING

Knowns and Constants:

No. of data points..... 88
Radius of well casing..... 0.08
Radius of well..... 0.33
Aquifer saturated thickness..... 9.08
Well screen length..... 9.75
Static height of water in well..... 9.08
Log(Re/Rw)..... 2.513
A, B, C..... 0.000, 0.000, 1.955

ANALYTICAL METHOD

Cooker and Rice (unconfined aquifer slug test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate	Std. Error
K =	3.8528E-005 +/-	3.4803E-006
y0 =	1.1803E+000 +/-	2.4590E-002

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:

Number of residuals..... 88
Number of estimated parameters.... 2
Degrees of freedom..... 86
Residual mean..... 0.005853
Residual standard deviation..... 0.1679
Residual variance..... 0.02819

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	0.265	1.1801	-0.91508	1
0.0066	0.574	1.1799	-0.6059	1
0.01	0.889	1.1797	-0.29071	1
0.0133	0.989	1.1795	-0.19053	1
0.0166	1.26	1.1793	0.080653	1
0.02	1.254	1.1792	0.074841	1
0.0233	1.431	1.179	0.25202	1
0.0266	1.632	1.1788	0.4532	1
0.03	1.097	1.1786	-0.081606	1
0.0333	0.586	1.1784	-0.59243	1
0.05	1.418	1.1775	0.24049	1
0.0666	1.512	1.1766	0.33541	1
0.0833	1.229	1.1757	0.053323	1
0.1	1.191	1.1748	0.01624	1
0.1166	1.298	1.1738	0.12415	1
0.1333	1.323	1.1729	0.15007	1
0.15	1.292	1.172	0.11998	1
0.1666	1.273	1.1711	0.10189	1
0.1833	1.267	1.1702	0.096803	1
0.2	1.248	1.1693	0.078716	1
0.2166	1.197	1.1684	0.028622	1
0.2333	1.311	1.1675	0.14353	1
0.25	1.311	1.1666	0.14444	1
0.2666	1.241	1.1657	0.075349	1
0.2833	1.216	1.1647	0.051258	1
0.3	1.229	1.1638	0.065166	1
0.3166	1.241	1.1629	0.078068	1
0.3333	1.235	1.162	0.072975	1
0.4166	1.223	1.1575	0.065489	1
0.5	1.21	1.153	0.056991	1
0.5833	1.204	1.1485	0.055469	1
0.6666	1.191	1.1441	0.046931	1
0.75	1.222	1.1396	0.08238	1
0.8333	1.172	1.1352	0.036807	1
0.9166	1.166	1.1308	0.035216	1
1	1.153	1.1264	0.026614	1
1.0933	1.141	1.1215	0.019513	1
1.1666	1.128	1.1177	0.010347	1
1.25	1.122	1.1133	0.0086937	1
1.3333	1.122	1.109	0.013018	1
1.4166	1.109	1.1047	0.0043259	1
1.5	1.103	1.1004	0.0026219	1
1.5833	1.103	1.0961	0.0068962	1
1.6666	1.103	1.0918	0.011154	1
1.75	1.084	1.0876	-0.0036	1
1.8333	1.084	1.0834	0.00062459	1
1.9166	1.078	1.0792	-0.0011672	1
2	1.071	1.075	-0.0039703	1
2.5	1.027	1.0501	-0.023149	1
3	0.996	1.0259	-0.029901	1
3.5	0.964	1.0022	-0.038213	1
4	0.939	0.97907	-0.040072	1
4.5	0.907	0.95647	-0.049465	1
5	0.882	0.93438	-0.052381	1
5.5	0.857	0.91281	-0.055806	1
6	0.832	0.89173	-0.059729	1
6.5	0.813	0.87114	-0.058139	1
7	0.794	0.85102	-0.057024	1
7.5	0.769	0.83137	-0.062374	1

8	0.75	0.81218	-0.062178	1
8.5	0.725	0.79342	-0.060425	1
9	0.72	0.7751	-0.055104	1
9.5	0.693	0.75721	-0.064207	1
10	0.681	0.73972	-0.058723	1
12	0.611	0.67373	-0.062733	1
14	0.561	0.61363	-0.052629	1
16	0.517	0.55889	-0.041887	1
18	0.488	0.50903	-0.021929	1
20	0.441	0.46362	-0.022618	1
22	0.41	0.42226	-0.012259	1
24	0.372	0.38459	-0.012589	1
26	0.359	0.35028	0.0087203	1
28	0.347	0.31903	0.027969	1
30	0.315	0.29057	0.02443	1
32	0.29	0.26465	0.025351	1
34	0.277	0.24104	0.035961	1
36	0.265	0.21954	0.045464	1
38	0.252	0.19995	0.052049	1
40	0.221	0.18211	0.038886	1
42	0.227	0.16587	0.061133	1
44	0.214	0.15107	0.06293	1
46	0.195	0.13759	0.057407	1
48	0.208	0.12532	0.082681	1
50	0.189	0.11414	0.074861	1
52	0.17	0.10396	0.066043	1
54	0.189	0.094683	0.094317	1
56	0.177	0.086236	0.0907	

SE1000C
Environmental Logger
01/22 15:14

Unit# 01606 Test 7

INPUT 1: Level (F) TOC

Reference 7.860
Linearity 0.120
Scale factor 19.890
Offset -0.140
Delay mSEC 50.000

Step 0 01/16 12:56:16

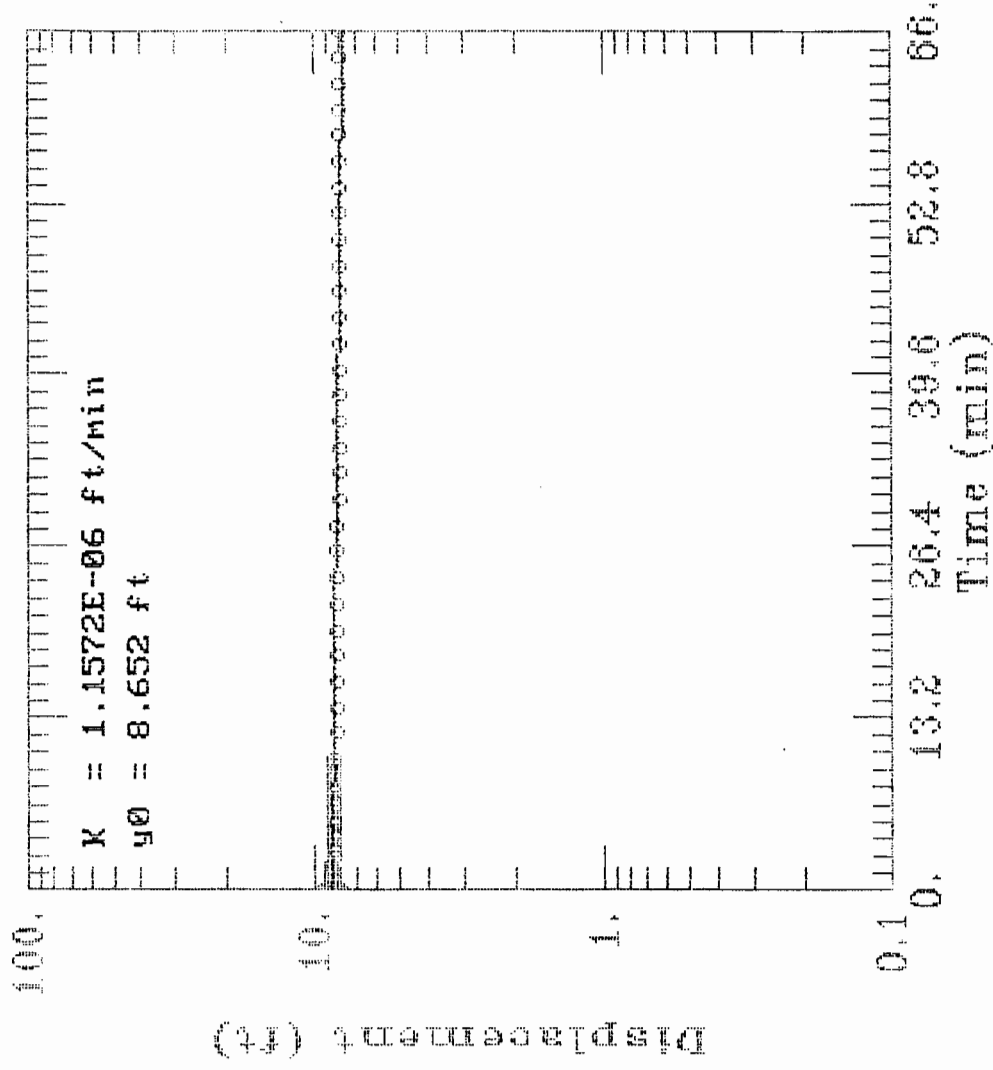
Elapsed Time INPUT 1

0.0000	7.847
0.0033	7.790
0.0066	7.481
0.0100	7.166
0.0133	7.066
0.0166	6.795
0.0200	6.801
0.0233	6.624
0.0266	6.423
0.0300	6.958
0.0333	7.469
0.0500	6.637
0.0666	6.543
0.0833	6.826
0.1000	6.864
0.1166	6.757
0.1333	6.732
0.1500	6.763
0.1666	6.782
0.1833	6.788
0.2000	6.807
0.2166	6.858
0.2333	6.744
0.2500	6.744
0.2666	6.814
0.2833	6.839
0.3000	6.826
0.3166	6.814
0.3333	6.820
0.4166	6.832
0.5000	6.845
0.5833	6.851
0.6666	6.864
0.7500	6.883
0.8333	6.883
0.9166	6.889
1.0000	6.902
1.0833	6.914
1.1666	6.927
1.2500	6.933
1.3333	6.933

1.4166	6.946
1.5000	6.952
1.5833	6.952
1.6666	6.965
1.7500	6.971
1.8333	6.971
1.9166	6.977
2.0000	6.984
2.5000	7.028
3.0000	7.059
3.5000	7.091
4.0000	7.116
4.5000	7.148
5.0000	7.173
5.5000	7.198
6.0000	7.223
6.5000	7.242
7.0000	7.261
7.5000	7.286
8.0000	7.305
8.5000	7.330
9.0000	7.355
9.5000	7.362
10.0000	7.374
12.0000	7.444
14.0000	7.494
16.0000	7.538
18.0000	7.576
20.0000	7.614
22.0000	7.645
24.0000	7.683
26.0000	7.696
28.0000	7.708
30.0000	7.740
32.0000	7.765
34.0000	7.778
36.0000	7.790
38.0000	7.803
40.0000	7.834
42.0000	7.828
44.0000	7.841
46.0000	7.860
48.0000	7.847
50.0000	7.866
52.0000	7.885
54.0000	7.866
56.0000	7.878
58.0000	7.885

CTO 0013
Pipe Line MW 3
Falling Test

MW-3 RISING



AQTESOLV

GERAGHTY
& MILLER, INC.
Modeling Group

ABTESOLV RESULTS
Version 1.10

1/92

16:35:28

TEST DESCRIPTION

Data set..... b:MW-3R.DAT
Data set title..... MW-3 RISING

Knowns and Constants:

No. of data points..... 92
Radius of well casing..... 0.08
Radius of well..... 0.33
Aquifer saturated thickness..... 9.08
Well screen length..... 9.75
Static height of water in well..... 9.08
Log(R_e/R_w)..... 2.513
A, B, C..... 0.000, 0.000, 1.955

ANALYTICAL METHOD

Bouwer and Rice (unconfined aquifer slug test)

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate	Std. Error
K =	1.1572E-006 +/-	7.9164E-008
y0 =	8.6520E+000 +/-	1.8500E-002

ANALYSIS OF MODEL RESIDUALS

residual = calculated - observed
weighted residual = residual * weight

Weighted Residual Statistics:

Number of residuals..... 92
Number of estimated parameters.... 2
Degrees of freedom..... 90
Residual mean..... 2.107E-005
Residual standard deviation..... 0.1456
Residual variance..... 0.0212

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0033	8.332	8.652	-0.31999	1
0.0066	8.647	8.652	-0.0049535	1
0.01	8.597	8.6519	-0.054912	1
0.0133	8.351	8.6519	-0.30087	1
0.0166	8.105	8.6518	-0.54683	1
0.02	8.332	8.6518	-0.31979	1
0.0233	8.867	8.6518	0.21525	1
0.0266	9.214	8.6517	0.56229	1
0.03	9.17	8.6517	0.51833	1
0.0333	8.704	8.6516	0.052371	1
0.05	8.685	8.6514	0.033573	1
0.0666	8.691	8.6512	0.039775	1
0.0833	8.716	8.651	0.064978	1
0.1	8.735	8.6508	0.08418	1
0.1166	8.76	8.6506	0.10938	1
0.1333	8.767	8.6504	0.11658	1
0.15	8.767	8.6502	0.11679	1
0.1666	8.754	8.65	0.10399	1
0.1833	8.76	8.6498	0.11019	1
0.2	8.754	8.6496	0.10439	1
0.2166	8.754	8.6494	0.1046	1
0.2333	8.735	8.6492	0.085799	1
0.25	8.76	8.649	0.111	1
0.2666	8.754	8.6488	0.1052	1
0.2833	8.754	8.6486	0.10541	1
0.3	8.741	8.6484	0.092608	1
0.3166	8.741	8.6482	0.09281	1
0.3333	8.748	8.648	0.10001	1
0.4166	8.741	8.647	0.094023	1
0.5	8.716	8.646	0.070035	1
0.5833	8.716	8.645	0.071046	1
0.6666	8.71	8.6439	0.066056	1
0.75	8.704	8.6429	0.061068	1
0.8333	8.71	8.6419	0.068078	1
0.9166	8.691	8.6409	0.050088	1
1	8.678	8.6399	0.0381	1
1.0933	8.672	8.6388	0.033231	1
1.1666	8.672	8.6379	0.034119	1
1.25	8.672	8.6369	0.03513	1
1.3333	8.66	8.6359	0.02414	1
1.4166	8.653	8.6349	0.018149	1
1.5	8.647	8.6338	0.01316	1
1.5833	8.653	8.6328	0.020169	1
1.6666	8.647	8.6318	0.015178	1
1.75	8.641	8.6308	0.010188	1
1.8333	8.628	8.6298	-0.0018028	1
1.9166	8.628	8.6288	-0.00079401	1
2	8.628	8.6278	0.00021583	1
2.5	8.603	8.6217	-0.018732	1
3	8.597	8.6157	-0.018685	1
3.5	8.571	8.6096	-0.038642	1
4	8.552	8.6036	-0.051603	1
4.5	8.546	8.5976	-0.051568	1
5	8.521	8.5915	-0.070537	1
5.5	8.508	8.5855	-0.077511	1
6	8.502	8.5795	-0.077489	1
6.5	8.483	8.5735	-0.090471	1
7	8.458	8.5675	-0.10946	1
7.5	8.458	8.5614	-0.10345	1
8	8.452	8.5554	-0.10344	1
8.5	8.433	8.5494	-0.11644	1

9	8.42	8.5434	-0.12345	1
9.5	8.468	8.5375	-0.12945	1
10	8.408	8.5315	-0.12346	1
12	8.376	8.5076	-0.13155	1
14	8.345	8.4837	-0.13871	1
16	8.319	8.4599	-0.14093	1
18	8.288	8.4362	-0.14822	1
20	8.256	8.4126	-0.15657	1
22	8.25	8.389	-0.139	1
24	8.225	8.3655	-0.14048	1
26	8.206	8.342	-0.13604	1
28	8.2	8.3187	-0.11866	1
30	8.174	8.2953	-0.12134	1
32	8.168	8.2721	-0.10409	1
34	8.149	8.2489	-0.099908	1
36	8.143	8.2258	-0.082789	1
38	8.13	8.2027	-0.072734	1
40	8.13	8.1797	-0.049744	1
42	8.124	8.1568	-0.032818	1
44	8.111	8.134	-0.022956	1
46	8.105	8.1112	-0.006159	1
48	8.099	8.0884	0.010575	1
50	8.099	8.0658	0.033244	1
52	8.105	8.0431	0.061851	1
54	8.086	8.0206	0.065393	1
56	8.08	7.9981	0.081873	1
58	8.08	7.9757	0.10429	1
60	8.067	7.9534	0.11364	1
62	8.074	7.9311	0.14293	1
64	8.074	7.9088	0.16516	1
66	8.055	7.8867	0.16833	1

=====

RESULTS FROM VISUAL

SE1000C
Environmental Logger
01/22 15:16

Unit# 01606 Test 7

INPUT 1: Level (F) TOC

Reference 7.860
Linearity 0.120
Scale factor 19.890
Offset -0.140
Delay mSEC 50.000

Step 1 01/16 13:55:03

Elapsed Time INPUT 1

0.0000	7.973
0.0033	8.332
0.0066	8.647
0.0100	8.597
0.0133	8.351
0.0166	8.105
0.0200	8.332
0.0233	8.867
0.0266	9.214
0.0300	9.170
0.0333	8.704
0.0500	8.685
0.0666	8.691
0.0833	8.716
0.1000	8.735
0.1166	8.760
0.1333	8.767
0.1500	8.767
0.1666	8.754
0.1833	8.760
0.2000	8.754
0.2166	8.754
0.2333	8.735
0.2500	8.760
0.2666	8.754
0.2833	8.754
0.3000	8.741
0.3166	8.741
0.3333	8.748
0.4166	8.741
0.5000	8.716
0.5833	8.716
0.6666	8.710
0.7500	8.704
0.8333	8.710
0.9166	8.691
1.0000	8.678
1.0833	8.672
1.1666	8.672
1.2500	8.672
1.3333	8.660

1.4166	8.653
1.5000	8.647
1.5833	8.653
1.6666	8.647
1.7500	8.641
1.8333	8.628
1.9166	8.628
2.0000	8.628
2.5000	8.603
3.0000	8.597
3.5000	8.571
4.0000	8.552
4.5000	8.546
5.0000	8.521
5.5000	8.508
6.0000	8.502
6.5000	8.483
7.0000	8.458
7.5000	8.458
8.0000	8.452
8.5000	8.433
9.0000	8.420
9.5000	8.408
10.0000	8.408
12.0000	8.376
14.0000	8.345
16.0000	8.319
18.0000	8.288
20.0000	8.256
22.0000	8.250
24.0000	8.225
26.0000	8.206
28.0000	8.200
30.0000	8.174
32.0000	8.168
34.0000	8.149
36.0000	8.143
38.0000	8.130
40.0000	8.130
42.0000	8.124
44.0000	8.111
46.0000	8.105
48.0000	8.099
50.0000	8.099
52.0000	8.105
54.0000	8.086
56.0000	8.080
58.0000	8.080
60.0000	8.067
62.0000	8.074
64.0000	8.074
66.0000	8.055

CTO 0013
Pipe Line MW 3
Rising Test

APPENDIX E
CHAIN-OF-CUSTODY FORMS

SOLUTIONS' LOG #
41161972-605-01733

COMPANY NAME:

LINKER ENVIRONMENTAL, INC

SOLUTIONS LABORATORIES, INC.

814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

1 of 5

PROJECT MANAGER:

DAVE MATHROS

Phone:

412-269-6000

Address (Office): Airport office Mark

Site Location:

430 Reister RD, Cambridge PA 17108

Pile Line

Project Number:

Project Name:

19013-64-SV2-PL

Pile Line

I attest that the proper field sampling procedures were used during the collection of these samples.

KENNETH A. TURNER
Sampler name

ANALYSIS REQUEST

OTHER

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602 ☐ 8020 ☐ MTBE ☐	BTEX only 602 ☐ 8020 ☐ MTBE ☐	Oil & Grease 503 B+D ☐	TPH 418.1 ☐ 503B,D,E ☐ GC ☐	EPA 601 ☐ 8010 ☐	EPA 602 ☐ 8020 ☐	EPA 608 ☐ 8080 ☐	EPA 610 ☐ 8310 ☐	EpTOX METALS ☐ PEST ☐ HERB ☐	TCLP METALS ☐ VOA ☐ SEMIVOA ☐	EPA METALS ☐ SPSA ☐ RCRA ☐	HRSD AG ☐ METALS ☐	LEAD FLAME ☐ FURNACE ☐	CORR ☐ FLASH ☐ REACT ☐	FLASHPOINT, PH
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME														

MW1-01	Boxing	01 A1	1	X								X			1-8-92/1037			X													
MW1-02	Boxing	01 A1 A2	2	X								X			1-8-92/1039			X													
MW2-01	Boxing	03 A1	1	X								X			1-8-92/1325			X													
MW2-02	Boxing	04 A1 A2	2	X								X			1-8-92/1330			X													
MW3-01	Boxing	05 A1	1	X								X			1-14-92/1033			X													
MW3-02	Boxing	06 A1 A2	2	X								X			1-14-92/1034			X													
MW4-01	Boxing	07 A1	1	X								X			1-11-92/1446			X													

Relinquished by Sampler: Kenneth A. Turner Date: 1-15-92 Time: 0700 Received by: Received by Laboratory: Received by: Remarks: Request 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED BY FED EX

Relinquished by: Date: Time: Received by: Received by Laboratory: Received by: Remarks: Request 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED BY FED EX

Relinquished by: Date: Time: Received by: Received by Laboratory: Received by: Remarks: Request 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED BY FED EX

SPECIAL HANDLING 1-16-92

SPECIAL DETECTION LIMITS (Specify)

CONTAINERS:

REGULAR DETECTION LIMITS

EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

SPECIAL REPORTING REQUIREMENTS:
Please combine soil & water analysis!

GLASS ☒ 40 ML ☒
AMBER ☐ 500 ML ☐
PLASTIC ☐ 1 Liter ☐
WHIRLPAC ☐ other _____

SOLUTIONS' LOG #
01161993-115-01733

COMPANY NAME:

BAKER ENVIRONMENTAL, INC.

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

2 of 5

PROJECT MANAGER:

DAVE J. MARROUSE

Phone:

410 269-6000

Address (Office): Airport Office Bldg

Site Location:

420 Route N. Corbitts, PA 15108

Pipe Line

Project Number:

19013-64-SVZ-PL

Project Name:

Pipe Line

I attest that the proper field sampling procedures were used during the collection of these samples.

Kenneth A. Tuan

Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602	BTEX only 602	Oil & Grease 5	TPH 418.1 □	EPA 601 □ 8	EPA 602 □ 8	EPA 608 □ 8	EPA 610 □ 8	EpTOX METALS	TCLP METALS	EPA METALS □	HRSD AG □	LEAD FLAME □	CORR □ FLAS	FLASHPOINT, 1		
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE																TIME	
NW4-02	Boring	08-A1, A2	2		X								X			1-11-92	1448		X													X
NW5-01	Boring	09 A1	1		X								X			1-10-92	1345		X													
NW5-02	Boring	10 A1, A2	2		X								X			1-12-92	1347		X													X
NW6-01	Boring	10 A1	1		X								X			1-14-92	0844		X													
NW6-02	Boring	10 A1, A2	2		X								X			1-14-92	0846		X													X
NW7-01	Boring	13 A1	1		X								X			1-14-92	1032		X													
NW7-02	Boring	14 A1, A2	2		X								X			1-14-92	1035		X													X

Relinquished by Sampler:

Kenneth A. Tuan

Date 1-15-92 Time 0700

Received by:

Relinquished by:

Date Time

Received by:

Relinquished by:

Date Time

Received by Laboratory:

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE #

PURCHASE ORDER # FAX

SPECIAL DETECTION LIMITS (Specify)

REGULAR DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS:

Please contact soil & water analytical results

CONTAINERS:

GLASS ☒ AMBER ☐

PLASTIC ☐ WHIRLPAC ☐

other

REMARKS:

Request 14 DAY TURN AROUND
SAMPLES BACK IN ICE
AND SHIPPED BY FEDEX

ANALYSIS REQUEST

OTHER

[illegible]

SOLUTIONS' LOG # #1161997-005-01733		SOLUTIONS LABORATORIES, INC. 814-B Greenbrier Circle Chesapeake, VA 23320 (804) 420-0467/Fax 420-4204											
COMPANY NAME: <i>Baker Env</i>													
PROJECT MANAGER: <i>Dave Mamase</i>		Phone: <i>412-269-0206</i>											
Address (Office): Airport Office Bldg 81043		Site Location:											
<i>430 Rouser Rd. Campbells, PH. 15108</i>		<i>PIPE LINE</i>											
Project Number: <i>19013-64-SUZ-PK</i>		Project Name: <i>PIPE LINE</i>											
I attest that the proper field sampling procedures were used during the collection of these samples. <i>Kenneth A. Tull</i>													
Field Sample ID		Source of Sample											
SOLN'S LAB # (lab use only)		# containers											
		MATRIX				METHOD PRESERVED				SAMPLING			
		water	soil	air	sludge	other	HCl	HNO ₃	H ₂ SO ₄	ICE	NONE	other	DATE
<i>DW-02</i>	<i>Boiling</i>	<i>22-A1</i>	/	X					X			<i>1-14-92</i>	<i>1205</i>
<i>B1-01</i>	<i>Boiling</i>	<i>23-A1</i>	/	X					X			<i>1-11-92</i>	<i>1327</i>
<i>B2-02</i>	<i>Boiling</i>	<i>24-A1</i>	/	X					X			<i>1-11-92</i>	<i>1330</i>
<i>B3-01</i>	<i>Boiling</i>	<i>25-A1</i>	/	X					X			<i>1-11-92</i>	<i>1410</i>
<i>B2-02</i>	<i>Boiling</i>	<i>26-A1</i>	/	X					X			<i>1-11-92</i>	<i>1412</i>
<i>B3-01</i>	<i>Boiling</i>	<i>27-A1</i>	/	X					X			<i>1-10-92</i>	<i>1250</i>
<i>B3-02</i>	<i>Boiling</i>	<i>28-A1</i>	/	X					X			<i>1-10-92</i>	<i>1252</i>
Relinquished by Sampler: <i>Kenneth A. Tull</i>		Date <i>1-15-91</i>	Time <i>0700</i>	Received by:									
Relinquished by:		Date	Time	Received by:									
Relinquished by:		Date <i>1-16-92</i>	Time <i>1230</i>	Received by Laboratory:		<i>[Signature]</i>							
SPECIAL HANDLING				SPECIAL DETECTION LIMITS (Specify)				CONTAINERS:					
EXPEDITED (48) ☐ (24) ☐				<i>REGULAR DETECTION LIMITS</i>				GLASS ☒					
THREE DAYS ☐								AMBER ☐					
SEVEN DAYS ☐								PLASTIC ☐					
PURCHASE ORDER # _____ FAX _____				SPECIAL REPORTING REQUIREMENTS: <i>PLEASE CONTINUE SOIL ANALYSIS LNB ONE FINISH 1207.</i>				WHIRLPAC ☐					
								other _____					

SOLUTIONS' LOG #
C/116 1992-005-01733

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

5 of 5

COMPANY NAME:
ENTER ENV.

PROJECT MANAGER:
DAVE MANROSE

Phone: 412 269-2026

Address (Office): Airport Office Apt Bldg 3

Site Location: 430 ROUSEL RD, CAMPBELL'S RD. 15108 PIPE LINE

Project Name: FIRE LINE

Project Number: 19013-64-502-PL

I attest that the proper field sampling procedures were used during the collection of these samples.

KENNETH A. TUN
Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602 ☐ 8020 ☐ MTBE ☐	BTX only 602 ☐ 8020 ☐ MTBE ☐	Oil & Grease 503 B+D ☐	TPH 418.1 ☐ 503B,D,E ☐ GC ☐	EPA 601 ☐ 8010 ☐	EPA 602 ☐ 8020 ☐	EPA 608 ☐ 8080 ☐	EPA 610 ☐ 8310 ☐	EPTOX METALS ☐ PEST ☐ HERB ☐	TCLP METALS ☐ VOA ☐ SEMIOVA ☐	EPA METALS ☐ SPSA ☐ RCRA ☐	HRSD AG ☐ METALS ☐	LEAD FLAME ☐ FURNACE ☐	CORR ☐ FLASH ☐ REACT ☐	FlashPoint, PH	OTHER
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME															
B4-01	Boring	29-A1	1	X								X			1-12-92	1575															
B4-02	Boring	30-A1	1	X								X			1-12-92	1517															
MW8-01	Boring	31-A1	1	X								X			1-8-92	1330															
B5-01	Boring	32-A1	1	X								X			1-11-92	1330															
DW5-01	Boring	33-A1	1	X								X			1-9-92	1257															
B6-01	Boring	34-A1	1	X								X			1-12-92	1517															

Relinquished by Sampler: *Ken A. Tun*

Date: *1-13-92* Time: *0700*

Received by: *Ken A. Tun*

Date: *1-13-92* Time: *0700*

Received by Laboratory: *Ken A. Tun*

REMARKS: REQUEST IN ONLY TURN AROUND SAMPLES PICKED IN ICE AND SHIPPED FRO EX

Relinquished by:

Date: *1-16-92* Time: *1230*

Received by Laboratory: *Ken A. Tun*

Date: *1-16-92* Time: *1230*

Received by Laboratory: *Ken A. Tun*

Date: *1-16-92* Time: *1230*

Received by Laboratory: *Ken A. Tun*

REMARKS: REQUEST IN ONLY TURN AROUND SAMPLES PICKED IN ICE AND SHIPPED FRO EX

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE # _____

PURCHASE ORDER # _____ FAX _____

SPECIAL DETECTION LIMITS (Specify)

Regular Detection Limits

SPECIAL REPORTING REQUIREMENTS:

PLEASE COMBINE SOIL WITH ANALYTICAL RESULTS INTO 1 FINAL REPORT.

CONTAINERS:

GLASS ☒ AMBER ☐

PLASTIC ☐ WHIRLPAC ☐

other _____

40 ML ☒ 500 ML ☐ 1 Liter ☐ other _____

SOLUTIONS LOG #
010142 - 001

COMPANY NAME:
BAKER ENV

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

1 OF 3

PROJECT MANAGER:

DAVE MARROSE

Phone:

412-269-2026

ANALYSIS REQUEST

Address (Office): 408 Bldg 3

Site Location:

430 Rouser Rd. Campbell's Pt 15108

PIPE LINE

Project Number:

19013-64-502-92

Project Name:

PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

KENNETH A. TUN

Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602	BTEX only 602	Oil & Grease 5	TPH 418.1 □	EPA 601 X 8	EPA 602 X 8	EPA 608 □ 8	EPA 610 □ 8	EpTOX METALS	TCLP METALS	EPA METALS □	HRSD AG □	LEAD FLAME □	CORR □ FLA		
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE															TIME	
MW1	WELL	01A1-A5	53	X								X			1-15-92	1515			X	X											X
MW2	WELL	02A1,A2	2	X								X			1-15-92	1315				X											
MW3	WELL	03A1-A5	5	X								X			1-12-92	1530			X	X											X
MW4	WELL	04A1,A2	2	X								X			1-16-92	1330			X	X											
MW5	WELL	05A1,A2	2	X								X			1-16-92	1216			X	X											
MW6	WELL	06A1,A2	2	X								X			1-15-92	1415			X	X											
MW7	WELL	07A1-A4	4	X								X			1-15-92	1145			X	X											
																													</		

Relinquished by Sampler:

Kenneth A. Tun

Date

1-17-92

Time

0800

Received by:

Relinquished by:

Date

Time

Received by:

Relinquished by:

Date

Time

Received by Laboratory:

Detective

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE #

PURCHASE ORDER # FAX

SPECIAL DETECTION LIMITS (Specify)

Regular Detection Limits

SPECIAL REPORTING REQUIREMENTS:

PLEASE COMBINE SOIL & WATER

into 15ml RE:

CONTAINERS:

GLASS ☒

AMBER ☒

PLASTIC ☐

WHIRLPAK ☐

other

40 ML ☒

500 ML ☐

1 Liter ☒

other

REMARKS:

REQUEST 14 DAY TURN AROUND
SAMPLES PACKED IN ICE
AND SHIPPED FedEx
06A2 ARRIVED BROKEN
07A2 ARRIVED BROKEN

OTHER

SOLUTIONS' LOG #
01181992-001

COMPANY NAME:
BAKER ENV

SOLUTIONS LABORATORIES, INC.
814B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST 205-3

PROJECT MANAGER:
DAVE MARKS

Phone:
410-269-2026

Address (Office): 408 Bldg 3

4100 Rousee RD. Cambridge, PA 15108

Site Location:
PIPE LINE

Project Number:
19015-641-502-PL

Project Name:
PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

Kenneth H. N. TUN

Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602	BTEX only 602	Oil & Grease 5	TPH 418.1 □	EPA 601 ☒ 8	EPA 602 ☒ 8	EPA 608 □ 8	EPA 610 □ 8	EpTOX METALS	TCLP METALS	EPA METALS □	HRSD AG □	LEAD FLAME □	CORR □ FLA	625	
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE																TIME
NW 8	WELL	08A1, A2	2	X								X			1-16-92	1330					X										
NW 9	WELL	09A1, A2	2	X								X			1-15-92	1545				X											
NW 10	WELL	10A1	1	X								X			1-16-92	1530															X
DW 1	WELL	11A1, A2	2	X								X			1-15-92	1530					X										
DW 2	WELL	12A1, A2	2	X								X			1-15-92	1830					X										
DW 3	WELL	13A1-A4	4	X								X			1-16-92	1415				X	X										
DW 4	WELL	14A1, A2	2	X								X			1-16-92	1000					X										

Relinquished by Sampler:
Kenneth H. N. TUN

Date
8-17-92

Time
0800

Received by:

Relinquished by:

Date

Time

Received by:

Relinquished by:

Date
1-16-92

Time
1430

Received by Laboratory:
D. Small

SPECIAL HANDLING

SPECIAL DETECTION LIMITS (Specify)

Regular Detection Limits

EXPEDITED. (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

SPECIAL REPORTING REQUIREMENTS:
Please combine Soil & water

Into 1 Final Report

CONTAINERS:

GLASS ☒
AMBER ☒
PLASTIC ☐
WHIRLPAC ☐
other _____

CUSTODY RECORD

REMARKS:
REQUEST 1st DAY TURNAROUND
Samples picked up in ICE
AND SHIPPED Fed. Ex.

OTHER

625

SOLUTIONS' LOG #
01181947A - 001

COMPANY NAME:
Baker Env

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

3 of 3

PROJECT MANAGER:

Dave Mardock

Phone:

413-869-2026

Address (Office): 700 Blvd 3

Site Location:

4120 Route 80, Cornapolis, PA. 15108 Pipe Line

Project Number:

17013-64-502-02

Project Name:

Pipe Line

I attest that the proper field sampling procedures were used during the collection of these samples.

Kenneth A. Tura

Sampler name

ANALYSIS REQUEST

OTHER

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING	
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE

700 Blvd Distilled water 15A1-AS5 X 1-16-92 8000

GAS hydro. 602 ☐ 8020 ☐ MTBE ☐
BTEX only 602 ☐ 8020 ☐ MTBE ☐
Oil & Grease 503 B+D ☐
TPH 418.1 ☐ 503B,D,E ☐ GC ☐
EPA 601 ☒ 8010 ☐
EPA 602 ☒ 8020 ☐
EPA 608 ☐ 8080 ☐
EPA 610 ☐ 8310 ☐
EpTOX METALS ☐ PEST ☐ HERB ☐
TCLP METALS ☐ VOA ☐ SEMVOA ☐
EPA METALS ☐ SPSA ☐ RCRA ☐
HRSD AG ☐ METALS ☐
LEAD FLAME ☐ FURNACE ☐
CORR ☐ FLASH ☐ REACT ☐
625

Relinquished by Sampler:

Kenneth A. Tura

Date 1-17-92 Time 0800

Received by:

Relinquished by:

Date

Received by:

Relinquished by:

Date 1-18-92 Time 1430

Received by Laboratory:

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

SPECIAL DETECTION LIMITS (Specify)

Require Detection Limits

SPECIAL REPORTING REQUIREMENTS:
Please combine samples with the same
1 Final Report

CONTAINERS:

GLASS ☒
AMBER ☒
PLASTIC ☐
WHIRLPAK ☐
other _____

REMARKS:

REQUEST 14 DAY TURN AROUND
SAMPLES PICKED UP IN ICE
AND SHIPPED FED EX

CUSTODY RECORD

40 ML ☒
500 ML ☐
1 Liter ☒
other _____

SOLUTIONS LOG #
2191992-001

COMPANY NAME:

DATE ENV

PROJECT MANAGER:
DAVE MAMROSE

Address (Office): 808 Bldg 5

430 Rousar Rd. Carroll's Pt 15108

Project Number:

19015-67-502-12

I attest that the proper field sampling procedures were used during the collection of these samples.

Signature of A. Tula

KEENEATH A. TULA

Sampler name

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

Phone:

412-269-2026

Site Location:

Pipe Line

Project Name:

Pipe Line

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

1 of 3

ANALYSIS REQUEST

OTHER

GAS hydro. 602 ☐ 8020 ☐ MTBE ☐
BTEX only 602 ☐ 8020 ☐ MTBE ☐
Oil & Grease 503 B+D ☐
TPH 418.1 ☐ 503B,D,E ☐ GC ☐
EPA 601 ☒ 8010 ☐
EPA 602 ☒ 8020 ☐
EPA 608 ☐ 8080 ☐
EPA 610 ☐ 8310 ☐
EpTOX METALS ☐ PEST ☐ HERB ☐
TCLP METALS ☐ VOA ☐ SEMIVOA ☐
EPA METALS ☐ SPSA ☐ RCRA ☐
HRSD AG ☐ METALS ☐
LEAD FLAME ☐ FURNACE ☐
CORR ☐ FLASH ☐ REACT ☐

6.25

MSSID

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX				METHOD PRESERVED				SAMPLING		GAS hydro. 602	BTEX only 602	Oil & Grease	TPH 418.1 ☐	EPA 601 ☒	EPA 602 ☒	EPA 608 ☐	EPA 610 ☐	EpTOX METALS	TCLP METALS	EPA METALS ☐	HRSD AG ☐	LEAD FLAME ☐	CORR ☐ FLA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE																other	DATE	TIME																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Mw1	well	01A1-A5 55	X									X			1-15-92	15:15			X																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

REMARKS:

Request in Dry Turn around
Samples packed in ice
and shipped Fed ex
06A2 ARRIVED BROKEN
07A2 ARRIVED BROKEN

CUSTOMER RECORD

CONTAINERS

GLASS ☒
AMBER ☒
PLASTIC ☐
WHIRLPAC ☐
other _____

SPECIAL DETECTION LIMITS (Specify)

Regular Detection Limits

SPECIAL REPORTING REQUIREMENTS:

Please indicate soil & water

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

011E1992-001

COMPANY NAME:

BATEL ENV

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

205-3

PROJECT MANAGER:

DAVE MARASE

Phone:

410-269-2020

Address (Office):

401 610-3
720 ROUSE RD. CHESAPEAKE, VA 23108

Site Location:

PIE LINE

Project Number:

19015-641-SV2-PL

Project Name:

PIE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

KENNETH A. TUA

Signature: K.A. Tua

Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602	BTEX only 602	Oil & Grease 5	TPH 418.1 ☐	EPA 601 ☒ 8	EPA 602 ☒ 8	EPA 608 ☐ 8	EPA 610 ☐ 8	EpTOX METALS	TCLP METALS	EPA METALS ☐	HRSD AG ☐	LEAD FLAME ☐	CORR ☐ FLAS	6.25					
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE																	TIME			
MW 3	WELL	08A1, A2	2	X								X			1-16-92	1530				X															
MW 4	WELL	09A1, A2	2	X								X			1-16-92	1545				X															
MW 10	WELL	10A1	1	X								X			1-16-92	1530																			
MW 1	WELL	11A1, A2	2	X								X			1-16-92	1530				X															
MW 2	WELL	12A1, A2	2	X								X			1-16-92	1530				X															
MW 3	WELL	13A1-A4	4	X								X			1-16-92	1515				X															
MW 4	WELL	14A1, A2	2	X								X			1-16-92	1000				X															
																																	</		

Relinquished by Sampler:

Date

Time

Received by:

Received by Laboratory:

CUSTOMER RECORD

REMARKS:
REQUEST 17 DAY TURNAROUND
SAMPLES PICKED UP IN ICE
AND SHIPPED FOR EX.

Relinquished by:

Date

Time

Received by:

Relinquished by:

Date

Time

Received by Laboratory:

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE #

PURCHASE ORDER #

FAX

SPECIAL DETECTION LIMITS (Specify)

REGULAR DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS:
Please indicate size of water

IN TO 1 FINAL REPORT

CONTAINERS

GLASS ☒

AMBER ☒

PLASTIC ☐

WHIRLPAK ☐

other

10A1

12A1

13A1

14A1

40-ML-B

500 ML ☐

1 Liter ☒

other

DEC 10 0930 1/21/92

COMPANY NAME:

ORIGINATOR'S REPORT AND ANALYSIS REQUEST

33

Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

Phone:

44-269-2026

Site Location:

Pipe Liner

Project Name:

PIPE LINE

KENNETH A. TUN

Sampler name[illegible]

Received by:

Received by:

Received by Laboratory:

SPECIAL DETECTION LIMITS (Specity)

REGULAR DETECTION LIMITS
SPECIAL REPORTING REQUIREMENTS:
PLEASE COMBINE SOL & URINE INTO

CONTAINERS: 57400073 151115
151115
 GLASS ☒ 40 ML ☒
 AMBER ☒ 500 ML ☐
 PLASTIC ☐ 1 Liter ☒
 WHIRLPAK ☐ other _____
 other _____

REMARKS:
REQUEST 14 DAY TURN AROUND
SAMPLES PROVIDED IN ICE
AND SHIPPED FED EX

SOLUTIONS' LOG #

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

COMPANY NAME:
BAKER ENV

PROJECT MANAGER:

DAVE MARROSE

Address (Office): A. Spawt Office Park

420 KEEPER RD. CORROPOUS RD. 15108

Project Number:

15108-64-5VZ-AL

I attest that the proper field sampling procedures were used during the collection of these samples.

Kenneth A. TUA
Robert C. Sevelick
Sampler name

Phone:

412 269-6000

Site Location:

PIPE LINE

Project Name:

PIPE LINE

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

ANALYSIS REQUEST

OTHER

PROJECT MANAGER:										Phone:									
DAVE MAMROSE										412 269-6000									
Address (Office): Airport Office Park										Site Location:									
420 Keweenaw Rd. Cornwallis PA. 15108										PIPE LINE									
Project Number:										Project Name:									
15103-64-5VZ-AL										PIPE LINE									
I attest that the proper field sampling procedures were used during the collection of these samples.										KAREN M. A. TUN Robt. C. Sevens Sampler name									
Field Sample ID	Source of Sample	SOLN'S LAB # (lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING					
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME			
GAS hydro. 602 ☐ 8020 ☐ MTBE ☐																			
BTEX only 602 ☐ 8020 ☐ MTBE ☐																			
Oil & Grease 503 B+D ☐																			
TPH 418.1 ☐ 503B,D,E ☐ GC ☐																			
EPA 601 ☐ 8010 ☐																			
EPA 602 ☒ 8020 ☐																			
EPA 608 ☐ 8080 ☐																			
EPA 610 ☐ 8310 ☐																			
EpTOX METALS ☐ PEST ☐ HERB ☐																			
TCLP METALS ☐ VOA ☐ SEMIVOA ☐																			
EPA METALS ☐ SPSA ☐ RCRA ☐																			
HRSD AG ☐ METALS ☐																			
LEAD FLAME ☐ FURNACE ☐																			
CORR ☐ FLASH ☐ REACT ☐																			
														OTHER					

Relinquished by Sampler:

Robert C. Sevelick

Relinquished by:

Received by:

Relinquished by:

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE #

PURCHASE ORDER # FAX

SPECIAL DETECTION/LIMITS (Specify)

Relinquish Detection Limits

SPECIAL REPORTING REQUIREMENTS:

PLEASE CONTINUE SOLID & METALS ANALYSIS

CONTAINERS:

GLASS ☒ AMBER ☐

PLASTIC ☐ WHIRLPAC ☐

other

40 ML ☒ 500 ML ☐ 1 Liter ☐ other

REMARKS:

REQUEST IN BAT TOWN A Round
SAMPLES PARTIAL IN ICE
or supplied with RECORD

SOLUTIONS' LOG

19211941-003

SOLUTIONS LABORATORIES, INC.

814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

2 of 4

COMPANY NAME:
Baker Inc.

PROJECT MANAGER:

Dave Marmas

Phone:

112-269-6000

Address (Office): Airport Office H&E

Site Location:

430 Roush Rd. Cambridge, PA 15108

PIPE LINE

Project Number:

19013-64-502-HL

Project Name:

PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

KEVIN H. TUN
ROBERT C. SEVICK
Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED					SAMPLING		GAS hydro. 602	BTEx only 602	Oil & Grease 5	TPH 418.1 □	EPA 601 □ 8	EPA 602 ☒ 8	EPA 608 □ 8	EPA 610 □ 8	EpTOX METALS	TCLP METALS	EPA METALS □	HRSD AG □	LEAD FLAME □	CORR □ FLA	
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE															TIME
12-w-H8	HP	13A1, 42	2	X								X			12-18	1410				X										
12-w-H9	HP	14A1, 42	2	X								X			12-18	1555				X										
12-w-H10	HP	10A1, 42	2	X								X			12-18	1630				X										
12-w-H11	HP	11A1, 42	2	X								X			12-18	1645				X										
12-w-H12	HP	12A1, 42	2	X								X			12-18	1715				X										
12-w-H13	HP	13A1, 42	2	X								X			12-18	1640				X										
12-w-H14	HP	14A1, 42	2	X								X			12-18	1700				X										

Relinquished by Sampler:

Kevin H. Tun

Date

12-19-91

Time

0800

Received by:

Robert C. Sevcik

Relinquished by:

Date

Time

Received by:

Relinquished by:

Date

Time

Received by Laboratory:

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐THREE DAYS ☐SEVEN DAYS ☐ QUOTE #

PURCHASE ORDER # FAX

SPECIAL DETECTION LIMITS (Specify)

Relinquish Detection Limits

SPECIAL REPORTING REQUIREMENTS:

Please combine soil & water analysis results into one final report for project

ANALYSIS REQUEST

OTHER

GAS hydro. 602	☐	8020	☐	MTBE	☐
BTEX only 602	☐	8020	☐	MTBE	☐
Oil & Grease 503	☐	B+D	☐		
TPH 418.1	☐	503B,D,E	☐	GC	☐
EPA 601	☐	8010	☐		
EPA 602	☒	8020	☐		
EPA 608	☐	8080	☐		
EPA 610	☐	8310	☐		
EpTOX METALS	☐	PEST	☐	HERB	☐
TCLP METALS	☐	VOA	☐	SEMIVOA	☐
EPA METALS	☐	SPSA	☐	RCRA	☐
HRSD AG	☐	METALS	☐		
LEAD FLAME	☐	FURNACE	☐		
CORR	☐	FLASH	☐	REACT	☐

REMARKS:
REQUEST BY DUTYMAN H. TUN
SAMPLE PACKED IN ICE AND
SHIPPED

CONTAINERS:

GLASS ☒ 40 ML ☒AMBER ☐ 500 ML ☐PLASTIC ☐ 1 Liter ☐WHIRLPAC ☐ other

[illegible]

[illegible]

APPENDIX F
LABORATORY ANALYSES REPORTS

SAMPLE DATA SUMMARY PACKAGE

Table of Contents

1. Narrative
2. Chain-Of-Custody Reports
3. Results of Analysis
 - a. Soils-Inorganic
 - b. Soils-Organic
 - c. Waters-Organic
4. Appendix A- QC Report
5. Appendix B- Glossary of Report and Data Information

1. Narrative

NARRATIVE

Laboratory: Solutions Laboratories, Inc.

Date Sample received by Solutions: 12/21/91, 01/16/92, 01/18/92

Project Name: Baker Environmental, Pipe Line- 19013-64-SVZ-PL

Contract Number: 19001-43-SRN-3
Navy CLEAN Program

Results of the Following samples are included in this data package:

Sample ID	Lab No.	Matrix	Analysis
PL-W-H1 thru PL-W-H21 MW1-01 thru MW8-01, DW1-01 thru DW5-01, and B1-01 thru B6-01	12211992-003	Water	602
	01161992-005	Soil	TPH-CAL Flash Point pH
MW1 thru MW10, DW1 thru DW4	01181992-001	Water	602,601,625

Inorganics

All samples were analyzed following Method 1010 for Flash Point and Method 9041 for pH.

Holding times were met for all analyses.

Organics

All samples were analyzed following 3550/5330 CAL Method for Total Petroleum Hydrocarbons, and EPA 8020 for soils and and EPA 602 for waters.

Official holding times were met for all analyses, except the holding time for TPH for 01161992-005.

RELEASE OF THE DATA CONTAINED IN THIS HARDCOPY DATA PACKAGE HAS BEEN AUTHORIZED BY THE LABORATORY MANAGER OR HIS DESIGNEE, AS VERIFIED BY THE FOLLOWING SIGNATURE:

Dorothy S. Small
DOROTHY S. SMALL

DATE:

Feb. 1, 1992
February 1, 1992

2. Chain-of-Custody Reports

SOLUTIONS LABORATORIES, INC.

814 B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

CHAIN-OF-CUSTODY REPORT

SOLUTIONS LOG #: 12211992-003

COMPANY NAME: BAKER ENVIRONMENTAL
PROJECT MANAGER: DAVE MANROSE
BILLING ADDRESS: AIRPORT OFFICE PARK, BLDG 3
CORANPOLIS, PA 15108
TELEPHONE #: (412) 269-6000
FAX #: (412) 269-2002
P.O.#:

DATE/TIME RECEIVED: 12/21/92 1030
SAMPLER: KENNETH TUA, ROBERT SEVCIK

SAMPLE ID	FIELD SAMPLE ID	SAMPLED DATE	SAMPLED TIME	# OF CONT.	CONTAINER	LOCATION	PERSERV.	MATRIX
01A1,A2	PL-W-H1	12/17/91	1010	2	40 ML VOA	PIPE LINE	40C	WATER
02A1,A2	PL-W-H2	12/17/91	1055	2	40 ML VOA	PIPE LINE	40C	WATER
03A1,A2	PL-W-H3	12/17/91	1315	2	40 ML VOA	PIPE LINE	40C	WATER
04A1,A2	PL-W-H4	12/17/91	1530	2	40 ML VOA	PIPE LINE	40C	WATER
05A1,A2	PL-W-H5	12/18/91	1150	2	40 ML VOA	PIPE LINE	40C	WATER
06A1,A2	PL-W-H6	12/18/91	1230	2	40 ML VOA	PIPE LINE	40C	WATER
07A1,A2	PL-W-H7	12/18/91	1320	2	40 ML VOA	PIPE LINE	40C	WATER
08A1,A2	PL-W-H8	12/18/91	1410	2	40 ML VOA	PIPE LINE	40C	WATER
09A1,A2	PL-W-H9	12/18/91	1555	2	40 ML VOA	PIPE LINE	40C	WATER
10A1,A2	PL-W-H10	12/18/91	1630	2	40 ML VOA	PIPE LINE	40C	WATER
11A1,A2	PL-W-H11	12/18/91	1645	2	40 ML VOA	PIPE LINE	40C	WATER
12A1,A2	PL-W-H12	12/18/91	1715	2	40 ML VOA	PIPE LINE	40C	WATER
13A1,A2	PL-W-H13	12/18/91	1640	2	40 ML VOA	PIPE LINE	40C	WATER
14A1,A2	PL-W-H14	12/18/91	1700	2	40 ML VOA	PIPE LINE	40C	WATER
15A1,A2	PL-W-H15	12/18/91	1105	2	40 ML VOA	PIPE LINE	40C	WATER
16A1,A2	PL-W-H16	12/18/91	1135	2	40 ML VOA	PIPE LINE	40C	WATER
17A1,A2	PL-W-H17	12/18/91	1230	2	40 ML VOA	PIPE LINE	40C	WATER
18A1,A2	PL-W-H18	12/18/91	1313	2	40 ML VOA	PIPE LINE	40C	WATER
19A1,A2	PL-W-H19	12/18/91	1440	2	40 ML VOA	PIPE LINE	40C	WATER
20A1,A2	PL-W-H20	12/18/91	1515	2	40 ML VOA	PIPE LINE	40C	WATER
21A1,A2	PL-W-H21	12/18/91	1515	2	40 ML VOA	PIPE LINE	40C	WATER
22A1,A2	TRIP BLANK	UNKNOWN	UNK	2	40 ML VOA	PIPE LINE	40C	WATER

SAMPLE ID	ANALYSIS TO BE PERFORMED	DUE DATE
01A1,A2 THRU 22A1,A2	602	01/06/92

CONDITION OF SAMPLE: GOOD

RECEIVED BY: DOROTHY SMALL

RELINQUISHED BY: FEDERAL EXPRESS

SOLUTIONS G #
1121441-143

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

ANALYSIS REQUEST

PROJECT MANAGER:
DAVE MAMROSE
413 269-6000

Address (Office): A. ROBERT OFFICE PARK
120 KENNETH A. TOWNSHIP RD. 15108
PIPE LINE

Project Number:
11013-61-SVZ-PL

Phone:
413 269-6000

Site Location:
PIPE LINE

Project Name:
PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.
Robert A. Town

Robert A. Town
Sampler name

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX				METHOD PRESERVED				SAMPLING			
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE
PL-W-H1	11013-61-SVZ-PL	11013-61-SVZ-PL	2	X						X				12-17-91	1010
PL-W-H2	HP	11013-61-SVZ-PL	3	X						X				12-17	1055
PL-W-H3	HP	11013-61-SVZ-PL	3	X						X				12-17	1315
PL-W-H4	HP	11013-61-SVZ-PL	2	X						X				12-17	1530
PL-W-H5	HP	11013-61-SVZ-PL	2	X						X				12-18	1150
PL-W-H6	HP	11013-61-SVZ-PL	2	X						X				12-18	1230
PL-W-H7	HP	11013-61-SVZ-PL	3	X						X				12-18	1330

REMARKS:
REQUEST 14 DAY TURN AROUND.
SAMPLES PACKED IN ICE
TO SHIP VIA FedEx.

CUSTODY RECORD

EXPEDITED (48) ☐ (24) ☐

THREE DAYS ☐

SEVEN DAYS ☐ QUOTE # _____

PURCHASE ORDER # _____ FAX _____

SPECIAL HANDLING

SPECIAL DETECTION/LIMITS (Specify)
Revised Detection Limits

SPECIAL REPORTING REQUIREMENTS:
Fluoride combine soil & water samples
RESULTS will be returned for Project

CONTAINERS:
GLASS ☒ 40 ML ☒
AMBER ☐ 500 ML ☐
PLASTIC ☐ 1 Liter ☐
WHIRLPAK ☐ other _____

[illegible]

SOLUTIONS LABORATORIES, 814-B Greenbrier Circle Chesapeake, VA 23320 (804) 420-0467/Fax 420-4204						CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST															
SOLUTIONS # _____ OF 3																					
COMPANY NAME: <i>BAKIR LUVU</i>						ANALYSIS REQUEST															
PROJECT MANAGER: <i>DANIEL MURROSE</i> Phone: <i>412-269-6000</i>						OTHER															
Address (Office): <i>AIRPORT OFFICE PARK</i> Site Location: <i>PPE LINE</i>																					
Project Number: <i>19012 - 64-SVZ-PPL</i> Project Name: <i>PPE LINE</i>																					
Sampler name: <i>KENNETH A. TUA</i>																					
I attest that the proper field sampling procedures were used during the collection of these samples. <i>Kenneth A. Tua</i>																					
Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX water air sludge other	METHOD PRESERVED HCl HNO ₃ H ₂ SO ₄ ICE NONE other	SAMPLING DATE	SAMPLING TIME	GAS hydro. 602 □ 8020 □ MTBE □	BTEX only 602 □ 8020 □ MTBE □	Oil & Grease 503 B+D □	TPH 418.1 □ 503B,D,E □ GC □	EPA 601 □ 8010 □	EPA 602 ☒ 8020 □	EPA 608 □ 8080 □	EPA 610 □ 8310 □	EPTOX METALS □ PEST □ HERB □	TCLP METALS □ VOA □ SEMIOVA □	EPA METALS □ SPSA □ RCRA □	HRSO AG □ METALS □	LEAD FLAME □ FURNACE □	CORR □ FLASH □ REACT □
<i>PL-W-H12</i>	<i>HP</i>	<i>15 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1105</i>						☒								
<i>PL-W-H16</i>	<i>HP</i>	<i>16 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1135</i>						☒								
<i>PL-W-H17</i>	<i>HP</i>	<i>17 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1230</i>						☒								
<i>PL-W-H18</i>	<i>HP</i>	<i>18 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1313</i>						☒								
<i>PL-W-H19</i>	<i>HP</i>	<i>19 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1440</i>						☒								
<i>PL-W-H20</i>	<i>HP</i>	<i>20 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1515</i>						☒								
<i>PL-W-H21</i>	<i>HP</i>	<i>21 AL, HA</i>	<i>3</i>	☒		<i>12-18</i>	<i>1515</i>						☒								
Relinquished by Sampler: <i>Kenneth A. Tua</i>						Time Received by:		CUSTODY RECORD				REMARKS: <i>REQUEST 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED VIA 120 EX.</i>									
Relinquished by:						Time Received by:															
Relinquished by:						Time Received by:															
Special Handling: EXPEDITED (48) ☐ (24) ☐ THREE DAYS ☐ SEVEN DAYS ☐ QUOTE # _____ PURCHASE ORDER # _____ FAX _____						Special Detection Limits (Specify) <i>REGULAR DETECTION LIMITS</i>						CONTAINERS: GLASS ☒ 40 ML ☒ AMBER ☐ 500 ML ☐ PLASTIC ☐ 1 Liter ☐ WHIRLPAC ☐ other _____									

SOLUTIONS LOG #		SOLUTIONS LABORATORIES, INC. 814-B Greenbrier Circle Chesapeake, VA 23320 (804) 420-0467/Fax 420-4204		CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST																																			
COMPANY NAME: BAKER ENV		PROJECT MANAGER: DAVE MAMMOSE		ANALYSIS REQUEST																																			
Address (Office): AOL Bldg 3 420 Rouse Rd		Site Location: Camp Lejeune		OTHER																																			
Project Number: 19013-64-JVE-PL		Project Name: Pipeline																																					
I attest that the proper field sampling procedures were used during the collection of these samples. Included by Solutions		MATRIX		METHOD PRESERVED		SAMPLING		SAMPLER NAME		GAS hydro. 602 ☐ 8020 ☐ MTBE ☐		BTEX only 602 ☐ 8020 ☐ MTBE ☐		Oil & Grease 503 B+D ☐		TPH 418.1 ☐ 503B,D,E ☐ GC ☐		EPA 601 ☐ 8010 ☐		EPA 602 ☐ 8020 ☐		EPA 608 ☐ 8080 ☐		EPA 610 ☐ 8310 ☐		EPTOX METALS ☐ PEST ☐ HERB ☐		TCLP METALS ☐ VOA ☐ SEMVOA ☐		EPA METALS ☐ SPSSA ☐ RCRA ☐		HRSD AG ☐ METALS ☐		LEAD FLAME ☐ FURNACE ☐		CORR ☐ FLASH ☐ REACT ☐			
Field Sample ID		Source of Sample		SOLN'S LAB # (Lab use only)		# containers		water		soil		air		sludge		other		HCl		HNO3		H2SO4		ICE		NONE		other		DATE		TIME							
Trip Blank		22 A1		1		X				X		X		X		X																							
Trip Blank		22 A2		1		X				X		X		X		X																							

SOLUTIONS LABORATORIES, INC.

814 B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

CHAIN-OF-CUSTODY REPORT

SOLUTIONS LOG #: 01161992-005

COMPANY NAME: BAKER ENVIRONMENTAL
PROJECT MANAGER: DAVE MANROSE
BILLING ADDRESS: AIRPORT OFFICE PARK, BLDG 3
CORAPOLIS, PA 15108
TELEPHONE #: (412) 269-6000
FAX #: (412) 269-2002
P.O.#:

DATE/TIME RECEIVED: 1/16/92 1230
SAMPLER: KENNETH A TUA

SAMPLE ID	FIELD SAMPLE ID	SAMPLED DATE	SAMPLED TIME	# OF CONT.	CONTAINER	LOCATION	PRESERV.	MATRIX
01A1	MW1-01	01/08/92	1037	1	40 ML VOA	PIPE LINE	4 OC	SOIL
02A1,A2	MW1-02	01/08/92	1039	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
03A1	MW2-01	01/08/92	1325	1	40 ML VOA	PIPE LINE	4 OC	SOIL
04A1,A2	MW2-02	01/08/92	1330	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
05A1	MW3-01	01/11/92	1033	1	40 ML VOA	PIPE LINE	4 OC	SOIL
06A1,A2	MW3-02	01/11/92	1034	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
07A1	MW4-01	01/11/92	1446	1	40 ML VOA	PIPE LINE	4 OC	SOIL
08A1,A2	MW4-02	01/11/92	1448	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
09A1	MW5-01	01/12/92	1345	1	40 ML VOA	PIPE LINE	4 OC	SOIL
10A1,A2	MW5-02	01/12/92	1347	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
11A1	MW6-01	01/14/92	0844	1	40 ML VOA	PIPE LINE	4 OC	SOIL
12A1,A2	MW6-02	01/14/02	0846	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
13A1	MW7-01	01/14/92	1032	1	40 ML VOA	PIPE LINE	4 OC	SOIL
14A1,A2	MW7-02	01/14/92	1035	2	40ML/8oz GL	PIPE LINE	4 OC	SOIL
15A1	DW1-01	01/08/92	1530	1	40 ML VOA	PIPE LINE	4 OC	SOIL
16A1	DW1-02	01/08/92	1533	1	40 ML VOA	PIPE LINE	4 OC	SOIL
17A1	DW2-01	01/09/92	1257	1	40 ML VOA	PIPE LINE	4 OC	SOIL
18A1	DW2-02	01/09/92	1259	1	40 ML VOA	PIPE LINE	4 OC	SOIL
19A1	DW3-01	01/11/92	1032	1	40 ML VOA	PIPE LINE	4 OC	SOIL
20A1	DW3-02	01/11/92	1035	1	40 ML VOA	PIPE LINE	4 OC	SOIL
21A1	DW4-01	01/14/92	1203	1	40 ML VOA	PIPE LINE	4 OC	SOIL
22A1	DW4-02	01/14/92	1205	1	40 ML VOA	PIPE LINE	4 OC	SOIL
23A1	B1-01	01/11/92	1327	1	40 ML VOA	PIPE LINE	4 OC	SOIL
24A1	B1-02	01/11/92	1330	1	40 ML VOA	PIPE LINE	4 OC	SOIL
25A1	B2-01	01/11/92	1410	1	40 ML OVA	PIPE LINE	4 OC	SOIL
26A1	B2-02	01/11/92	1412	1	40 ML VOA	PIPE LINE	4 OC	SOIL
27A1	B3-01	01/12/92	1250	1	40 ML OVA	PIPE LINE	4 OC	SOIL
28A1	B3-02	01/12/92	1252	1	40 ML OVA	PIPE LINE	4 OC	SOIL
29A1	B4-01	01/12/92	1515	1	40 ML OVA	PIPE LINE	4 OC	SOIL
30A1	B4-02	01/12/92	1517	1	40 ML OVA	PIPE LINE	4 OC	SOIL
31A1	MW8-01	01/08/92	1330	1	8 oz GL	PIPE LINE	4 OC	SOIL
32A1	B5-01	01/11/92	1330	1	40 ML VOA	PIPE LINE	4 OC	SOIL
33A1	DW5-01	01/09/92	1257	1	40 ML VOA	PIPE LINE	4 OC	SOIL
34A1	B6-01	01/12/92	1517	1	40 ML VOA	PIPE LINE	4 OC	SOIL

SAMPLE ID	ANALYSIS TO BE PERFORMED	DUE DATE
01A1-30A1 AND 32A1-34A1	TPH/GC	01/30/92
02A2, 04A2, 06A2, 08A2, 10A2, 12A2, 14A2, 31A1	FLASH POINT, pH	01/30/92

CONDITION OF SAMPLE: GOOD

RECEIVED BY: J FEROLINO

RELINQUISHED BY: FEDERAL EXPRESS

SOLUTIONS LABORATORIES, INC. 814-B Greenbrier Circle Chesapeake, VA 23320 (804) 420-0467/Fax 420-4204						SOLUTIONS LABORATORY RECORD AND ANALYSIS REQUEST																							
SOLUTIONS LOG # 01161992-605-01733						ANALYSIS REQUEST																							
COMPANY NAME: ENTER ENVIRONMENTAL, INC.						PROJECT MANAGER: DAVE MARROSE																							
PHONE: 412 269-6000						SITE LOCATION: PIPE LINE																							
ADDRESS (OFFICE): Airport Office Park 420 Rousen Rd., Connetquot PA. 15108						PROJECT NAME: PIPE LINE																							
PROJECT NUMBER: 19013-64-SVZ-PL						SAMPLER NAME: KENNETH A. TUA																							
I attest that the proper field sampling procedures were used during the collection of these samples. <i>Kenneth A. Tua</i>						MATRIX																							
Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# Containers	MATERIAL PRESERVED				SAMPLING		GAS hydro. 602 □ 8020 □ MTBE □	BTEX only 602 □ 8020 □ MTBE □	Oil & Grease 503 B+D □	TPH 418.1 □ 503B,D,E □ GC □	EPA 601 □ 8010 □	EPA 602 □ 8020 □	EPA 608 □ 8080 □	EPA 610 □ 8310 □	EPTOX METALS □ PEST □ HERB □	TCLP METALS □ VOA □ SEMI-VOA □	EPA METALS □ SPSS □ RCRA □	HRSD AG □ METALS □	LEAD FLAME □ FURNACE □	CORR □ FLASH □ REACT □	FLASH POINT, PH	OTHER				
				water	soil	air	sludge	other	HCl																	HNO ₃	H ₂ SO ₄	ICE	NONE
MW1-01 BORING		01 A1	1	X						X			X																
MW1-02 BORING		02 A1 A2	2	X						X			X																
MW2-01 BORING		03 A1	1	X						X			X																
MW2-02 BORING		04 A1 A2	2	X						X			X																
MW3-01 BORING		05 A1	1	X						X			X																
MW3-02 BORING		06 A1 A2	2	X						X			X																
MW4-01 BORING		07 A1	1	X						X			X																
Relinquished by Sampler: <i>Kenneth A. Tua</i>						Time Date 1-15-92 0700						Received by:						CUSTODY RECORD						REMARKS: REQUEST 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED BY FED EX					
Relinquished by:						Date Date 1-15-92 0700						Received by:						Received by Laboratory: <i>Kenneth A. Tua</i>											
Relinquished by:						Date Date 1-16-92 1030						Received by:						Special DETECTION LIMITS (Specify) REGULAR DETECTION LIMITS SPECIAL REPORTING REQUIREMENTS: PLEASE COMBINE SOIL & WATER ANALYSES RESULTS Into 1 Final Report						CONTAINERS: GLASS ☒ 40 ML ☒ AMBER ☐ 500 ML ☐ PLASTIC ☐ 1 Liter ☐ WHIRLPAK ☐ other _____					
PURCHASE ORDER # _____ FAX _____						EXPEDITED (48) □ (24) □ THREE DAYS □ SEVEN DAYS □ QUOTE # _____						SPECIAL HANDLING						CONNECTIONS											

SOLUTIONS LABORATORIES, 814-B Greenbrier Circle, Chesapeake, VA 23320, (804) 420-0467/Fax 420-4204

SOLUTIONS LABORATORIES, 814-B Greenbrier Circle, Chesapeake, VA 23320, (804) 420-0467/Fax 420-4204

COMPANY NAME: BAKER ENVIRONMENTAL, INC.

PROJECT MANAGER: DAVE MARROSE

Address (Office): AIRPORT OFFICE PARK, 430 ROSSER RD CORNELLIS, WA 98108

Project Number: 19013-64-SVZ-PL

I attest that the proper field sampling procedures were used during the collection of these samples.

Phone: 412 269-6000

Site Location: PIPE LINE

Project Name: PIPE LINE

Sampler name: Kenneth A. Clue

ANALYSIS REQUEST

OTHER

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

0F 5

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX				METHOD PRESERVED				SAMPLING		
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other
DW1-01	BORING	15-A1	1	X							X		1-8-92	1530
DW1-02	BORING	16-A1	1	X							X		1-8-92	1533
DW2-01	BORING	17-A1	1	X							X		1-9-92	1257
DW2-02	BORING	18-A1	1	X							X		1-9-92	1259
DW3-01	BORING	19-A1	1	X							X		1-11-92	1032
DW3-02	BORING	20-A1	1	X							X		1-11-92	1035
DW4-01	BORING	21-A1	1	X							X		1-11-92	1305

REMARKS: REQUEST 14 DAY TURN AROUND, SAMPLES PACKED IN ICE AND SHIPPED FED EX.

CUSTODY RECORD

Received by: [Signature]

Received by: [Signature]

Received by Laboratory: [Signature]

SPECIAL HANDLING

EXPEDITED (48) [] (24) []

THREE DAYS []

SEVEN DAYS [] QUOTE # []

PURCHASE ORDER # [] FAX []

SPECIAL DETECTION LIMITS (Specify)

REGULAR DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS: PLEASE CONSIDER SOIL & WATER ANALYSIS, RESULTS IN 72 HOURS / Final Report.

CONTAINERS:

GLASS [X] 40 ML [X]

AMBER [] 500 ML []

PLASTIC [] 1 Liter []

WHIRLPAK [] other []

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

ANALYSIS REQUEST

PROJECT MANAGER:
DAVE MAMROSE
412-269-0206

Address (Office): Airport Office Bldg 3
420 ROUSER RD. CORPARK, PA. 15108
PIPE LINE

Project Name:
19013-24-SUZ-PL
PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.
Kenneth A. Tura

Field Sample ID

Source of Sample

SOLN'S LAB # (Lab use only)

containers

MATRIX

METHOD PRESERVED

SAMPLING

DW4-02	BORING	22-A1	1	water		H2SO4	ICE	NONE	other	DATE	TIME
B1-01	BORING	23-A1	1	water			X			1-11-92	1305
B2-02	BORING	24-A1	1	water			X			1-11-92	1330
B3-01	BORING	25-A1	1	water			X			1-11-92	1410
B4-02	BORING	26-A1	1	water			X			1-11-92	1412
B5-01	BORING	27-A1	1	water			X			1-11-92	1450
B6-02	BORING	28-A1	1	water			X			1-11-92	1552

OTHER

CORR ☐ FLASH ☐ REACT ☐

LEAD FLAME ☐ FURNACE ☐

HRSD AG ☐ METALS ☐

EPA METALS ☐ SPSS ☐ RCRA ☐

TCLP METALS ☐ VOA ☐ SEMIOVA ☐

EPTOX METALS ☐ PEST ☐ HERB ☐

EPA 610 ☐ 8310 ☐

EPA 608 ☐ 8080 ☐

EPA 602 ☐ 8020 ☐

EPA 601 ☐ 8010 ☐

TPH 418.1 ☐ 503B,D,E ☐ GC ☐

Oil & Grease 503 B+D ☐

BTEX only 602 ☐ 8020 ☐ MTBE ☐

GAS hydro. 602 ☐ 8020 ☐ MTBE ☐

REMARKS:
REQUEST 14 DAY TURN AROUND
SAMPLES PACKED IN ICE AND
SHIPPED BY FED EX

CUSTODY RECORD

Received by:
Time
1-15-91 0700

Received by:
Time
1-16-92 1230

Received by Laboratory:
Time
1-16-92 1230

SPECIAL HANDLING
EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE #
PURCHASE ORDER # FAX

SPECIAL DETECTION LIMITS (Specify)
REGULAR DETECTION LIMITS
SPECIAL REPORTING REQUIREMENTS:
PLEASE CONFIRM SOIL & WATER ANALYSIS
INFO ONE FINAL REPORT.

CONTAINERS:
GLASS ☒
AMBER ☐
PLASTIC ☐
WHIRLPAK ☐
other

SOLUTIONS LOG # C-116 1992-005-01733		SOLUTIONS LABORATORIES, INC. 814-B Greenbrier Circle Chesapeake, VA 23320 (804) 420-0467/Fax 420-4204		CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST																		
COMPANY NAME: <u>BAKER ENV.</u>		PROJECT MANAGER: <u>DAVE MARROSE</u> Phone: <u>412 269-2026</u>		ANALYSIS REQUEST																		
Address (Office): <u>AIRPORT OFFICE PARK BLDG.3</u> <u>412 ROYER RD. CORAOPIS PA. 15108 PIPE LINE</u>		Site Location:		OTHER																		
Project Number: <u>19013-G4-SUZ-PL</u>		Project Name: <u>PIPE LINE</u>																				
I attest that the proper field sampling procedures were used during the collection of these samples. <u>Kenneth A. Tua</u> <u>KENNETH A. TUA</u> Sampler name																						
Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	MATRIX			METHOD PRESERVED			SAMPLING		EPA 601 □ 8010 □	EPA 602 □ 8020 □	EPA 608 □ 8080 □	EPA 610 □ 8310 □	EPTOX METALS □ PEST □ HERB □	TCLP METALS □ VOA □ SEMVOA □	EPA METALS □ SPSP □ RCRA □	HRSD AG □ METALS □	LEAD FLAME □ FURNACE □	CORR □ FLASH □ REACT □	FINSPOINT, PH	
			water	soil	air	sludge	HCl	HNO3	H2SO4	ICE												NONE
B4-01	BORING	29-A1	X							X												
B4-02	BORING	30-A1	X							X												
MW8-01	BORING	31-A1	X							X											X	
B5-01	BORING	32-A1	X							X												
DWS-01	BORING	33-A1	X							X												
B6-01	BORING	34-A1	X							X												
Relinquished by Sampler: <u>Kenneth A. Tua</u>		Date <u>1-15-92</u>	Time <u>0700</u>		Received by:		CUSTODY RECORD		REMARKS: <u>REQUEST 14 DAY TURN AROUND SAMPLES PICKED IN ICE AND SHIPPED FED EX</u>													
Relinquished by:		Date <u>1-16-92</u>	Time <u>1230</u>		Received by Laboratory:																	
Relinquished by:		Date <u>1-16-92</u>	Time <u>1230</u>																			

SPECIAL HANDLING
EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

SPECIAL DETECTION LIMITS (Specify)
REGULAR DETECTION LIMITS
SPECIAL REPORTING REQUIREMENTS:
PLEASE COMBINE SOIL & WATER ANALYTICAL RESULTS INTO 1 FINAL REPORT.

CONTAINERS:
GLASS ☒ 40 ML ☒
AMBER ☐ 500 ML ☐
PLASTIC ☐ 1 Liter ☐
WHIRLPAK ☐ other _____

SOLUTIONS LABORATORIES, INC.

814 B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

CHAIN-OF-CUSTODY REPORT

SOLUTIONS LOG #: 01181992-001

COMPANY NAME: BAKER ENVIRONMENTAL

PROJECT MANAGER: DAVE MANROSE

BILLING ADDRESS: AIRPORT OFFICE PARK, BLDG 3
CORAOPOLIS, PA 15108

TELEPHONE #: (412) 269-6000

FAX #: (412) 269-2002

P.O.#:

DATE/TIME RECEIVED: 1/18/92;1430

SAMPLER: KENNETH A TUA

SAMPLE ID	FIELD SAMPLE ID	SAMPLED DATE	SAMPLED TIME	# OF CONT.	CONTAINER	LOCATION	PRESERV. MATRIX	
01A1,A2,A3,A4,A5	MW1	01/15/92	1545	5	4-40 ML VOA, 1 L	PIPE LINE	4oC	WATER
02A1,A2	MW2	01/15/92	1315	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
03A1,A2,A3	MW3	01/16/92	1530	5	4-40 ML VOA, 1 L	PIPE LINE	4 oC	WATER
04A1,A2,	MW4	01/16/92	1330	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
05A1,A2	MW5	01/16/92	1216	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
06A1,A2	MW6	01/15/92	1415	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
07A1,A2,A3,A4	MW7	01/15/92	1145	4	4-40 ML VOA	PIPE LINE	4 oC	WATER
08A1,A2	MW8	01/16/92	1330	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
09A1,A2	MW9	01/15/92	1545	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
10A1	MW10	01/16/92	1530	1	1-1 L GL	PIPE LINE	4 oC	WATER
11A1,A2	DW1	01/15/92	1520	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
12A1,A2	DW2	01/15/92	1250	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
13A1,A2,A3,A4	DW3	01/16/92	1415	4	4-40 ML VOA	PIPE LINE	4 oC	WATER
14A1,A2	DW4	01/16/92	1000	2	2-40 ML VOA	PIPE LINE	4 oC	WATER
15A1,A2,A3,A4,A5	TRIP BL	01/16/92	2000	5	4-40 ML VOA, 1 L	PIPE LINE	4 oC	WATER

SAMPLE ID	ANALYSIS TO BE PERFORMED	DUE DATE
01A1,A2 THRU 08A1,A2		
11A1,A2 THRU 15A1,A2	602	1/30/92
01A3,A4; 03A3,A4		
07A3,A4; 09A3,A4		
13A3,A4; 15A3,A4	601	1/30/91
01A5,03A5,10A1		
15A5	625	1/30/92

CONDITION OF SAMPLE: GOOD, EXCEPT 06A2, 07A2 WERE BROKEN ON ARRIVAL

RECEIVED BY: D. SMALL

RELINQUISHED BY: FEDERAL EXPRESS

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

SOLUTIONS LAB #
01151742 - 001
COMPANY NAME:
BAKER ENV

PROJECT MANAGER:
DAVE MAMROSE
Address (Office): AOP Bldg 3
430 ROUSER RD. CORAOPOLIS PA 15108 PIPE LINE
Project Number:
19013-64-SUZ-PL
Project Name:
PIPE LINE

Phone:
412-269-2026
Site Location:
KENNETH A. TUA
Sampler name

I attest that the proper field sampling procedures were used during the collection of these samples.

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED						SAMPLING	
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME
MW1	WELL	01A1-A5	5	X								X			1-15-92	1545
MW2	WELL	02A1-A2	2	X								X			1-15-92	1315
MW3	WELL	03A1-A5	5	X								X			1-16-92	1530
MW4	WELL	04A1-A2	2	X								X			1-16-92	1330
MW5	WELL	05A1-A2	2	X								X			1-16-92	1216
MW6	WELL	06A1-A2	2	X								X			1-15-92	1415
MW7	WELL	07A1-A4	4	X								X			1-15-92	1145

Relinquished by Sampler:
Kenneth A. Tua
Received by:
Date: 1-17-92 Time: 0800
Relinquished by:
Date: Time:
Relinquished by:
Date: 1-18-92 Time: 1430

CUSTODY RECORD

REMARKS:
REQUEST 14 DAY TURN AROUND
SAMPLES PACKED IN ICE
AND SHIPPED FED EX
06A2 ARRIVED BROKEN
07A2 ARRIVED BROKEN

SPECIAL HANDLING
EXPEDITED (48) ☐ (24) ☐
THREE DAYS ☐
SEVEN DAYS ☐ QUOTE # _____
PURCHASE ORDER # _____ FAX _____

SPECIAL DETECTION LIMITS (Specify)
Regular Detection Limits

SPECIAL REPORTING REQUIREMENTS:
PLEASE COMBINE SOIL & WATER
INTO 1 FINAL REPORT

CONTAINERS:
GLASS ☒ 40 ML ☒
AMBER ☒ 500 ML ☐
PLASTIC ☐ 1 Liter ☒
WHIRLPAK ☐ other _____

SOLUTIONS G #

01181993-001

COMPANY NAME:

BAKER ENV

SOLUTIONS LABORATORIES, INC.

814-B Greenbrier Circle

Chesapeake, VA 23320

(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD
AND ANALYSIS REQUEST

2 of 3

ANALYSIS REQUEST

PROJECT MANAGER:

DAVE MANROSE

Phone:

412-269-2026

Address (Office): AOP 61063

Site Location:

420 Rousar RD. CARROLLS, PA 15108

PIPE LINE

Project Number:

Project Name:

19015-641-SV2-PL

PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name

Kenneth A. Dine

KENNETH A. DINE

Field Sample ID	Source of Sample	SOLN'S LAB # (Lab use only)	# containers	MATRIX					METHOD PRESERVED						SAMPLING		
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME	
MW 8	WELL	08A1, A2	2	X									X			1-16-92	1330
MW 9	WELL	09A1, A2	2	X									X			1-15-92	1545
MW 10	WELL	10A1	1	X									X			1-16-92	1530
DW 1	WELL	11A1, A2	2	X									X			1-15-92	1520
DW 2	WELL	12A1, A2	2	X									X			1-15-92	1250
DW 3	WELL	13A1-A14	4	X									X			1-16-92	1415
DW 4	WELL	14A1, A2	2	X									X			1-16-92	1000

Relinquished by Sampler:

Kenneth A. Dine

Date

1-17-92

Time

0800

Received by:

Relinquished by:

Date

Time

Received by:

Relinquished by:

Date

Time

Received by Laboratory:

D. Small

CUSTODY RECORD

REMARKS:

REQUEST 1-11 DAY TURNAROUND
SAMPLES PICKED UP IN ICE
AND SHIPPED FEEL EX.

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐THREE DAYS ☐SEVEN DAYS ☐

QUOTE #

PURCHASE ORDER #

FAX

SPECIAL DETECTION LIMITS (Specify)

Regular Detection Limits

SPECIAL REPORTING REQUIREMENTS:

PLEASE COMBINE SOIL & WATER

INTO 1 FINAL REPORT

CONTAINERS:

GLASS ☒AMBER ☒PLASTIC ☐WHIRLPAK ☐

other

40 ML ☒500 ML ☐1 Liter ☒

other

OTHER

625

CORR ☐FLASH ☐REACT ☐LEAD FLAME ☐FURNACE ☐HRSD AG ☐METALS ☐EPA METALS ☐SPSA ☐RCRA ☐TCLP METALS ☐VOA ☐SEMI-VOA ☐EPTOX METALS ☐PEST ☐HERB ☐EPA 610 ☐8310 ☐EPA 608 ☐8080 ☐EPA 602 ☒8020 ☐EPA 601 ☒8010 ☐TPH 418.1 ☐503B,D,E ☐GC ☐Oil & Grease 503 B+D ☐BTX only 602 ☐8020 ☐MTBE ☐GAS hydro. 602 ☐8020 ☐MTBE ☐

[illegible]

SOLUTIONS LABORATORIES, INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

SOLUTIONS LABORATORIF
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

SOLUTIONS LABORATORIF
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

ANALYSIS REQUEST

PROJECT MANAGER:	Phone:
DAVE MAMROSE	412 - 269 - 2026
Address (Office): AOP B1063	Site Location:
420 ROUSER RD. CORAOPOLIS PA 15108	P.I.P.E LINE
Project Number:	Project Name:
14013-671-SUZ-PL	P.I.P.E LINE
I attest that the proper field sampling procedures were used during the collection of these samples. <i>Kenneth A. TUA</i> Kenneth A. TUA Sampler name	

Field Sample ID	Source of Sample	SOLN'S LAB # (lab use only)	# containers	MATRIX				METHOD PRESERVED					SAMPLING			
				water	soil	air	sludge	other	HCl	HNO3	H2SO4	ICE	NONE	other	DATE	TIME
MW1	WELL 01A1	A5	5	X								X			1-15-92	1545
MW2	WELL 02A1	A2	2	X								X			1-15-92	1315
MW3	WELL 03A1	A5	5	X								X			1-16-92	1530
MW4	WELL 04A1	A2	2	X								X			1-16-92	1320
MW5	WELL 05A1	A2	2	X								X			1-16-92	1216
MW6	WELL 06A1	A2	2	X								X			1-15-92	1415
MW7	WELL 07A1	A4	4	X								X			1-15-92	1145

Relinquished by Sampler: <i>Kimetha C. Allen</i>	Date <i>1-17-92</i>	Time <i>0800</i>	Received by:
Relinquished by:	Date	Time	Received by:
Relinquished by:	Date <i>1-18-92</i>	Time <i>1430</i>	Received by Laboratory: <i>D. Smith</i>

SPECIAL HANDLING EXPEDITED (48) ☐ (24) ☐ THREE DAYS ☐ SEVEN DAYS ☐ QUOTE # _____ PURCHASE ORDER # _____ FAX _____	SPECIAL DETECTION LIMITS (Special Handling) <i>REGULAR DETECTION</i>	SPECIAL REPORTING REQUIREMENTS <i>PLEASE CONFIRM WITH US FOR INFO. FINAL REPORT</i>

[illegible]

REMARKS:	REQUEST 14 DAY TURN AROUND SAMPLES PACKED IN ICE AND SHIPPED FED EX OGA 2 ARRIVED BROKEN O7A 2 ARRIVED BROKEN REQ'D 0930 HRS. 12/1/82 O1A1-A5 <u>1 Liter</u> O5A1-A5 40 ML ☒ 500 ML ☐ 1 Liter ☒ other _____
CUSTODY RECORD	CONTAINERS GLASS ☒ AMBER ☒ PLASTIC ☐ WHIRLPAK ☐ other _____
	(ity) Limits NTS: DATE

SOLUTIONS LABORATORIES INC.
814-B Greenbrier Circle
Chesapeake, VA 23320
(804) 420-0467/Fax 420-4204

01121' -001
COMPANY NAME:
BAKER ENV

ANALYSIS REQUEST

PROJECT MANAGER:	Phone:
DAVE MARASE	412-269-2026
Address (Office): A00 Bldg-3	Site Location:
420 ROUSE RD CORNOLIS, PA. 15108	PIPE LINE
Project Number:	Project Name:
19013-64-SUZ-PL	PIPE LINE

I attest that the proper field sampling procedures were used during the collection of these samples.

Sampler name[illegible]

Received by:

Date 1-17-82 Time 08:20

Relinquished by Sampler:
Harrell A. Lee

Received by:

Date _____ Time _____

Relinquished by:

Received by Laboratory:

Date	Time
1-15-92	1430

Relinquished by:

**CUSTODY
RECORD**

REMARKS:

REQUEST 14 DAY TURN AROUND
SAMPLES PACKED IN ICE
AND SHIPPED FED EX

SPECIAL HANDLING

EXPEDITED (48) ☐ (24) ☐
THREE DAYS : ☐
SEVEN DAYS ☐ QUOTE ☐

PURCHASE ORDER # _____ FAX _____

SPECIAL DETECTION LIMITS (Specify)

REGULAR DETECTION LIMITS

SPECIAL REPORTING REQUIREMENTS:

PLEASE COMBINE SOIL & WATER INTO
1 FINAL REPORT

CONTAINERS

GLASS ☒
AMBER ☒
PLASTIC ☐
WHIRLPAK ☐
other _____

DEFID 0939 12/192
15/11/192

3. Results of Analysis

3.a. Soils-Inorganic

SOLUTIONS LABORATORIES, INC.

814-B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

REPORT OF ANALYSIS

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

SAMPLE ID	FIELD ID	ANALYSIS	RESULT	UNITS	METHOD/DATE/TIME/ANALYST
02A2	MW1-02	Ph	6.85	N/A	9045/01-29-92/0330/LP
04A2	MW2-02	Ph	4.27	N/A	9045/01-29-92/0330/LP
06A2	MW3-02	Ph	6.01	N/A	9045/01-29-92/0330/LP
08A2	MW4-02	Ph	4.04	N/A	9045/01-30-92/1330/LP
10A2	MW5-02	Ph	4.90	N/A	9045/01-30-92/1330/LP
12A2	MW6-02	Ph	4.36	N/A	9045/01-30-92/1330/LP
14A2	MW7-02	Ph	4.55	N/A	9045/01-30-92/1330/LP
31A2	MW8-01	Ph	4.20	N/A	9045/01-30-92/1330/LP
02A2	MW1-02	FLASH POINT	> 140	oC	9045/01-29-92/0330/LP
04A2	MW2-02	FLASH POINT	> 140	oC	9045/01-29-92/0330/LP
06A2	MW3-02	FLASH POINT	> 140	oC	9045/01-29-92/0330/LP
08A2	MW4-02	FLASH POINT	> 140	oC	9045/01-30-92/1330/LP
10A2	MW5-02	FLASH POINT	> 140	oC	9045/01-30-92/1330/LP
12A2	MW6-02	FLASH POINT	> 140	oC	9045/01-30-92/1330/LP
14A2	MW7-02	FLASH POINT	> 140	oC	9045/01-30-92/1330/LP
31A2	MW8-01	FLASH POINT	> 140	oC	9045/01-30-92/1330/LP

3.b. Soils-Organic

SOLUTIONS LABORATORIES, INC.

814-B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

REPORT OF ANALYSIS

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	MW1-01	MW1-02	MW2-01	MW2-02	MW3-01
LAB NO:	01A1	02A1	03A1	04A1	05A1
SAMPLE DATE:	01/08/92	01/08/92	01/08/92	01/08/92	01/11/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/30/92	01/29/92	01/29/92	01/29/92	01/30/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	391.10	0.25 U	7.52	9.50	742.06
TYPE	WEATHERED JET FUEL	N/A	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	MW3-02	MW4-01	MW4-02	MW5-01	MW5-02
LAB NO:	06A1	07A1	08A1	09A1	10A1
SAMPLE DATE:	01/11/92	01/11/92	01/11/92	01/12/92	01/12/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/30/92	01/29/92	01/29/92	01/29/92	01/29/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	795.19	0.456	2.55	0.25 U	0.25 U
TYPE	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL	N/A	N/A

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	MW6-01	MW6-02	MW7-01	MW7-02	DW1-01
LAB NO:	11A1	12A1	13A1	14A1	15A1
SAMPLE DATE:	01/14/92	01/14/92	01/14/92	01/14/92	01/08/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/29/92	01/29/92	01/29/92	01/30/92	01/30/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	0.25 U	2.05	1.25	32.74	3.27
TYPE	N/A	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	DW1-02	DW2-01	DW2-02	DW3-01	DW3-02
LAB NO:	16A1	17A1	18A1	19A1	20A1
SAMPLE DATE:	01/08/92	01/09/92	01/09/92	01/11/92	01/11/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/29/92	01/29/92	01/29/92	01/29/92	01/30/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	28.73	4.79	6.65	626.85	182.93
TYPE	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	DW4-01	DW4-02	B1-01	B1-02	B2-01
LAB NO:	21A1	22A1	23A1	24A1	25A1
SAMPLE DATE:	01/14/92	01/14/92	01/11/92	01/11/92	01/11/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/29/92	01/29/92	01/29/92	01/29/92	01/29/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	0.25 U	4.48	792.30	811.00	0.25 U
TYPE	N/A	WEATHERED JET FUEL	WEATHERED JET FUEL	WEATHERED JET FUEL	N/A

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	B2-02	B3-01	B3-02	B4-01	B4-02
LAB NO:	26A1	27A1	28A1	29A1	30A1
SAMPLE DATE:	01/11/92	01/12/92	01/12/92	01/12/92	01/12/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/91
ANALYSIS DATE:	01/29/92	01/29/92	01/29/92	01/29/92	01/29/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	893.46	0.25 U	100.55	11.25	0.25 U
TYPE	WEATHERED JET FUEL	N/A	WEATHERED JET FUEL	WEATHERED JET FUEL	N/A

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL INC.
AIRPORT OFFICE PARK, BLDG.
420 ROUSER ROAD
COROAPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01161992-005
MATRIX: SOIL
DATE/TIME RECEIVED: 01/16/92; 1230

METHOD TPH-CAL METHOD

CLIENT NO:	B5-01	DW5-01	B6-01
LAB NO:	32A1	33A1	34A1
SAMPLE DATE:	01/11/92	01/09/92	01/12/92
RECEIVED DATE:	01/16/92	01/16/92	01/16/92
DATE EXTRACTED:	01/28/92	01/28/92	01/28/92
ANALYSIS DATE:	01/29/92	01/29/92	01/29/92
INSTRUMENT ID:	HP/FID	HP/FID	HP/FID
MATRIX:	SOIL	SOIL	SOIL
UNITS:	mg/KG	mg/KG	mg/KG

ANALYSIS

TOTAL PETROLEUM HYDROCARBONS	358.07	0.25 U	4.10
TYPE	WEATHERED JET FUEL	N/A	WEATHERED JET FUEL

3.c. Waters-Organic

SOLUTIONS LABORATORIES, INC.

814-B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

REPORT OF ANALYSIS

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL, INC.
ATTN: KENNETH TUA
AIRPORT OFFICE PARK, BLDG 3
420 ROUSER RD.
CORAOPOLIS, PA 15108
(412) 269-2026

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01181992-001
MATRIX: WATER

METHOD 601

CLIENT NO:	MW1	MW3	MW7	MW9
LAB NO:	01A3	03A3	07A3	09A1
SAMPLE DATE:	01/15/92	01/16/92	01/15/92	01/15/92
RECEIVED DATE:	01/18/92	01/18/92	01/18/92	01/18/92
ANALYSIS DATE:	01/26/92	01/26/92	01/26/92	01/26/92
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

BROMODICHLOROMETHANE	1.0 U	1.0 U	1.0 U	1.0 U
BROMOFORM	2.0 U	2.0 U	2.0 U	2.0 U
BROMOETHANE	5.0 U	5.0 U	5.0 U	5.0 U
CARBON TETRACHLORIDE	1.2 U	1.2 U	1.2 U	1.2 U
CHLOROBENZENE	2.5 U	2.5 U	2.5 U	2.5 U
CHLOROETHANE	5.0 U	5.0 U	5.0 U	5.0 U
2-CHLOROETHYL VINYL ETHER	1.0 U	1.0 U	1.0 U	1.0 U
CHLOROFORM	0.5 U	0.5 U	0.5 U	0.5 U
CHLOROMETHANE	0.8 U	0.8 U	0.8 U	0.8 U
DIBROMOCHLOROMETHANE	0.9 U	0.9 U	0.9 U	0.9 U
1,2-DICHLOROBENZENE	1.5 U	1.5 U	1.5 U	1.5 U
1,3-DICHLOROBENZENE	3.0 U	3.0 U	3.0 U	3.0 U
1,4-DICHLOROBENZENE	2.0 U	2.0 U	2.0 U	2.0 U
DICHLORODIFLUOROMETHANE	5.0 U	5.0 U	5.0 U	5.0 U
1,1,- DICHLOROETHANE	0.7 U	0.7 U	0.7 U	0.7 U
1,2-DICHLOROETHANE	0.3 U	0.3 U	0.3 U	0.3 U
1,1-DICHLOROETHENE	1.3 U	1.3 U	1.3 U	1.3 U
TRANS-1,2-DICHLOROETHENE	1.0 U	1.0 U	1.0 U	1.0 U
1,2-DICHLOROPROPANE	0.4 U	0.4 U	0.4 U	0.4 U
CIS-1,3-DICHLOROPROPENE	3.0 U	3.0 U	3.0 U	3.0 U
TRANS-1,3-DICHLOROPROPENE	3.0 U	3.0 U	3.0 U	3.0 U
METHYLENE CHLORIDE	3.0 U	3.0 U	3.0 U	3.0 U
TETRACHLOROETHENE/ 1,1,2,2-TETRACHLOROETHANE	0.3 U	0.3 U	0.3 U	0.3 U
1,1,2-TRICHLOROETHENE/ 1,1,1-TRICHLOROETHANE	0.3 U	0.3 U	0.3 U	0.3 U
TRICHLOROFLUOROMETHANE	5.0 U	5.0 U	5.0 U	5.0 U
VINYL CHLORIDE	1.8 U	1.8 U	1.8 U	1.8 U

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL, INC.
ATTN: KENNETH TUA
AIRPORT OFFICE PARK, BLDG 3
420 ROUSER RD.
CORAOPOLIS, PA 15108
(412) 269-2026

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01181992-001
MATRIX: WATER

METHOD 601

CLIENT NO:	DW3	TRIP BLANK
LAB NO:	13A1	15A1
SAMPLE DATE:	01/16/92	01/16/92
RECEIVED DATE:	01/18/92	01/18/92
ANALYSIS DATE:	01/26/92	01/26/92
INSTRUMENT ID:	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1
UNITS:	ug/L	ug/L

COMPOUNDS

BROMODICHLOROMETHANE	1.0 U	1.0 U
BROMOFORM	2.0 U	2.0 U
BROMOETHANE	5.0 U	5.0 U
CARBON TETRACHLORIDE	1.2 U	1.2 U
CHLOROBENZENE	2.5 U	2.5 U
CHLOROETHANE	5.0 U	5.0 U
2-CHLOROETHYLVINYL ETHER	1.0 U	1.0 U
CHLOROFORM	0.5 U	0.5 U
CHLOROMETHANE	0.8 U	0.8 U
DIBROMOCHLOROMETHANE	0.9 U	0.9 U
1,2-DICHLOROBENZENE	1.5 U	1.5 U
1,3-DICHLOROBENZENE	3.0 U	3.0 U
1,4-DICHLOROBENZENE	2.0 U	2.0 U
DICHLORODIFLUOROMETHANE	5.0 U	5.0 U
1,1,- DICHLOROETHANE	0.7 U	0.7 U
1,2-DICHLOROETHANE	0.3 U	0.3 U
1,1-DICHLOROETHENE	1.3 U	1.3 U
TRANS-1,2-DICHLOROETHENE	1.0 U	1.0 U
1,2-DICHLOROPROPANE	0.4 U	0.4 U
CIS-1,3-DICHLOROPROPENE	3.0 U	3.0 U
TRANS-1,3-DICHLOROPROPENE	3.0 U	3.0 U
METHYLENE CHLORIDE	3.0 U	3.0 U
TETRACHLOROETHENE/		
1,1,2,2-TETRACHLOROETHANE	0.3 U	0.3 U
1,1,2-TRICHLOROETHENE/		
1,1,1-TRICHLOROETHANE	0.3 U	0.3 U
TRICHLOROFLUOROMETHANE	5.0 U	5.0 U
VINYL CHLORIDE	1.8 U	1.8 U

SOLUTIONS LABORATORIES, INC.

814-B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

REPORT OF ANALYSIS

DATE: JANUARY 5, 1992

BAKER ENVIRONMENTAL, INC.
AIRPORT OFFICE PARK BLDG.
420 ROUSER ROAD
CORAOPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 12211991-003-01A1,A2 THRU 22A1,A2
MATRIX: WATER

METHOD 602

CLIENT NO:	PL-W-H1	PL-W-H2	PL-W-H3	PL-W-H4	PL-W-H5
LAB NO:	01A2	02A1	03A2	04A2	05A
SAMPLE DATE:	12/17/91	12/17/91	12/17/91	12/17/91	12/17/91
RECEIVED DATE:	12/21/91	12/21/91	12/21/91	12/21/91	12/21/91
EXTRACTION DATE:	N/A	N/A	N/A	N/A	N/A
ANALYSIS DATE:	12/29/91	12/29/91	12/29/91	12/29/91	12/30/91
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.20 U	0.20 U	0.20 U	0.34	0.32
BENZENE	0.28	0.87	0.20 U	0.20 U	3.06
TOLUENE/EDB	0.29	0.57	0.20 U	0.18 J	0.73
ETHYL BENZENE	0.44	0.15 J	0.55	0.28	1.80
M & P XYLENE & CHLOROBENZENE	0.20 U	1.09	0.20 U	1.05	2.48
O XYLENE	0.20 U	0.20 U	0.20 U	2.47	1.62
1,4 & 1,3					
DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	0.40 U	53.50
1,2 DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	0.40 U	24.46

DATE: JANUARY 5, 1992

BAKER ENVIRONMENTAL, INC.
AIRPORT OFFICE PARK BLDG.
420 ROUSER ROAD
CORAOPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 12211991-003-01A1,A2 THRU 22A1,A2
MATRIX: WATER

METHOD 602

CLIENT NO:	PL-W-H6	PL-W-H7	PL-W-H8	PL-W-H9	PL-W-H10
LAB NO:	06A1	07A1	08A1	09A1	10A2
SAMPLE DATE:	12/18/91	12/18/91	12/18/91	12/18/91	12/18/91
RECEIVED DATE:	12/21/91	12/21/91	12/21/91	12/21/91	12/21/91
EXTRACTION DATE:	N/A	N/A	N/A	N/A	N/A
ANALYSIS DATE:	12/30/91	12/30/91	12/30/91	12/30/91	12/30/91
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.32	0.20 U	0.35	1.44	81.98
BENZENE	1.99	1.97	1.96	0.20 U	3.04
TOLUENE/EDB	0.63	0.63	0.20 U	0.20 U	4.79
ETHYL BENZENE	0.20 U	0.20 U	0.20 U	0.20 U	0.67
M & P XYLENE & CHLOROBENZENE	0.20 U	0.20 U	0.72	0.20 U	6.36
O XYLENE	0.20 U	0.20	0.20 U	0.20 U	1.02
1,4 & 1,3 DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	0.40 U	1.86
1,2 DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	0.40 U	1.14

NOTE: IT HAS BEEN DETERMINED THAT METHANE HAS A RETENTION TIME AT THE SAME WINDOW OF RETENTION AS MTBE. THIS MAY BE AFFECTING THE CONCENTRATION REPORTED FOR MTBE IN SAMPLE 12211991-003-10A1.

DATE: JANUARY 5, 1991

BAKER ENVIRONMENTAL, INC.
AIRPORT OFFICE PARK BLDG.
420 ROUSER ROAD
CORAOPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 12211991-003-01A1,A2 THRU 22A1,A2
MATRIX: WATER

METHOD 602

CLIENT NO:	PL-W-H11	PL-W-H12	PL-W-H13	PL-W-H14	PL-W-H15
LAB NO:	11A1	12A1	13A2	14A1	15A2
SAMPLE DATE:	12/18/91	12/18/91	12/18/91	12/18/91	12/18/91
RECEIVED DATE:	12/21/91	12/21/91	12/21/91	12/21/91	12/21/91
EXTRACTION DATE:	N/A	N/A	N/A	N/A	N/A
ANALYSIS DATE:	12/31/91	12/31/91	12/31/91	12/31/91	12/31/91
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.36	194.56	0.23	0.66	0.27
BENZENE	1.96	2.82	0.20 U	1.97	0.20 U
TOLUENE/EDB	0.56	5.65	0.52	0.84	0.65
ETHYL BENZENE	0.20 U	0.99	0.26	0.20 U	0.20 U
M & P XYLENE & CHLOROBENZENE	0.89	7.73	1.61	0.75	0.20 U
O XYLENE	0.20 U	1.13	0.20 U	0.20 U	0.20 U
1,4 & 1,3					
DICHLOROBENZENE	2.79	1.62	2.57	0.40 U	0.40 U
1,2 DICHLOROBENZENE	1.74	0.98	4.97	0.40 U	0.40 U

NOTE: IT HAS BEEN DETERMINED THAT METHANE HAS A RETENTION TIME AT THE SAME WINDOW OF RETENTION AS MTBE. THIS MAY BE AFFECTING THE CONCENTRATION REPORTED FOR MTBE IN SAMPLE 12211991-003-12A1.

DATE: JANUARY 5, 1991

BAKER ENVIRONMENTAL, INC.
AIRPORT OFFICE PARK BLDG.
420 ROUSER ROAD
CORAOPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 12211991-003-01A1,A2 THRU 22A1,A2
MATRIX: WATER

METHOD 602

CLIENT NO:	PL-W-H16	PL-W-H17	PL-W-H18	PL-W-H19	PL-W-H20
LAB NO:	16A1	17A1	18A1	19A1	20A1
SAMPLE DATE:	12/18/91	12/18/91	12/18/91	12/18/91	12/18/91
RECEIVED DATE:	12/21/91	12/21/91	12/21/91	12/21/91	12/21/91
EXTRACTION DATE:	N/A	N/A	N/A	N/A	N/A
ANALYSIS DATE:	12/31/91	12/31/91	12/31/91	12/31/91	12/31/91
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.29	0.39	128.55	1.08	0.16 J
BENZENE	0.20 U	0.20	2.42	2.13	1.96
TOLUENE/EDB	0.65	0.97	3.79	0.60	0.20 U
ETHYL BENZENE	0.20 U	0.20 U	0.14 J	0.33	0.39
M & P XYLENE & CHLOROBENZENE	0.20 U	0.20 U	4.72	1.86	0.65
O XYLENE 1,4 & 1,3	0.20 U	0.20 U	0.76	0.20 U	0.75
DICHLOROBENZENE	0.40 U	0.40 U	1.54	2.01	6.95
1,2 DICHLOROBENZENE	0.40 U	0.40 U	0.95	3.40	16.05

NOTE: IT HAS BEEN DETERMINED THAT METHANE HAS A RETENTION TIME AT THE SAME WINDOW OF RETENTION AS MTBE. THIS MAY BE AFFECTING THE CONCENTRATION REPORTED FOR MTBE IN SAMPLE 12211991-003-18A1.

DATE: JANUARY 5, 1991

BAKER ENVIRONMENTAL, INC.
AIRPORT OFFICE PARK BLDG.
420 ROUSER ROAD
CORAOPOLIS, PA 15108

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 12211991-003-01A1,A2 THRU 22A1,A2
MATRIX: WATER

METHOD 602

CLIENT NO:	PL-W-H21	TRIP BLANK
LAB NO:	21A1	22A1
SAMPLE DATE:	12/18/91	N/A
RECEIVED DATE:	12/21/91	12/21/91
EXTRACTION DATE:	N/A	N/A
ANALYSIS DATE:	12/31/91	12/31/91
INSTRUMENT ID:	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1
UNITS:	ug/L	ug/L

COMPOUNDS

MTBE	0.31	0.20 U
BENZENE	0.20 U	0.20 U
TOLUENE/EDB	0.49	0.73
ETHYL BENZENE	12.08	0.20 U
M & P XYLENE & CHLOROBENZENE	10.83	1.01
O XYLENE	6.57	0.20 U
1,4 & 1,3		
DICHLOROBENZENE	66.75	0.40 U
1,2 DICHLOROBENZENE	156.08	0.40 U

SOLUTIONS LABORATORIES, INC.

814-B GREENBRIER CIRCLE
CHESAPEAKE, VA 23320
(T) (804) 420-0467
(F) (804) 420-4204

REPORT OF ANALYSIS

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL, INC.
ATTN: KENNETH TUA
AIRPORT OFFICE PARK, BLDG 3
420 ROUSER RD.
CORAOPOLIS, PA 15108
(412) 269-2026

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01181992-001
MATRIX: WATER

METHOD 602

CLIENT NO:	MW1	MW2	MW3	MW4	MW5
LAB NO:	01A1	02A1	03A1	04A1	05A1
SAMPLE DATE:	01/15/92	01/15/92	01/16/92	01/16/92	01/16/92
RECEIVED DATE:	01/18/92	01/18/92	01/18/92	01/18/92	01/18/92
ANALYSIS DATE:	01/22/92	01/19/92	01/23/92	01/19/92	01/20/92
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
BENZENE	2.26	0.20 U	0.20 U	0.20 U	0.20 U
TOLUENE/EDB	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
ETHYL BENZENE	5.72	0.20 U	0.08 J	0.20 U	0.20 U
M & P XYLENE & CHLOROBENZENE	2.75	0.20 U	0.20 U	0.20 U	0.20 U
O XYLENE	0.74	0.20 U	2.15	0.20 U	0.66
1,4, & 1,3 DICHLOROBENZENE	63.75	0.40 U	37.72	0.40 U	2.05
1,2 DICHLOROBENZENE	70.85	0.40 U	20.61	0.40 U	1.63

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL, INC.
ATTN: KENNETH TUA
AIRPORT OFFICE PARK, BLDG 3
420 ROUSER RD.
CORAOPOLIS, PA 15108
(412) 269-2026

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01181992-001
MATRIX: WATER

METHOD 602

CLIENT NO:	MW6	MW7	MW8	DW1	DW2
LAB NO:	06A1	07A1	08A1	11A1	12A1
SAMPLE DATE:	01/15/92	01/15/92	01/16/92	01/15/92	01/15/92
RECEIVED DATE:	01/18/92	01/18/92	01/18/92	01/18/92	01/18/92
ANALYSIS DATE:	01/20/92	01/20/92	01/21/92	01/21/92	01/19/92
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1	1	1
UNITS:	ug/L	ug/L	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
BENZENE	0.20 U	0.20 U	0.20 U	3.16	0.20 U
TOLUENE/EDB	0.20 U	0.20 U	0.20 U	7.35	1.86
ETHYL BENZENE	0.20 U	0.20 U	0.20 U	1.88	0.20 U
M & P XYLENE & CHLOROBENZENE	0.20 U	0.20 U	0.20 U	2.05	1.45
O XYLENE 1,4, & 1,3	0.20 U	0.20 U	0.20 U	1.14	0.20 U
DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	18.28	0.40 U
1,2 DICHLOROBENZENE	0.40 U	0.40 U	0.40 U	5.29	0.40 U

DATE: JANUARY 30, 1992

BAKER ENVIRONMENTAL, INC.
ATTN: KENNETH TUA
AIRPORT OFFICE PARK, BLDG 3
420 ROUSER RD.
CORAOPOLIS, PA 15108
(412) 269-2026

PROJECT NAME: PIPE LINE
PROJECT NUMBER: 19013-64-SVZ-PL

SOL LOG: 01181992-001
MATRIX: WATER

METHOD 602

CLIENT NO:	DW3	DW4	TRIP BLANK
LAB NO:	13A1	14A1	15A1
SAMPLE DATE:	01/16/92	01/16/92	01/16/92
RECEIVED DATE:	01/18/92	01/18/92	01/18/92
ANALYSIS DATE:	01/21/92	01/22/92	01/21/92
INSTRUMENT ID:	HP/P&T	HP/P&T	HP/P&T
DILUTION FACTOR:	1	1	1
UNITS:	ug/L	ug/L	ug/L

COMPOUNDS

MTBE	0.20 U	0.20 U	0.20 U
BENZENE	1.94	0.20 U	0.20 U
TOLUENE/EDB	0.94	8.23	0.20 U
ETHYL BENZENE	0.38	0.20 U	0.08 J
M & P XYLENE & CHLOROBENZENE	3.50	0.20 U	0.20 U
O XYLENE 1,4, & 1,3	0.20 U	0.20 U	0.20 U
DICHLOROBENZENE	1.18	0.40 U	0.40 U
1,2 DICHLOROBENZENE	0.77	0.40 U	0.40 U

MARYLAND SPECTRAL SERVICES, INC.
1500 Caton Center Drive Baltimore, MD 21227

SEMIVOLATILE ORGANICS BY EPA GC/MS METHOD 625

Solution's Log: 01181992-001

CLIENT SAMPLE ID:	01A1-A5	03A1-A5	10A1	15A1-A5	SWBLK0122
	MW1	MW3	MW10	TRIP-BLANK	
LAB SAMPLE ID:	92012101	92012102	92012103	92012104	METHOD_BLANK
SAMPLE DATE:	01/15/92	01/16/92	01/16/92	01/16/92	
RECEIVED DATE:	01/21/92	01/21/92	01/21/92	01/21/92	
EXTRACTION DATE:	01/22/92	01/22/92	01/22/92	01/22/92	01/22/92
ANALYSIS DATE:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/92
FILE NAME:	S012101	S012102	S012103	S012104	SWBLK0122
INSTRUMENT ID:	MSC	MSC	MSC	MSC	MSC
MATRIX:	WATER	WATER	WATER	WATER	WATER
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
SEMIVOLATILE COMPOUNDS					
Acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Acenaphthylene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Anthracene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzidine	25 U	25 U	25 U	25 U	25 U
Benzo(a)Anthracene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo(a)Pyrene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo(b+k)fluoranthenes	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzo(g,h,i)Perylene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Bromophenyl-phenylether	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Butylbenzylphthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Chloro-3-Methylphenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
bis(2-Chloroethoxy)Methane	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
bis(2-Chloroethyl)Ether	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
bis(2-Chloroisopropyl)Ether	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Chloronaphthalene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Chlorophenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Chlorophenyl-phenylether	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chrysene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-Butylphthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Di-n-Octyl Phthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Dibenz(a,h)Anthracene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Dichlorobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,4-Dichlorobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,3-Dichlorobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Diethylphthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Dimethyl Phthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4-Dimethylphenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4,6-Dinitro-2-Methylphenol	25 U	25 U	25 U	25 U	25 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U
2,4-Dinitrotoluene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,6-Dinitrotoluene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2-Diphenylhydrazine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
bis(2-Ethylhexyl)Phthalate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Fluoranthene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

MARYLAND SPECTRAL SERVICES, INC.
1500 Caton Center Drive Baltimore, MD 21227

SEMIVOLATILE ORGANICS BY EPA GC/MS METHOD 625

Solution's Log: 01181992-001

CLIENT SAMPLE ID:	01A1-A5	03A1-A5	10A1	15A1-A5	SWBLK0122
	MW1	MW3	MW10	TRIP-BLANK	
LAB SAMPLE ID:	92012101	92012102	92012103	92012104	METHOD_BLANK
SAMPLE DATE:	01/15/92	01/16/92	01/16/92	01/16/92	
RECEIVED DATE:	01/21/92	01/21/92	01/21/92	01/21/92	
EXTRACTION DATE:	01/22/92	01/22/92	01/22/92	01/22/92	01/22/92
ANALYSIS DATE:	01/28/92	01/28/92	01/28/92	01/28/92	01/28/92
FILE NAME:	S012101	S012102	S012103	S012104	SWBLK0122
INSTRUMENT ID:	MSC	MSC	MSC	MSC	MSC
MATRIX:	WATER	WATER	WATER	WATER	WATER
UNITS:	UG/L	UG/L	UG/L	UG/L	UG/L
SEMIVOLATILE COMPOUNDS					
Fluorene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorobutadiene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorocyclopentadiene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachloroethane	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Indeno(1,2,3-cd)Pyrene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Isophorone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitroso-Di-n-Propylamine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodimethylamine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
N-Nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Naphthalene	<u>48</u>	5.0 U	<u>28</u>	5.0 U	5.0 U
Nitrobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Nitrophenol	25 U	25 U	25 U	25 U	25 U
2-Nitrophenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U
Phenanthrene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Pyrene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,2,4-Trichlorobenzene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2,4,6-Trichlorophenol	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

4. Appendix A- QC Report

SOIL VOLITALE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

LAB NAME: SOLUTIONS LABORATORIES, INC.

SAMPLE NUMBER: 01181992-001-15A2

LAB CODE: SOL

MATRIX SPIKE SAMPLE NO: 121691-61-5

UNITS: ug/L

COMPOUND	SPIKE ADDED	SAMPLE CON	MS CON	MS % REC	QC LIMIT
ETHYL BENZENE	6.72	0.20 U	7.39	109.97	66-142
TOLUENE	6.91	0.20 U	7.34	106.22	59-139
CHLOROBENZENE	8.18	0.20 U	10.45	127.75	70-120

COMPOUND	SPIKE ADDED	MSD CON	MSD % REC	% RPD	QC LIMIT
ETHYL BENZENE	6.72	7.23	107.59	2.3 21	66-14
TOLUENE	6.91	7.21	104.34	1.9 21	59-139
CHLOROBENZENE	8.18	9.98	122.00	5.6 21	70-120

3B

SOIL VOLITALE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

LAB NAME: SOLUTIONS LABORATORIES, INC.

SAMPLE NUMBER: 12211991-003-09A2

LAB CODE: SOL

MATRIX SPIKE SAMPLE NO: 121691-61-5

UNITS: ug/L

COMPOUND	SPIKE ADDED	SAMPLE CON	MS CON	MS % REC	QC LIMIT
ETHYL BENZENE	6.72	0.20 U	5.53	82.29	66-142
TOLUENE	6.91	0.20 U	7.30	105.64	59-139
CHLOROBENZENE	8.18	1.01	10.51	114.36	70-120

COMPOUND	SPIKE ADDED	MSD CON	MSD % REC	% RPD	QC LIMIT
ETHYL BENZENE	6.72	6.04	89.94	8.88	21 66-14
TOLUENE	6.91	8.29	120.01	12.73	21 59-139
CHLOROBENZENE	8.18	11.68	127.11	10.56	21 70-120

4A

VOLATILE METHOD BLANK SUMMARY

LAB NAME: SOLUTIONS LABORATORIES, INC

LAB CODS: SOL

DATE ANALYZED: 12-29-91

TIME ANALYZED: 0928

MATRIX: WATER

INSTRUMENT: H.P/P&T

<u>SAMPLE ID</u>	<u>LAB ID</u>	<u>LAB FILE ID</u>	<u>TIME ANALYZED</u>
PL-W-H1	12211991-003-01A1	12211991-003	1423
PL-W-H2	12211991-003-02A1	12211991-003	1542
PL-W-H3	12211991-003-03A1	12211991-003	1041

4A

VOLATILE METHOD BLANK SUMMARY

LAB NAME: SOLUTIONS LABORATORIES, INC

LAB CODS: SOL

DATE ANALYZED: 12-30-91

TIME ANALYZED: 0904

MATRIX: WATER

INSTRUMENT: H.P/P&T

<u>SAMPLE ID</u>	<u>LAB ID</u>	<u>LAB FILE ID</u>	<u>TIME ANALYZED</u>
PL-W-H4	12211991-003-04A1	12141991-002	0958
FF-W-H5	12211991-003-05A1	12141991-002	1609
FF-W-H6	12211991-003-06A1	12141991-002	2214
FF-W-H7	12211991-003-07A2	12141991-002	2300
FF-W-H8	12211991-003-08A1	12141991-002	1002
FF-W-H9	12211991-003-09A1	12141991-002	1044
FF-W-H10	12211991-003-10A1	12141991-002	1137

VOLATILE METHOD BLANK SUMMARY

LAB NAME: SOLUTIONS LABORATORIES, INC

LAB CODS: SOL

DATE ANALYZED: 12-31-91

TIME ANALYZED: 0937

MATRIX: WATER

INSTRUMENT: H.P/P&T

<u>SAMPLE ID</u>	<u>LAB ID</u>	<u>LAB FILE ID</u>	<u>TIME ANALYZED</u>
PL-W-H11	12211991-003-11A2	12211991-003	1313
PL-W-H12	12211991-003-12A1	12211991-003	1359
PL-W-H13	12211991-003-13A1	12211991-003	1529
PL-W-H14	12211991-003-14A1	12211991-003	1843
PL-W-H15	12211991-003-15A1	12211991-003	2000
PL-W-H16	12211991-003-16A1	12211991-003	2050
PL-W-H17	12211991-003-17A1	12211991-003	2138
PL-W-H18	12211991-003-18A1	12211991-003	2227
PL-W-H19	12211991-003-19A1	12211991-003	1015
PL-W-H20	12211991-003-20A1	12211991-003	1040
PL-W-H21	12211991-003-21A1	12211991-003	1116
TRIP BLANK	12211991-003-22A1	12211991-003	1203

2C
WATER SEMIVOLATILE SURROGATE RECOVERY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

	EPA SAMPLE NO.	S1 (NBZ) #	S2 (FBP) #	S3 (TPH) #	S4 (PHL) #	S5 (2FP) #	S6 (TBP) #	OTHER	TOT OUT
	=====	=====	=====	=====	=====	=====	=====	=====	=====
01	01A1-A5	58	66	104	25	48	102		0
02	03A1-A5	59	65	34	18	29	59		0
03	10A1	60	68	96	25	46	110		0
04	15A1-A5	52	62	60	21	45	89		0
05	FF-W-MW6	64	67	65	20	32	88		0
06	FF-WD-W2	78	66	69	22	35	104		0
07	FIELD-BLANK	71	72	81	22	39	76		0
08	MW-8	72	74	94	21	45	72		0
09	SWBLK0114	56	64	81	33	49	80		0
10	SWBLK0116	42	48	85	28	48	50		0
11	SWBLK0122	48	51	90	26	50	61		0

QC LIMITS

S1 (NBZ) = Nitrobenzene-d5 (35-114)
 S2 (FBP) = 2-Fluorobiphenyl (43-116)
 S3 (TPH) = Terphenyl (33-141)
 S4 (PHL) = Phenol-d5 (10-94)
 S5 (2FP) = 2-Fluorophenol (21-100)
 S6 (TBP) = 2,4,6-Tribromophenol (10-123)

Column to be used to flag recovery values
 * Values outside of contract required QC limits
 D Surrogates diluted out

4B
SEMIVOLATILE METHOD BLANK SUMMARY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

Lab File ID: SWBLK0122 Lab Sample ID: METHOD_BLANK

Date Extracted: 01/22/92 Extraction: (SepF/Cont/Sonc)

Date Analyzed: 01/28/92 Time Analyzed: 1237

Matrix: (soil/water) WATER Level: (low/med) LOW

Instrument ID: MSC

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	01A1-A5	92012101	S012101	01/28/92
02	03A1-A5	92012102	S012102	01/28/92
03	10A1	92012103	S012103	01/28/92
04	15A1-A5	92012104	S012104	01/28/92

COMMENTS: BNA WATER BLANK 1 L TO 2 ML EXTRACTED 1/22/92
CAP COL MSC

5B
SEMIVOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

Lab File ID: 0128DFTC1 DFTPP Injection Date: 01/28/92

Instrument ID: MSC DFTPP Injection Time: 1012

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 60.0% of mass 198	45.7
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	57.6
70	Less than 2.0% of mass 69	0.0 (0.0)1
127	40.0 - 60.0% of mass 198	42.0
197	Less than 1.0% of mass 198	0.0
198	Base peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	7.4
275	10.0 - 30.0% of mass 198	22.0
365	Greater than 1.00% of mass 198	1.12
441	Present, but less than mass 443	6.6
442	Greater than 40.0% of mass 198	45.9
443	17.0 - 23.0% of mass 442	8.9 (19.4)2

1-Value is % mass 69

2-Value is % mass 442

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	SSTD050	50PPM_BNA	0128S2C1	01/28/92	1028
02	SWBLK0122	METHOD BLANK	SWBLK0122	01/28/92	1237
03	01A1-A5	92012101	S012101	01/28/92	1325
04	03A1-A5	92012102	S012102	01/28/92	1405
05	10A1	92012103	S012103	01/28/92	1458
06	15A1-A5	92012104	S012104	01/28/92	1540

6C

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS

Case No.: SL0114

SAS No.:

SDG No.:

Instrument ID: MSC

Calibration Date(s): 01/20/92

01/20/92

Min RRF for SPCC(%) = 0.050

Max %RSD for CCC(*) = 30.0%

LAB FILE ID:		RRF20 = 0120S1C1		RRF50 = 0120S2C1			
RRF80 = 0120S3C1		RRF120= 0120S4C1		RRF160= 0120S5C1			
COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	RRF	% RSD
Dibenzofuran	2.123	2.008	1.935	1.870	1.673	1.922	8.7
2,4-Dinitrotoluene	0.391	0.404	0.429	0.451	0.390	0.413	6.4
Diethylphthalate	1.876	1.850	1.751	1.703	1.520	1.740	8.2
4-Chlorophenyl-phenylether	0.895	0.889	0.831	0.829	0.758	0.840	6.6
Fluorene	1.356	1.272	1.204	1.169	1.024	1.205	10.3
4-Nitroaniline		0.185	0.294	0.259	0.276	0.254	18.8
4,6-Dinitro-2-Methylphenol		0.127	0.153	0.153	0.152	0.146	8.8
N-Nitrosodiphenylamine	* 0.450	0.420	0.448	0.422	0.434	0.435	3.2*
4-Bromophenyl-phenylether	0.273	0.294	0.302	0.286	0.306	0.292	4.5
Hexachlorobenzene	0.370	0.396	0.408	0.373	0.399	0.389	4.3
Pentachlorophenol	*	0.192	0.197	0.197	0.203	0.197	2.3*
Phenanthrene	1.007	0.971	0.991	0.966	1.024	0.992	2.5
Anthracene	0.971	0.985	0.981	0.877	0.929	0.949	4.8
Di-n-Butylphthalate	1.211	1.230	1.209	1.170	1.184	1.201	2.0
Fluoranthene	* 1.167	1.171	1.285	1.147	1.178	1.190	4.6*
Pyrene	1.228	1.196	1.146	1.304	1.155	1.206	5.3
Butylbenzylphthalate	0.372	0.359	0.372	0.429	0.430	0.392	8.7
3,3'-Dichlorobenzidine	1.326	1.241	1.401	1.439	1.456	1.373	6.5
Benzo(a)Anthracene	1.102	1.092	1.065	1.102	1.066	1.085	1.7
Chrysene	1.014	1.048	1.090	1.074	1.079	1.061	2.9
bis(2-Ethylhexyl)Phthalate	0.592	0.567	0.603	0.649	0.655	0.613	6.2
Di-n-Octyl Phthalate	* 1.246	1.416	1.431	1.560	1.515	1.434	8.4*
Benzo(b)fluoranthene	1.541	1.661	1.702	1.751	1.785	1.688	5.6
Benzo(k)fluoranthene	1.464	1.699	1.573	1.541	1.420	1.539	7.0
Benzo(a)Pyrene	* 1.445	1.554	1.531	1.531	1.514	1.515	2.7*
Indeno(1,2,3-cd)Pyrene	1.699	1.828	1.808	1.705	1.619	1.732	5.0
Dibenz(a,h)Anthracene	1.589	1.555	1.598	1.521	1.625	1.578	2.6
Benzo(g,h,i)Perylene	1.433	1.497	1.577	1.447	1.394	1.470	4.8
Nitrobenzene-d5	0.435	0.407	0.412	0.407	0.401	0.412	3.2
2-Fluorobiphenyl	1.503	1.504	1.401	1.390	1.220	1.404	8.3
Terphenyl-d14	0.907	0.929	0.890	1.003	0.961	0.938	4.8
Phenol-d5	1.120	0.946	0.960	0.956	0.900	0.976	8.6
2-Fluorophenol	0.901	0.861	0.828	0.825	0.774	0.838	5.6
2,4,6-Tribromophenol	0.361	0.439	0.408	0.414	0.377	0.400	7.7

(1) Cannot be separated from Diphenylamine

6B

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS

Case No.: SL0114

SAS No.:

SDG No.:

Instrument ID: MSC

Calibration Date(s): 01/20/92

01/20/92

Min RRF for SPCC(%) = 0.050

Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF20 = 0120S1C1 RRF50 = 0120S2C1

RRF80 = 0120S3C1 RRF120= 0120S4C1 RRF160= 0120S5C1

COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	RRF	% RSD
Phenol *	1.215	1.087	1.066	1.029	0.977	1.075	8.3*
bis(2-Chloroethyl) Ether	1.241	0.987	0.995	0.964	0.929	1.023	12.2
2-Chlorophenol	1.083	0.954	0.949	0.960	0.913	0.972	6.7
1,3-Dichlorobenzene	1.622	1.402	1.346	1.309	1.241	1.384	10.5
1,4-Dichlorobenzene *	1.738	1.543	1.491	1.423	1.360	1.511	9.6*
Benzyl Alcohol	0.731	0.697	0.700	0.711	0.673	0.702	3.0
1,2-Dichlorobenzene	1.608	1.463	1.376	1.324	1.247	1.404	9.9
2-Methylphenol	1.451	1.270	1.243	1.170	1.145	1.256	9.6
bis(2-Chloroisopropyl) Ether	2.011	1.472	1.622	1.588	1.600	1.659	12.4
4-Methylphenol	1.506	1.323	1.317	1.279	1.255	1.336	7.4
N-Nitroso-Di-n-Propylamine #	1.210	0.995	1.011	0.994	0.971	1.036	9.5#
Hexachloroethane	0.836	0.655	0.650	0.579	0.564	0.657	16.5
Nitrobenzene	0.411	0.386	0.382	0.361	0.359	0.380	5.6
Isophorone	0.849	0.781	0.766	0.764	0.747	0.781	5.1
2-Nitrophenol *	0.151	0.155	0.163	0.173	0.169	0.162	5.7*
2,4-Dimethylphenol	0.341	0.321	0.327	0.330	0.317	0.327	2.8
Benzoic Acid		0.227	0.210	0.172	0.170	0.195	14.5
bis(2-Chloroethoxy)Methane	0.409	0.390	0.387	0.389	0.373	0.390	3.3
2,4-Dichlorophenol *	0.286	0.320	0.311	0.319	0.298	0.307	4.8*
1,2,4-Trichlorobenzene	0.343	0.360	0.341	0.343	0.325	0.342	3.6
Naphthalene	0.948	0.890	0.854	0.817	0.770	0.856	8.0
4-Chloroaniline	0.345	0.406	0.409	0.422	0.397	0.396	7.5
Hexachlorobutadiene *	0.318	0.362	0.332	0.327	0.318	0.331	5.5*
4-Chloro-3-Methylphenol *	0.332	0.327	0.318	0.316	0.308	0.320	3.0*
2-Methylnaphthalene	0.645	0.606	0.590	0.569	0.549	0.592	6.2
Hexachlorocyclopentadiene #	0.414	0.393	0.508	0.575	0.497	0.477	15.5#
2,4,6-Trichlorophenol *	0.422	0.437	0.415	0.440	0.418	0.426	2.7*
2,4,5-Trichlorophenol		0.741	0.633	0.637	0.581	0.648	10.4
2-Chloronaphthalene	1.279	1.249	1.161	1.164	1.030	1.177	8.2
2-Nitroaniline		0.347	0.382	0.406	0.382	0.379	6.4
Dimethyl Phthalate	1.655	1.622	1.553	1.521	1.416	1.553	6.0
Acenaphthylene	1.931	1.798	1.755	1.680	1.499	1.733	9.2
2,6-Dinitrotoluene	0.258	0.261	0.279	0.280	0.264	0.268	3.9
3-Nitroaniline		0.256	0.311	0.348	0.306	0.305	12.4
Acenaphthene *	1.203	1.138	1.089	1.079	0.958	1.093	8.3*
2,4-Dinitrophenol #		0.160	0.180	0.214	0.180	0.184	12.2#
4-Nitrophenol #		0.244	0.241	0.276	0.237	0.250	7.2#

7B
SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

Instrument ID: MSC Calibration date: 01/21/92 Time: 0957

Lab File ID: 0121S2C1 Init. Calib. Date(s): 01/20/92 01/20/92

Min RRF50 for SPCC(%) = 0.050 Max %D for CCC(*) = 25.0%

COMPOUND	RRF	RRF50	%D
Phenol	1.075	1.163	-8.2
bis(2-Chloroethyl) Ether	1.023	1.070	-4.6
2-Chlorophenol	0.972	1.020	-4.9
1,3-Dichlorobenzene	1.384	1.474	-6.5
1,4-Dichlorobenzene	1.511	1.596	-5.6
Benzyl Alcohol	0.702	0.737	-5.0
1,2-Dichlorobenzene	1.404	1.506	-7.3
2-Methylphenol	1.256	1.345	-7.1
bis(2-Chloroisopropyl) Ether	1.659	1.998	-20.4
4-Methylphenol	1.336	1.415	-5.9
N-Nitroso-Di-n-Propylamine	1.036	1.182	-14.1
Hexachloroethane	0.657	0.858	-30.6
Nitrobenzene	0.380	0.447	-17.6
Isophorone	0.781	0.809	-3.6
2-Nitrophenol	0.162	0.167	-3.1
2,4-Dimethylphenol	0.327	0.318	2.8
Benzoic Acid	0.195	0.246	-26.2
bis(2-Chloroethoxy) Methane	0.390	0.395	-1.3
2,4-Dichlorophenol	0.307	0.321	-4.6
1,2,4-Trichlorobenzene	0.342	0.358	-4.7
Naphthalene	0.856	0.877	-2.5
4-Chloroaniline	0.396	0.339	14.4
Hexachlorobutadiene	0.331	0.396	-19.6
4-Chloro-3-Methylphenol	0.320	0.301	5.9
2-Methylnaphthalene	0.592	0.569	3.9
Hexachlorocyclopentadiene	0.477	0.460	3.6
2,4,6-Trichlorophenol	0.426	0.397	6.8
2,4,5-Trichlorophenol	0.648	0.686	-5.9
2-Chloronaphthalene	1.177	1.132	3.8
2-Nitroaniline	0.379	0.351	7.4
Dimethyl Phthalate	1.553	1.435	7.6
Acenaphthylene	1.733	1.556	10.2
2,6-Dinitrotoluene	0.268	0.247	7.8
3-Nitroaniline	0.305	0.165	45.9
Acenaphthene	1.093	1.019	6.8
2,4-Dinitrophenol	0.184	0.128	30.4
4-Nitrophenol	0.250	0.218	12.8

7C

SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS

Case No.: SL0114

SAS No.:

SDG No.:

Instrument ID: MSC

Calibration date: 01/21/92 Time: 0957

Lab File ID: 0121S2C1

Init. Calib. Date(s): 01/20/92 01/20/92

Min RRF50 for SPCC(#) = 0.050

Max %D for CCC(*) = 25.0%

COMPOUND	RRF	RRF50	%D
=====	=====	=====	=====
Dibenzofuran	1.922	1.822	5.2
2,4-Dinitrotoluene	0.413	0.335	18.9
Diethylphthalate	1.740	1.654	4.9
4-Chlorophenyl-phenylether	0.840	0.825	1.8
Fluorene	1.205	1.102	8.5
4,6-Dinitro-2-Methylphenol	0.146	0.133	8.9
N-Nitrosodiphenylamine	* 0.435	0.442	-1.6 *
4-Bromophenyl-phenylether	0.292	0.359	-23.0
Hexachlorobenzene	0.389	0.483	-24.2
Pentachlorophenol	* 0.197	0.189	4.1 *
Phenanthrene	0.992	1.007	-1.5
Anthracene	0.949	0.933	1.7
Di-n-Butylphthalate	1.201	1.129	6.0
Fluoranthene	* 1.190	1.010	15.1 *
Pyrene	1.206	1.300	-7.8
Butylbenzylphthalate	0.392	0.324	17.4
3,3'-Dichlorobenzidine	1.373	1.030	25.0
Benzo(a)Anthracene	1.085	1.019	6.1
Chrysene	1.061	1.069	-0.8
bis(2-Ethylhexyl)Phthalate	0.613	0.529	13.7
Di-n-Octyl Phthalate	* 1.434	1.561	-8.9 *
Benzo(b)fluoranthene	1.688	2.050	-21.5
Benzo(k)fluoranthene	1.539	1.781	-15.7
Benzo(a)Pyrene	* 1.515	1.730	-14.2 *
Indeno(1,2,3-cd)Pyrene	1.732	1.404	18.9
Dibenz(a,h)Anthracene	1.578	1.350	14.5
Benzo(g,h,i)Perylene	1.470	1.218	17.1
=====	=====	=====	=====
Nitrobenzene-d5	0.412	0.470	-14.1
2-Fluorobiphenyl	1.404	1.395	0.6
Terphenyl-d14	0.938	1.088	-16.0
Phenol-d5	0.976	1.000	-2.5
2-Flouorophenol	0.838	0.914	-9.1
2,4,6-Tribromophenol	0.400	0.388	3.0

8B

SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

Lab File ID (Standard): 0128S2C1

Date Analyzed: 01/28/92

Instrument ID: MSC

Time Analyzed: 1028

	IS1 (DCB) AREA #	RT	IS2 (NPT) AREA #	RT	IS3 (ANT) AREA #	RT
=====	=====	=====	=====	=====	=====	=====
12 HOUR STD	15000	7.72	55400	10.24	30500	14.02
=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT	30000		110800		61000	
=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT	7500		27700		15250	
=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.						
=====	=====	=====	=====	=====	=====	=====
01 01A1-A5	14300	7.70	54900	10.22	36500	14.02
02 03A1-A5	15900	7.72	58200	10.24	37400	14.02
03 10A1	14500	7.72	53300	10.24	35600	14.02
04 15A1-A5	14900	7.72	52100	10.24	31400	14.02
05 SWBLK0122	10800	7.72	34600	10.24	23400	14.02

IS1 (DCB) = 1,4-Dichlorobenzene-d4

IS2 (NPT) = Naphthalene-d8

IS3 (ANT) = Acenaphthene-d10

UPPER LIMIT = + 100%

of internal standard area.

LOWER LIMIT = - 50%

of internal standard area.

Column used to flag internal standard area values with an asterisk

8C
SEMIVOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: FUEL_FARM

Lab Code: MSS Case No.: SL0114 SAS No.: SDG No.:

Lab File ID (Standard): 0128S2C1

Date Analyzed: 01/28/92

Instrument ID: MSC

Time Analyzed: 1028

	IS4 (PHN) AREA #	RT	IS5 (CRY) AREA #	RT	IS6 (PRY) AREA #	RT
=====	=====	=====	=====	=====	=====	=====
12 HOUR STD	59600	17.24	50100	23.17	18500	26.34
=====	=====	=====	=====	=====	=====	=====
UPPER LIMIT	119200		100200		37000	
=====	=====	=====	=====	=====	=====	=====
LOWER LIMIT	29800		25050		9250	
=====	=====	=====	=====	=====	=====	=====
EPA SAMPLE NO.						
=====	=====	=====	=====	=====	=====	=====
01 01A1-A5	67800	17.22	49100	23.17	24100	26.42
02 03A1-A5	74400	17.24	62600	23.15	29800	26.37
03 10A1	69400	17.24	50900	23.17	28200	26.41
04 15A1-A5	60700	17.24	48000	23.17	21800	26.37
05 SWBLK0122	42400	17.24	42200	23.17	19100	26.39

IS4 (PHN) = Phenanthrene-d10

IS5 (CRY) = Chrysene-d12

IS6 (PRY) = Perylene-d12

UPPER LIMIT = + 100%
of internal standard area.

LOWER LIMIT = - 50%
of internal standard area.

Column used to flag internal standard area values with an asterisk

5. Appendix B- Glossary of Report and Data Information

GLOSSARY OF SYMBOLS AND ABBREVIATIONS

1. < - "Less than". The number following the sign is the smallest amount which can be detected using this specific test.
2. > - "Greater than". The number following the sign is the highest amount which can be detected using this specific test.
3. °C and °F - "degrees of temperature", Celsius and Fahrenheit respectively.
4. % - "percent of part per hundred". When followed by the designation "by weight" it means grams per hundred grams. If followed by the designation "by volume" it refers to volume per unit volume, eg, milliliters per hundred milliliters.
5. g - "gram(s)". The unit weight used in the metric system. One gram equals about 1/28th of an ounce.
6. kg - "kilogram(s)". One kilogram is 1000 grams.
7. L - "liter(s)". The unit of volume used in the metric system.
8. lb - pound(s).
9. m³ - "cubic meter(s)". Usually used as a volume unit in air analyses.
10. MF - "Membrane Filtration". Method used for certain bacteriological tests in which results indicate colony counts after sample has been filtered through a 0.45 µm filter.
11. mg - "milligram(s)". One milligram is 1/1000 of a gram.
12. mg/L - "milligrams per liter". Equals "parts per million" for aqueous liquids.
13. ml - "milliliter(s)". One milliliter is 1/1000 of a liter.
14. MPN - "Most Probable Number". Analytical method used for certain bacteriological tests in which bacteria are calculated from a statistical formula related to the bacterial count observed in a series of dilutions of the sample.
15. ND - "none detected". Usually used when the limits of detection of the method have not been definitely established.
16. NTU - "Nephelometric Turbidity Units".
17. ppb - "parts per Billion". One ppb is 1/1000 of a ppm.
18. ppm - "parts per million". One ppm is equivalent to one microgram per gram (µg/g), or one gram per million grams (g/kg). For aqueous liquids ppm equates to milligrams per liter (mg/L), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas (µl/L).
19. TNTC - "Too numerous to count". Indicates in certain bacteriological tests that the test has run "off scale".
20. µg - "microgram(s)". One-millionth of a gram.
21. µg/g - "microgram per gram". Equals "parts per million" (ppm) for solids and sludges.

GLOSSARY OF SYMBOLS AND ABBREVIATIONS-continued

22. ul - "microliter(s)". One microliter is 1/1000 of a milliliter or one-millionth of a liter.
23. ul/L - "Microliter of gas per liter". Equals "part per million" (ppm) for gases or vapors.
24. umhos/cm - "micromhos/cm". Used in reporting specific conduction of solutions.
25. N/R - "Not requested".
26. MGD - "Million gallons per year".

DATA QUALIFIERS

INORGANIC CHEMICAL DATA

- B Reported value is <CRDL, but >IDL
- U Compound was analyzed for, but not detected
- E Value is estimated due to matrix interferences
- M Duplicate injection precision criteria not met
- N Spiked sample recovery not within control limits
- S Reported value was determined by the Method of Standard Additions (MSA)
- W Post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is <50% of spike absorbance
- * Duplicate analysis was not within control limits
- + Correction coefficient for MSA was <0.995

ORGANIC CHEMICAL DATA

- U Compound was analyzed for, but not detected
- J Value is estimated, either for a tentatively identified compound (TIC) or when a compound is present (spectral identification criteria are met, but the value is <CRQL)
- C Pesticide results were confirmed by GC/MS
- B Analyte found in associated blank as well as in sample
- E Concentration exceeds calibration range of GC/MS instrument
- D Compound identified in an analysis at a secondary dilution factor
- A The TIC is a suspected aldol-condensation product
- X Additional flags defined separately

APPENDIX G
HEALTH AND SAFETY PLAN

**FINAL
HEALTH AND SAFETY PLAN FOR THE
SITE ASSESSMENT AT THE
CAMPBELL STREET FUEL FARM/
PIPELINE AREA**

**NEW RIVER MARINE CORPS AIR STATION
JACKSONVILLE, NORTH CAROLINA**

CONTRACT TASK ORDER 0013

Prepared For:

**DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
*Norfolk, Virginia***

Under:

**LANTDIV CLEAN Program
Contract N62470-89-D-4814**

Prepared By:

**BAKER ENVIRONMENTAL, INC.
*Coraopolis, Pennsylvania***

DECEMBER 3, 1991

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1.0 INTRODUCTION

1.1 Background

Baker Environmental, Inc. (Baker) will perform a site characterization study to investigate potentially contaminated soil and/or groundwater associated with the Campbell Street Fuel Farm/Pipeline Area located at the Marine Corps Air Station (MCAS), Camp Lejeune Reservation, Jacksonville, North Carolina. The objectives of the study are to: (1) investigate the geology and the hydrogeology in the area of concern; (2) study the extent/severity of potential subsurface fuel migration; (3) suggest practical methods of abatement and cleanup; and, (4) execute applicable sections of Title 15A, Subchapter 2N, Section .0600 of the North Carolina Administrative Code (Effective January 1, 1991).

1.2 Policy

It is the policy of Baker that all on-site hazardous waste management activities be performed in conformance with a Site-Specific Health and Safety Plan (HASP). The Site Health and Safety Officer (SHSO) is responsible for continually evaluating safety on the site and ensuring adherence to the HASP. The SHSO is directly responsible to the Site Manager for safety issues relevant to the site, and has the immediate authority to modify the existing HASP as site conditions warrant. The SHSO, or designee, will also be responsible for the preparation of a daily report which includes the day's events from a health and safety standpoint, documents measurements taken for health and safety purposes, accident reporting and any other relevant health and safety issues. The HASP may be modified/updated with the approval of the Project HSO (PHSO) and Project Manager.

1.3 Medical Surveillance Requirements

An essential requirement of the HASP is to provide that project personnel, who may be exposed to materials having potentially adverse and deleterious health effects, be medically certified and adequately trained prior to beginning work at the site. Baker's corporate medical surveillance program has been implemented to establish a medical baseline and monitor for any symptoms of over-exposure for individuals who participate in Remedial Investigations, Feasibility Studies, and construction-phase services at hazardous waste management sites. Additionally, the program is intended to determine the individual's capability for performing on-site work, including wearing respiratory protective equipment.

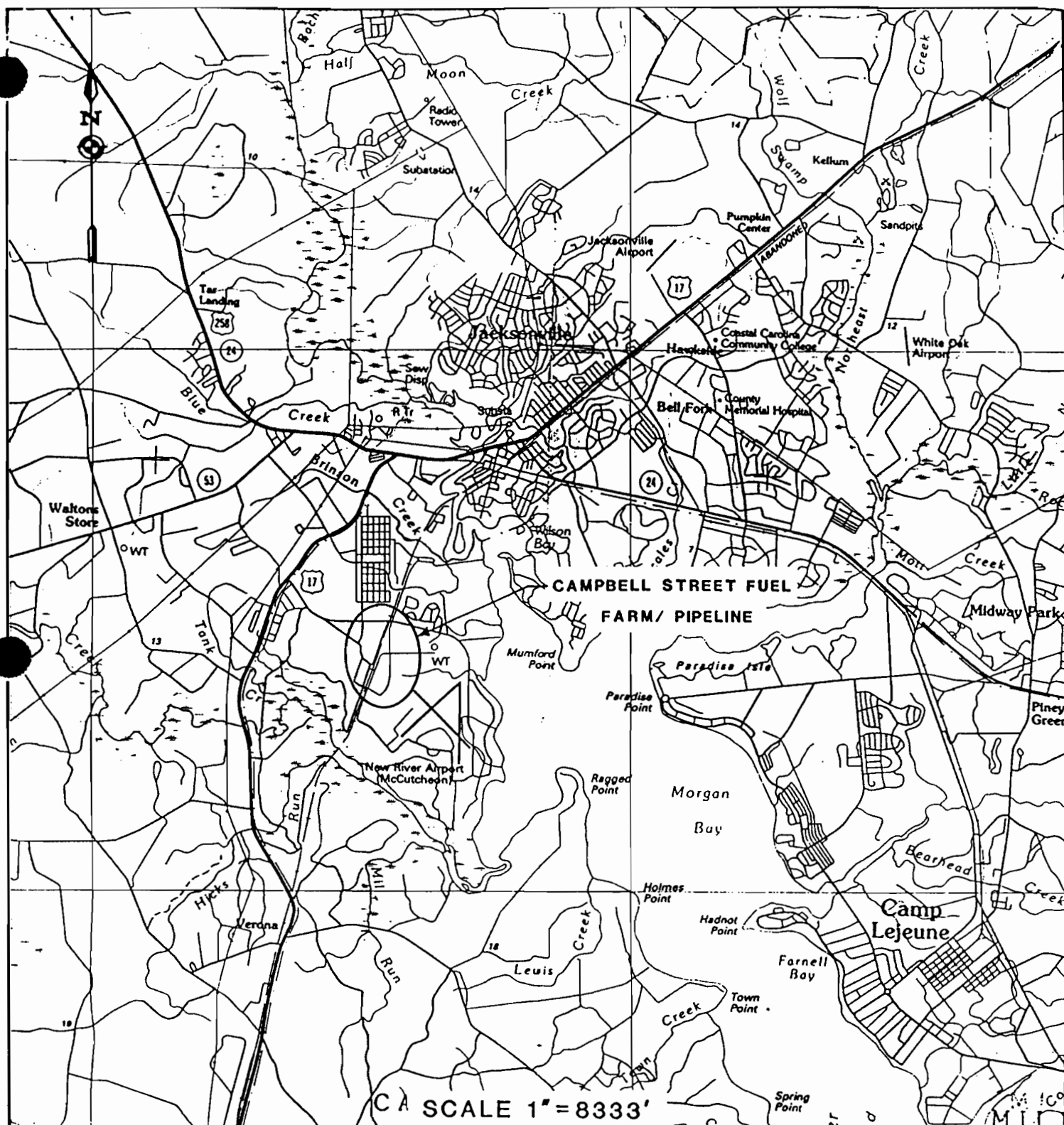


FIGURE 1
 CAMPBELL STREET FUEL FARM/PIPELINE
 SITE ASSESSMENT
 SITE LOCATION MAP
 NEW RIVER MARINE CORPS AIR STATION
 CAMP LEJEUNE RESERVATION
 JACKSONVILLE, NORTH CAROLINA

Each individual receives a physical examination by a licensed physician. Standard parameters such as height, weight, vision, temperature, and blood pressure are noted. The complete physical examination is complemented by occupational and medical histories. Other information obtained with the medical examination includes: chest x-rays, electrocardiogram, pulmonary function test, urinalysis, and blood tests. Attachment A describes the medical surveillance testing parameters performed annually on Baker employees.

1.4 Training Requirements

Baker requires that new personnel who will work on site be initially trained at a health and safety training course meeting the requirements outlined in 29CFR 1910.120. At a minimum, these are five-day (40-hour) courses which include field demonstrations. The key points of the training program include respiratory training, risk assessment, toxicology, chemical reactivity, use of monitoring equipment, downrange work procedures, site safety procedures, levels of protection, protective clothing, decontamination, and practical field exercises conducted for personal protection Levels A, B, and C.

In addition to the initial 40-hour training program, Baker requires field personnel to attend an annual refresher training program and supervisory personnel to attend an eight-hour supervisory training session. The purpose of the eight-hour refresher is to ensure that personnel retain the basic knowledge necessary to be adequately protected, and to demonstrate proper site health and safety procedures; the eight-hour supervisory training is required to ensure that supervisors have the basic knowledge necessary to understand and implement the elements of the HASP.

1.5 Pre-Entry Requirements

During the initial site set-up, the SHSO will make a reconnaissance of the on-site and off-site sampling areas. After this, the SHSO will call a meeting with Baker on-site personnel and the subcontractor's personnel. Site-specific safety procedures will be covered by the SHSO. Prior to each new sampling task, the safety procedures will be reviewed by the SHSO with the personnel involved. The SHSO will be available to address unforeseen circumstances and to implement appropriate changes to the HASP.

Subcontractors working on the project and involved in site investigation activities are required to comply with all applicable health and safety regulations for hazardous waste site operations.

Baker believes that the development of a HASP is necessary to ensure adequate protection for on-site personnel. The following HASP has been based on an outline developed by the U.S. Coast Guard for responding to hazardous chemical releases (U.S.C.G. Pollution Response COMDTINST-ML6456-30) and by NIOSH, OSHA, USCG, and EPA's recommended health and safety procedures (Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities). This plan, at a minimum, meets the requirements under OSHA's standard 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response). This plan has been designed as a Site-Specific HASP for the Site Assessment at the Campbell Street Fuel Farm/Pipeline Area located at the Marine Corps Air Station (MCAS), Camp Lejeune, North Carolina.

2.0 SITE DESCRIPTION

S.O.# 19013-40-SRN

Date: December 3, 1991

Location: MCAS, Camp Lejeune, North Carolina

Hazards:

- Potentially contaminated soil (unleaded gasoline & JP-5 aviation fuel).
- Potentially contaminated groundwater (as above).
- Potential hazards associated with drilling around utilities.
- Potential hazards associated with handling chemicals used during the hnu-hanby Field Test and Tracer Leak Detection System Testing.
- Site-specific hazards to be addressed at the pre-entry briefing.

Area affected:

- Building AS-143 (Gas Station)
- Fuel Farm and Pipeline Area

Surrounding population:

- Flight operation support buildings
- Air field, hangars, utility buildings

Anticipated weather conditions:

- Mild temperatures - 40° to 60° F

Additional information:

The Campbell Street Fuel Farm/Pipeline Area can be divided into three distinct areas:

1. The Fuel Farm - contains four Aboveground Storage Tanks (ASTs), two sets of two, each within a diked area. All tanks have a 215,000 gallon capacity. There is also an underground reclamation tank present with an unknown capacity.
2. Building AS-143 - a gas station located at the corner of White Street and Campbell Street, housing a 10,000 gallon Underground Storage Tank (UST), containing unleaded gasoline.
3. The Fuel Farm Pipeline - 5,200 feet in length which is located underground within the Marine Corps Air Station.

3.0 SITE ENTRY OBJECTIVES

The objective of the initial entry into the contaminated area is to characterize the degree, type, and extent (vertical and areal) of soil and groundwater contamination. This study will include the activities outlined in Section 7.1. Detail as to the number of samples to be taken can be found in the Work Plans.

4.0 SITE ORGANIZATION AND COORDINATION

The following personnel are designated to carry out the stated job functions for both on- and off-site activities. (Note: One person may carry out more than one job function.)

PROJECT MANAGER	David J. Mamrose
PROJECT HEALTH AND SAFETY OFFICER	Barbara J. Cummings
SITE MANAGER	Scott A. Dick
SITE HEALTH AND SAFETY OFFICER	Scott A. Dick
FIELD TEAM LEADER	Scott A. Dick

FIELD TEAM MEMBERS

Kenneth A. Tua
Robert C. Sevcik

NAVFACENGCOM REPRESENTATIVES

LANTDIV: Mr. Trueman L. Seamans, P. E. (804) 445-2935

ACTIVITY/BASE REPRESENTATIVES

Mr. Thomas Morris	(919) 451-5093
Ms. Mary Wheat	(919) 451-6143

FEDERAL/STATE/LOCAL REPRESENTATIVES

(Not Applicable)

CONTRACTOR(S)

Drilling Contractor:	ATEC Associates, Inc.
Survey Contractor:	(To Be Determined)
Pipeline Tracer Contractor:	Tracer Research Corporation

All personnel arriving or departing the site will be documented in the field log. All activities on site must be cleared through the Site Manager.

5.0 SITE CONTROL

5.1 General Requirements

The Site Manager is designated to coordinate access control and security on site. Perimeters have been established according to the Site Boundary procedures identified in Section 5.3. Site security will be established in conjunction with a cooperative effort between the Site Manager and Navy Site Contact.

Unauthorized personnel are not permitted within this area.

5.2 Site Conditions

The prevailing wind conditions are moderate and easterly.

The on-site Command Post has been established at (to be determined upon site arrival).

This location is upwind from the Exclusion Zone.

5.3 Site Boundaries

Control boundaries between the Exclusion Zone (the contaminated area) and the Contamination Reduction Zone (CRZ) (referred to as the hotline), and the Support Zone (clean area) are designated as follows:

- Exclusion Zone - A radius of at least 25 feet (when feasible) from Site Investigation Activity.
- Hotline - The boundary between the Exclusion Zone and CRZ.
- CRZ* - The area between the Exclusion Zone and the Support Zone (located upwind of the Site Activity).
- Contamination Control Line - The boundary between the CRZ and the Support Zone.
- Support Zone - The outermost area next to the CRZ and upwind of the Site Activity.

* Note: CRZ is required for activities in Level C protection and higher protection levels. Refer to Figure 2 for a "Typical Contamination Reduction Zone Layout."

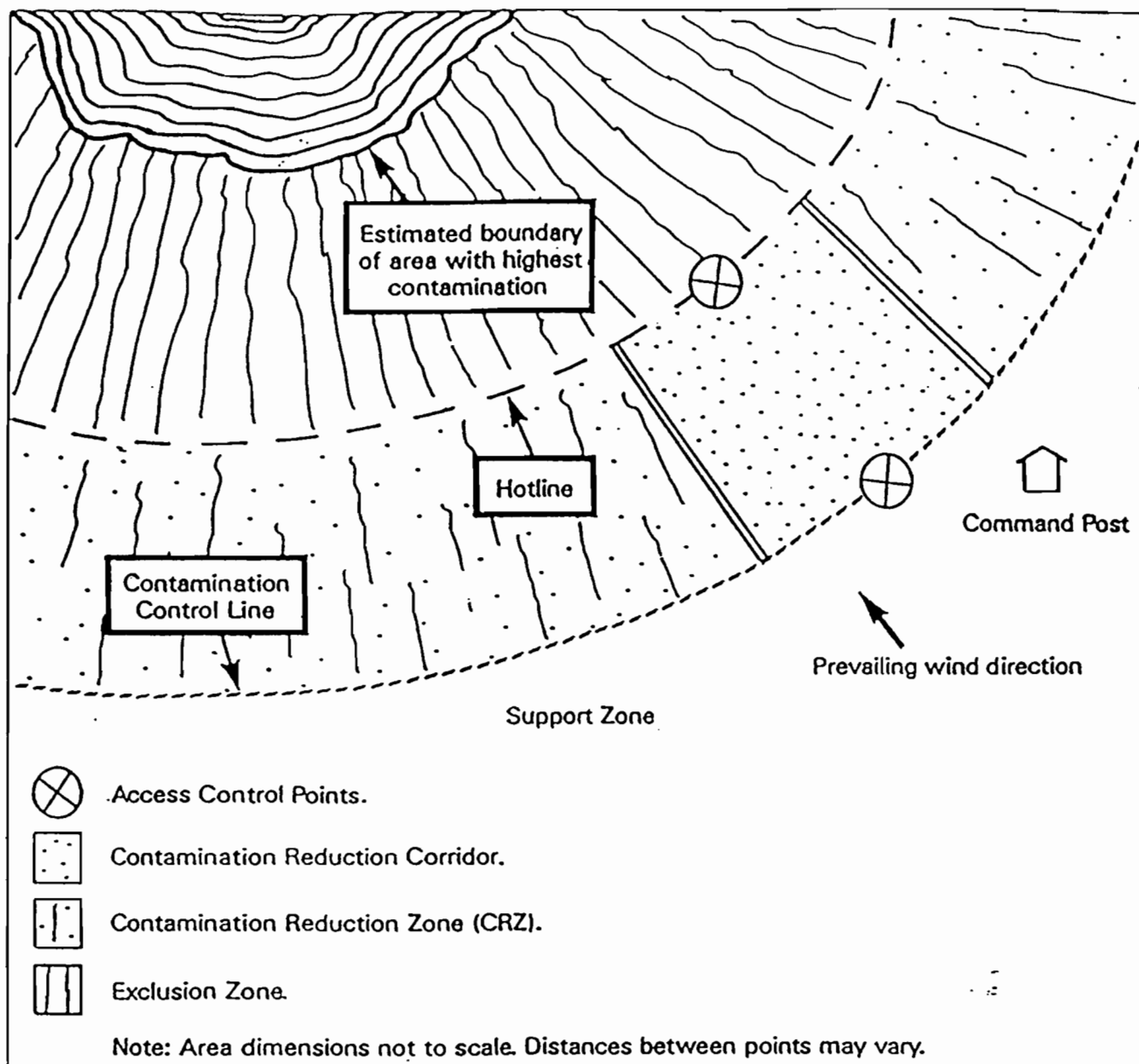


FIGURE 2
TYPICAL CONTAMINATION
REDUCTION ZONE LAYOUT

These boundaries are identified by:

- The hotline is demarcated using Red Boundary Tape.
- The Decontamination Corridor of the CRZ is demarcated using Yellow Boundary Tape.
- The Contamination Control Line is demarcated using Blue or Green Boundary Tape.
- As investigation locations vary throughout the project, adjustments will be made accordingly.

6.0 HAZARD EVALUATION

6.1 Preliminary Evaluation

Research into the history of the site under investigation indicated potential chemical and physical site hazards. A summary of the potential chemical and physical hazards at this site can be found in Sections 6.2 and 6.3, respectively.

6.2 Chemical Hazard Analysis

The toxicological properties of chemicals/substances identified during preliminary investigations at the Campbell Street Fuel Farm/Pipeline Area are identified in Table 1.

Chemical Safety Data Sheets for the known hazardous substances have been accumulated and are included as Attachment D. Additionally, Material Safety Data Sheets for the chemicals to be used in the performance of the hnu-hanby Field Test and Tracer Leak Detection Testing are also included in Attachment D.

6.3 Physical Hazard Analysis

6.3.1 Confined Space Entry

It is not anticipated that there will be a need for a confined space entry procedure during the Site Investigation activities. However, should this condition occur, procedures for entering a confined space are outlined in Attachment E - Baker Safety SOPs.

6.3.2 Heat Stress/Cold Exposure

Provisions for monitoring for heat stress and/or cold exposure will be determined by the Site HSO.

6.3.2.1 Heat Stress

For personnel wearing semipermeable or impermeable protective outerwear when there is an ambient air temperature greater than 70°F, heat stress monitoring is required and the following procedures will be implemented:

TABLE 1
TOXICOLOGICAL PROPERTIES OF CHEMICALS/SUBSTANCES PRESENT
AT THE CAMPBELL STREET FUEL FARM/PIPELINE AREA

Chemical/Substance	Source	Exposure Limit (EL) ^(a)	IDLH	Physical State ^(b)	Specific Gravity ^(c)	Routes of Exposure
JP-5 Aviation Fuel	AST and pipeline	200 ppm	NA	Liquid	0.82 @ 15°C	Inhalation, eye/skin adsorption
Unleaded Gasoline	UST	300 ppm	NA	Liquid	0.7321 @ 20°C	Inhalation, eye/skin adsorption

(a) EL - Exposure Limit = A time-weighted average concentration for a normal eight-hour work day and 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. The EL represents published Exposure Levels according to the following hierarchy: (1) OSHA PELs; (2) NIOSH RELs; (3) ACGIH TLVs; and, (4) other recognized sources.

(b) Physical state at 15°C and 1 atmosphere (unless otherwise mentioned).

(c) Specific Gravity = At 68°F (unless otherwise mentioned).

NA - Not Available

ppm - parts per million (in air)

AST - Aboveground Storage Tank

UST - Underground Storage Tank

1. Increased awareness of heat stress symptoms and buddy monitoring.
2. Fluid intake discipline.
3. Work-rest intervals.
4. Self monitoring of urine output quantities to prevent dehydration.

The following heat stress causes and symptoms are provided for buddy monitoring purposes. Site personnel must realize that monitoring the physical condition of fellow personnel in Level B and C protective ensembles will be difficult.

1. *Heat rash* results from continuous exposure to heat or humid air.
2. *Heat cramps* are caused by heavy sweating and inadequate fluid intake. Symptoms include muscle spasms and pain in the hands, feet, and abdomen.
3. *Heat exhaustion* occurs when body organs attempt to keep the body cool, due to inadequate fluid intake and personnel not acclimated to the environment. Symptoms include pale, cool, moist skin; heavy sweating; and dizziness.
4. *Heat stroke* is the most serious form of heat stress. It is a **MEDICAL EMERGENCY**. Symptoms are red, hot, dry skin; lack of perspiration; nausea; dizziness and confusion; strong, rapid pulse rate; and coma.

The need to seek medical attention and the urgency in seeking medical attention depends on the symptoms and the severity of the symptoms displayed by the affected individual. If *heat stroke* is noted or suspected, medical attention must be sought **IMMEDIATELY**. Efforts should be taken to cool the body to prevent serious injury or death. Excessive cooling can cause hypothermia and should be avoided.

Fluid intake should be increased during rest schedules to prevent dehydration. Drinking cool water is best; however, diluted electrolyte solutions (i.e., Gatorade) can be substituted for water. Each individual should monitor their urine output and adjust his fluid intake to ensure that urine output and urine color are close to normal.

6.3.2.2 Cold Exposure

Working in an environment where air temperatures are below freezing or where wind-chill factors lower air temperatures below freezing, there is a potential for either frostbite or hypothermia to occur. A brief description and exposure symptoms for both hypothermia and frostbite are as follows:

1. *Hypothermia* - a condition in which the body loses heat faster than it is produced. At a body temperature of 95°F, an average man is considered to be hypothermic. Vasodilators, which include alcohol and drugs, allow the body to lose heat faster which can accelerate hypothermia. The five stages of hypothermia include: (1) shivering; (2) apathy; (3) unconsciousness; (4) freezing; and (5) death.
2. *Frostbite* - a condition in which there is a freezing or partial freezing of some part of the body. Individuals previously exposed to frostbite are more susceptible to contracting it again. Vasoconstrictors, which include tobacco products, constrict blood vessels, and can accelerate frostbite. The three stages of frostbite include: (1) frostnip - the beginnings of frostbite whereby the skin begins to turn white; (2) superficial - similar to frostnip except the skin begins to turn numb; and (3) deep - the affected area is frozen to the bone, cold, numb, and very hard.

The need to seek medical attention and the urgency in seeking medical attention depends on the symptoms and the severity of the symptoms displayed by the affected individual. If the latent conditions of hypothermia or frostbite is noted or suspected, medical attention must be sought IMMEDIATELY to prevent permanent injury or death.

To prevent conditions from occurring have personnel:

- Dress in a minimum of three layers (a skin layer to absorb moisture and keep skin dry, an insulating layer, and an outer chemical-protective layer);
- Avoid touching cold metal with bare skin;
- Keep active; and
- Use shelter.

6.3.3 Explosion and Fire

In general, the following items present potential hazards and will be addressed.

- Explosion and fire resulting from heavy equipment malfunction.
- Explosion and fire resulting from penetration into underground utility lines (gas, electric).
- Explosion and fire resulting from ignition of trapped flammable vapors (e.g., vapors contained in USTs).
- Explosion and fire resulting from vehicular accidents.

As additional concerns are identified, provisions for making changes to the HASP will be presented by the SHSO, as needed.

6.3.4 Site-Specific Safety Hazards

It is expected that the following additional safety hazards are present at the Campbell Street Fuel Farm/Pipeline Area:

- There is a potential for exposure to reagent chemicals used in the performance of aromatic hydrocarbon testing with the hnu-hanby Field Test. Personnel performing this test are instructed to follow all standard operating procedures provided by the company, to reduce potential exposure.

Provisions for the monitoring of hazards particular to the specific site activities (such as slippery ground, uneven terrain, overhead equipment, electrical lines, etc.) shall be addressed at the pre-entry briefing by the SHSO or the assistant SHSO (where applicable). All personnel are expected to adhere to all applicable compliance regulations such as, but not limited to, OSHA standards 29 CFR 1910 and 1926.

6.4 Radiation Hazard Analysis

Given the background information provided for the Campbell Street Fuel Farm/Pipeline Area, radiation monitoring will not be required for this site assessment.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 Levels of Protection

Based on an evaluation of potential hazards, the following levels of personal protection have been designated for the applicable work areas or tasks:

Location	Job Task	Level of Protection				
		A	B	C	D	Other
CSFF and CSP	Surveying				X	
CSFF and CSP	Monitoring Well Installation				X	
CSFF and CSP	Groundwater Sampling				X	
CSFF and CSP	Hydropunch (hnu-hanby Field Test)				X	
CSFF and CSP	Soil Boring/Sampling				X(1)	
CSP	Tracer Leak Detection Sampling (Soil Gas Survey)				X	

(1) - High potential for upgrade to Level C protection.

CSFF - Campbell Street Fuel Farm

CSP - Campbell Street Pipeline

Specific protective equipment for each level of protection is as follows:

Level C

Chemical Resistant Clothing/Coveralls
Full-face or half-face cartridge respirator
Gloves (Inner - Disposable)
Gloves (Outer)
Hearing Protection*
Boots (Chemical Resistant - Overboots)
Hard Hat
Safety Glasses/Goggles

Level D

Chemical Resistant Clothing/Coveralls
Boots (Chemical Resistant - Overboots)
Hard Hat
Gloves (Outer)
Hearing Protection*
Safety Glasses/Goggles

*Due to the proximity of these sites to the "Flightline," hearing protection is required.

Continuous monitoring in the breathing zone with an HNu/OVA and periodic monitoring with Colorimetric (Dräger) Tubes as outlined in Section 11.3.1 (Table 2) will be conducted to evaluate this level of protection, to include the likelihood of protection upgrades.

CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL ONLY BE MADE WITH THE APPROVAL OF THE PROJECT HEALTH AND SAFETY OFFICER AND THE PROJECT MANAGER.

7.2 Respiratory Protection

If air-purifying cartridge respirators are authorized, an organic vapor/acid gas cartridge with a dust/mist prefilter is the appropriate cartridge for use with the known hazardous materials and corresponding concentrations. Cartridge change over frequency will be determined by the SHSO, and based on contaminant concentrations, exposure duration, breathing resistance and warning properties. Criteria for using this type of respiratory protection has been determined by qualified Baker personnel in compliance with Attachment E - Baker Safety SOPs.

7.3 Care and Cleaning of Personal Protective Equipment

Provisions for the care and cleaning of personal protective equipment used on site can be found in Attachment E - Baker Safety SOPs. Responsibility for compliance with these provisions lies with the Site Manager.

8.0 SITE WORK PLANS/PROJECT PERSONNEL

Work Plans detailing the work to be performed at each site can be found immediately attached to the HASP. The name and corresponding function for personnel to be present on site can be found in the table below.

Work party(s) consisting of two to three person teams will perform the following functions:

Name*	Function
Scott A. Dick	Site Manager, Site Health and Safety Officer (SHSO), Field Team Leader
Kenneth A. Tua	Project Geologist
Robert C. Sevick	Project Geologist
Drilling Contractor Personnel	Drilling Activities
Tracer Pipeline Contractor Personnel	Pipeline Tracer Activities
Survey Contractor Personnel	Site Survey Activities

*Note: At the time of the HASP Publication, specific site personnel and contractors had not been fully determined. Personnel identified are subject to change.

The work party(s) were briefed on the contents of this plan on _____ at _____ a.m./p.m.

9.0 COMMUNICATION PROCEDURES

Personnel in the Exclusion Zone should remain in constant communication or within sight of the Site Manager, or his/her representative. Any failure of radio communication requires an evaluation of whether personnel should leave the Exclusion Zone.

One long air horn blast is the emergency signal to indicate that all personnel should leave the Exclusion Zone.

The following standard hand signals will be used in case of failure of radio communications or when radio communications are not available:

Hand gripping throat	- Out of air, can't breathe
Grip partner's wrist or both hands around waist ...	- Leave area immediately
Hands on top of head	- Need assistance
Thumbs up	- OK, I am all right, I understand
Thumbs down	- No, negative

The following audible signals, using an air horn, will be implemented in the event of radio communications failure or when verbal or hand signals are not feasible:

- 1 - long = Evacuate/All's Clear
- 1-short = Attention Getter
- 2-short = Fire
- 3-short = Emergency/Need Help

Coordination between Baker and contractor personnel is the responsibility of the Site Manager. The best means for securing the lines of communication will be determined prior to start-up by on-site project personnel.

Telephone communication at the Command Post should be established as soon as practicable. The phone number is (To Be Determined).

10.0 DECONTAMINATION PROCEDURES

10.1 Site Decontamination

Personnel and equipment leaving the Exclusion Zone shall be thoroughly decontaminated. The following protocol shall be used for the decontamination stations according to levels of protection:

Level D	Level C
1. Equipment drop	1. Equipment drop
2. Boot and glove wash	2. Outer boot and glove wash
3. Boot and glove rinse	3. Outer boot and glove rinse
4. Boot and glove removal	4. Outer boot and glove removal
5. Coverall removal	5. Coverall removal/disposal
6. Hand/Face wash	6. Respirator removal
	7. Inner glove removal/disposal
	8. Hand/face wash
	9. Respirator cleaning/sanitizing

The following decontamination equipment is required for Level C and higher protection levels:

Four small tubs (two sets of wash and rinse water), scrub brush, towels, contaminated clothing disposal bag or drum, and, respiratory cleaning solution.

Non-phosphate detergent (Alconox) and water will be used as the decontamination solution. The decontamination liquids and clothes will be disposed of according to policy defined in the Work Plans under "Investigative Methods."

10.2 Emergency Decontamination

Emergency decontamination will include the following stations*:

Level D	Level C
1, 4, and 5 as referenced above	1, 4, 5, and 6 as referenced above

- * If circumstances dictate that contaminated clothing cannot be removed, wrap injured personnel with clean garments, blankets, etc., to avoid contaminating other personnel or transporting equipment.

10.3 Equipment Decontamination

Provisions for the decontamination of equipment will be based on the size and type of equipment used. Specific decontamination procedures for the Campbell Street Fuel Farm/Pipeline Area can be found in the corresponding Work Plans, under "Investigative Methods."

11.0 SITE SAFETY AND HEALTH

11.1 Responsibilities

The SHSO, as identified in Section 4.0, is directly responsible for safety requirements on site.

11.2 Emergency Medical Care

The nearest hospital is the Onslow County Memorial Hospital located on Western Boulevard in the city of Jacksonville, phone no.: (919) 577-2240. See Attachment C for written directions and map of route to hospital.

Local ambulance service is available from the City of Jacksonville and can be reached by phone at: (919) 455-9199. Whenever necessary, arrangements should be made for on-site standby.

First-aid equipment is available on site at the following locations:

First-aid kit:	Baker and Subcontractor Field Vehicle
Emergency eye wash bottle:	Baker and Subcontractor Field Vehicle
Emergency shower:	Rapid Refueling Area

11.2.1 Emergency Phone Numbers

List of emergency phone numbers:

Agency/Facility	Phone Number	Contact
Security (Police)	911 (On Base) or (919) 451-4555	Base Police
Fire	911 (On Base)	Base Fire Department
Ambulance	(919) 455-9119	Jacksonville Ambulance Response Operator
Hospital	(919) 577-2240	Onslow County Hospital Response Operator
Emergency	911 (On Base)	Base Dispatch

11.2.2 Substance-Specific Information

A summary of emergency medical information for known substances on site are provided in the table below. Chemical Safety Data Sheets can be found in Attachment D for additional information.

Substance	Acute Exposure Symptoms	First-Aid Instructions
JP-5 Aviation Fuel	Eye, skin, and nose irritation; coughing; and pulmonary distress	Inhalation: Remove to fresh air. Eyes: Hold eyelids open and flush with large amounts of water. Skin: Flush affected area with large amounts of water and wash with soap and water. Ingestion: Seek immediate medical attention.
Unleaded Gasoline	Mucous membrane irritation and CNS depression; dizziness; headache; respiratory arrest; coughing; and gagging	Inhalation: Remove to fresh air. Eyes: Hold eyelids open and flush with large amounts of water. Skin: Flush affected area with large amounts of water and wash with soap and water. Ingestion: Seek immediate medical attention.

11.2.3 Medical Training

The Site Manager is responsible for providing for or obtaining immediate medical attention. Instances requiring "First Aid" and/or CPR treatment will be addressed on site by qualified personnel. Instances requiring treatment beyond "First Aid" will be handled off site at appropriate facilities and reported to the Project Manager and PHSO within 24 hours. Any injury occurring on the site will be recorded on the SHSO's daily report. Refer to Attachment C for a list of emergency phone numbers and directions and route to the nearest hospital.

11.3 Environmental Monitoring

The following environmental monitoring instruments shall be used on site at the specified intervals:

11.3.1 Point Source

Point source monitoring is defined as monitoring performed at the source of the activity; therefore, the tasks being performed at each site along with the type and frequency of monitoring required have been outlined in Table 2. The action levels to be followed, given the concentration measured, are as follows:

*HNu/OVA

- Background to 1 ppm - Level D protection
- 1 ppm (above background) to 5 ppm for greater than 5 continuous minutes = Level C plus benzene monitoring
- >5 ppm for up to 15 continuous minutes = stop work
- Instantaneous concentrations >50 ppm = stop work

*HNu with 10.2 eV probe or OVA Model 128.

Dräger Tubes

- Below limits of detection (BLD) to less than the EL (Exposure Level)* - Level D
- EL to 5 times the EL = Level C
- >5 times the EL = stop work

*Refer to Table 1 for explanation

Combustible Gas Meter

- <10% of the Lower Explosive Limit (LEL) = continue work in Level D
- 10% to 20% of the LEL = continue work with extreme caution, work in Level C, and use non-sparking tools (if applicable)
- >20% of the LEL = stop work immediately and pursue alternative measures

11.3.2 Perimeter Monitoring

Perimeter monitoring is defined as monitoring performed at borders beyond the Support Zone and often at the "fenceline". Releases occurring during these types of investigative activities are expected to be minimal. Therefore, it is anticipated that the type and frequency of monitoring required for each site will be as follows:

TABLE 2

**MONITORING EQUIPMENT AND FREQUENCY FOR THE
CAMPBELL STREET FUEL FARM/PIPELINE AREA**

Job Task	HNu or OVA	Dräger Colorimetric Tubes
		(67 28561) Benzene
Surveying	NA	NA
Soil Boring/Sampling	I&P	P
Monitoring Well Installation	C	P
Groundwater Sampling	I&P	P
Tracer Leak Detection Sampling (Soil Gas Survey)	C	P
Hydropunch (hnu-hanby Field Test)	I&P	P

I = Initially - Immediately prior to start of job task to establish levels,
confirming level of protection

P = Periodically - When site condition or set-up changes

C = Continuously - Monitor levels continuously

NA = Not Applicable

Note: As air concentrations are measured, they should be documented. In the
case of continuous monitoring every 15 to 30 minutes.

- The OVA/HNu will be used periodically to scan the perimeter as a means of documenting any volatile releases that may extend past the work zone when volatiles are detected at the point source.
- Dräger Colorimetric Tubes will be used periodically to measure any potential releases of suspect chemicals when contaminants are detected at the point source. Refer to Table 2 to determine the specific tubes required for each task.

It is not anticipated that there will be a need for any additional monitoring. However, as work progresses, additions to the scope of monitoring will be investigated by the SHSO after conferring with the PHSO.

11.4 Personal Monitoring

The following personal monitoring will be in effect on site:

- Personal exposure monitoring, other than procedures outlined in Section 11.3 is not anticipated. However, as work progresses, additions to the scope of monitoring will be investigated by the SHSO after conferring with the PHSO.

See Attachment A for annual medical surveillance program requirements.

11.5 Equipment Maintenance and Calibration

Procedures for return of equipment to inventory and for maintenance of the equipment shall be followed in order to assure that the optimum level of operation is maintained for the item. Personnel using equipment shall complete a field equipment usage form which will be reviewed by the PHSO. Equipment calibration by the SHSO will be completed daily and entered into the equipment calibration log. Procedures for equipment maintenance and calibration can be found in Baker's Standard Operating Procedures for Administrative, Field, and Technical Activities Manual.

12.0 EMERGENCY PROCEDURES

The SHSO shall be notified of any on-site emergencies and be responsible for ensuring that the appropriate procedures are followed. [Note: It is assumed that a majority of the tasks performed at these sites will be in Level D, therefore, references to demarcated zones (re: exclusion and support zones) may not be applicable)]. The following standard emergency procedures will be used by on-site personnel.

In the event that there is an emergency in the Exclusion Zone or if immediate notification of project personnel is needed, the following audible signals, using a hand-held air horn, shall be implemented:

- 1 - long = Evacuate/All's Clear**
- 1-short = Attention Getter**
- 2-short = Fire**
- 3-short = Emergency/Need Help**

Personnel Injury in the Exclusion Zone: Upon notification of an injury in the Exclusion Zone, the designated emergency signal (verbal) warning or three short airhorn blasts shall be sounded. All site personnel shall assemble at the decontamination line. The rescue team will enter the Exclusion Zone (if required) to remove the injured person to the hotline. The SHSO and Site Manager and/or Field Team Leader will evaluate the nature of the injury, and assure that the affected person is a decontaminated according to Section 10.2. If required, contact should be made for an ambulance, and with the designated medical facility. No persons shall reenter the Exclusion Zone until the cause of the injury is determined.

Personnel Injury in the Support Zone: Upon notification of any injury in the Support Zone, the Field Team Leader and SHSO will assess the nature of the injury. If the cause of the injury or loss of the injured person does not affect the performance of site personnel, operations may continue. If the injury increases the risk to others, the designated emergency signal (verbal) warning or three short airhorn blasts shall be sounded and all site personnel shall move to the contamination control line for further instructions. Activities on site will stop until the added risk is mitigated.

Fire/Explosion: Upon notification of a fire or explosion on site, the designated emergency signal (verbal) warning or two short airhorn blasts shall be sounded and all site personnel

assembled at the decontamination line. The fire department shall be alerted and all personnel moved to a safe distance from the involved area according to procedures identified above.

Personal Protective Equipment Failure: If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her buddy shall immediately leave the Exclusion Zone. Reentry shall not be permitted until the equipment has been repaired or replaced.

Other Equipment Failure: If any other equipment on site fails to operate properly, the Site Manager and/or Field Team Leader and SHSO shall be notified and then determine the effect of this failure on continuing operations on site. If the failure affects the safety of personnel or prevents completion of the project tasks, all personnel shall leave the Exclusion Zone until the situation is evaluated and appropriate actions taken.

Injury reports will be completed for any accidents no matter how minor the injury may appear. Also, records on equipment failure will also be completed. All injuries resulting in treatment other than "first aid" will be reported to the Project Manager and PHSO within 24 hours.

In all situations, when an on-site emergency results in evacuation of the Exclusion Zone, personnel shall not reenter until:

1. The conditions resulting in the emergency have been corrected.
2. The hazards have been reassessed.
3. The Site HASP has been reviewed and, if appropriate, amended.
4. Site personnel have been briefed on any changes in the Site HASP.

A list of emergency phone numbers and contacts can be found in Attachment C and posted at the Baker command post.

13.0 WASTE HANDLING PROCEDURES

The protocols outlined in the Work Plans for the handling, packaging, storage, and disposal of contaminated materials must be followed to: (1) minimize the risk of off-site exposures that could endanger public health; and (2) limit the potential for liabilities associated with contaminated materials handling.

14.0 SPILL CONTAINMENT PROCEDURES

In the event that a spill of hazardous substances (gasoline, oil, etc.) occurs during the implementation of field activities, spill containment will be utilized to prevent the additional migration of contaminants through the site area. Specific spill containment procedures to be utilized will be dependent on the type of materials spilled and the type of environment affected. Potential spill containment procedures may include the use of speedi-dry absorbent material, absorbent pads, or removal and drumming of contaminated materials.

15.0 DECLARATION OF HASP REVIEW

All site personnel have read the above plan and are familiar with its provisions.

	Name	Signature
Site Health and Safety Officer, Site Manager, Field Team Leader	Scott A. Dick	
Field Geologist	Kenneth A. Tua	
Field Geologist	Robert C. Sevic	
Drilling Contractor Personnel	To Be Determined	
Drilling Contractor Personnel	To Be Determined	
Survey Contractor Personnel	To Be Determined	
Survey Contractor Personnel	To Be Determined	
Pipeline Tracer Contractor Personnel	To Be Determined	
Pipeline Tracer Contractor Personnel	To Be Determined	

*Actual field team members are to be determined.

Attachment A
Medical Surveillance Testing Parameters

ATTACHMENT A

MEDICAL SURVEILLANCE TESTING PARAMETERS*

Group I - Individuals Rarely in the Field (<10 days/year)

- Medical History and Physical
- EKG (for individuals over 30 yrs.)
- CBC with differential

Group II - Individuals Occasionally in the Field (10-30 days/year)

- Medical History and Physical
- EKG (for individuals over 30 yrs.)
- Chest X-ray (biannual)
- Pulmonary Function (spirometry)
- CBC with differential
- SMA 20 or 24 (liver enzyme scan)

Group III - Individuals Frequently in the Field (>30 days/year)

- Medical History and Physical
- Eye Test
- EKG (for individuals over 30 years)
- Audiogram
- Chest X-ray (biannual)
- Pulmonary Function (spirometry)
- CBC with differential
- SMA 20 or 24 (liver enzyme scan)
- Urinalysis (glucose scan)
- Specific Blood and Urine Tests (dependent on field exposure)
 - ▶ Lead ▶ Zinc
 - ▶ Mercury ▶ Chromium
 - ▶ Arsenic ▶ Volatile organics**
 - ▶ Cadmium ▶ Extractable organics**
 - ▶ Nickel ▶ Phenols**

Group III with Asbestos - Individuals frequently in the Field and also associated with asbestos

- Group III testing with the Asbestos Medical Questionnaire

Group IV - Individuals associated with Asbestos

- Medical history and physical
- Chest X-ray
- Pulmonary Function (spirometry)
- Urinalysis
- Asbestos Medical Questionnaire

* All tests annual except as indicated.

** Rare and expensive - to be indicated only if individuals are chronically exposed to organic compounds.

Attachment B
OSHA Training History of Project Personnel

ATTACHMENT B

OSHA TRAINING HISTORY OF PROJECT PERSONNEL

Personnel	Anticipated Site Activities Phase I	Training Status
Dave Mamrose	Project Manager	40-hr. training completed: 09/86 - Supervisory training: 03/88 8-hr. refresher completed: 02/91 - First Aid/CPR Certified: 11/91 - Medical surveillance participant
Barbara Cummings	Project Health and Safety Officer	40-hr. training completed: 10/91 - Supervisory training: 09/91 - First Aid/CPR Certified: 11/91 - Medical surveillance participant
Scott Dick	Site Manager/Field Team Leader/Site Health and Safety Officer	40-hr. training completed: 08/89 - Supervisory training: 08/90 8-hr. refresher completed: 08/90 - First Aid/CPR Certified: 11/91 - Medical surveillance participant
Kenneth Tua	Project Geologist	40-hr. training completed: 11/90 8-hr. refresher completed: 03/91 - Medical surveillance participant
Robert Sevcik	Project Geologist	40-hr. training completed: 09/91 - First Aid/CPR Certified: 12/90 - Medical surveillance participant

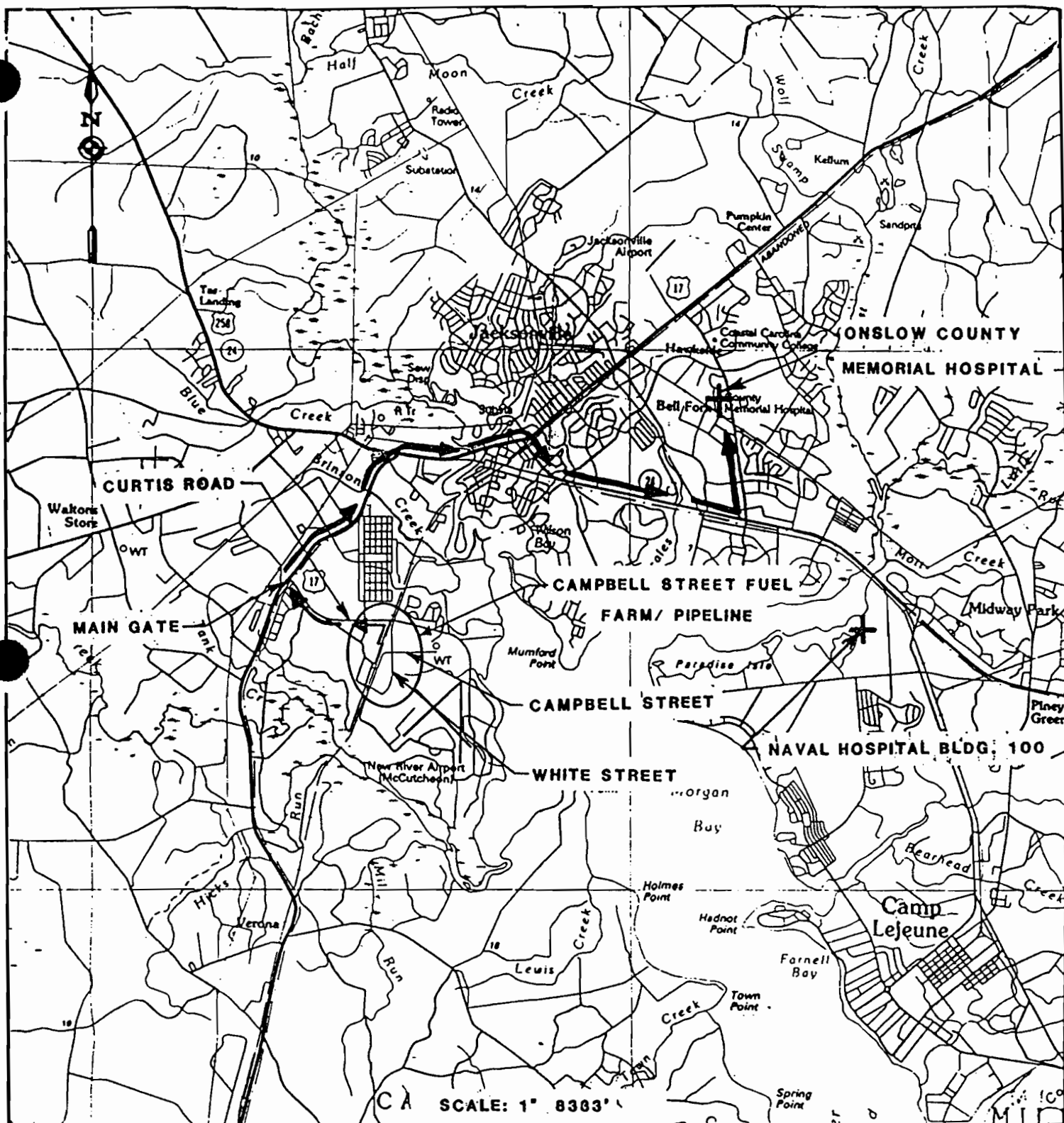
Attachment C
Directions and Hospital Route

ATTACHMENT C
DIRECTIONS AND HOSPITAL ROUTE

The following are directions to Onslow County Memorial Hospital:

1. Leave Base through "main gate."
2. Take Highway 24 east to Western Boulevard and turn left (north).
3. Continue on Western Boulevard to the fifth stop light and Onslow County Memorial Hospital will be on the left.

Agency/Facility	Phone Number	Contact
Security (Police)	911 (On Base) or (919) 451-4555	Base Police
Fire	911 (On Base)	Base Fire Department
Ambulance	(919) 455-9119	Jacksonville Ambulance Response Operator
Hospital	(919) 577-2240	Onslow County Hospital Response Operator
Emergency	911 (On Base)	Base Dispatch



EMERGENCY HOSPITAL ROUTE
 CAMPBELL STREET FUEL FARM/PIPELINE AREA
 NEW RIVER MARINE CORPS AIR STATION
 CAMP LEJEUNE, NORTH CAROLINA

Attachment D

Material Safety Data Sheets

- **hnu-hanby Field Test**
 - **Tracer Leak Detection System**
-

Attachment D
Chemical Safety Data Sheets
● **JP-5 Aviation Fuel**
● **Unleaded Gasoline**

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms Motor sport Petrol		Watery liquid Colorless to pale brown or pink Gasoline odor Floats on water. Flammable, irritating vapor is produced.
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to knock down vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.		
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea or vomiting. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If IN EYES, hold eyelids open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING	
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Leave warning-high flammability Evacuate area Disperse and flush		2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3
3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Miscellaneous Hydrocarbon Mixtures 3.2 Formula: (Mixture of hydrocarbons) 3.3 IMO/UN Designation: 3.1/1203 3.4 DOT ID No.: 1203 3.5 CAS Registry No.: Data not available		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to brown 4.3 Odor: Gasoline
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Protective goggles, gloves. 5.2 Symptoms Following Exposure: Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonia. Swallowing may cause irregular heartbeat. 5.3 Treatment of Exposure: INHALATION: maintain respiration and administer oxygen; enforce bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting; stomach should be leveraged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water. 5.4 Threshold Limit Value: 300 ppm 5.5 Short Term Inhalation Limit: 500 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 2, LD₅₀ = 0.5 to 5 g/kg. 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.25 ppm 5.11 IDLM Value: Data not available		

6. FIRE HAZARDS 6.1 Flash Point: -36°F C.C. 6.2 Flammable Limits in Air: 1.4%-7.4% 6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: None 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 653°F 6.8 Electrical Hazard: Class I, Group 0 6.9 Burning Rate: 4 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available		10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U-V-W	
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity With Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 33		11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Flammable liquid 11.2 HAS Hazard Rating for Bulk Water Transportation: Category Rating Fire _____ 3 Health _____ Vapor Irritant _____ 1 Liquid or Solid Irritant _____ 1 Poisons _____ 2 Water Pollution Human Toxicity _____ 1 Aquatic Toxicity _____ 2 Aesthetic Effect _____ 2 Reactivity _____ Other Chemicals _____ 0 Water _____ 0 Self Reaction _____ 0 11.2 NFPA Hazard Classification: Category Classification Health Hazard (Blue) _____ 1 Flammability (Red) _____ 3 Reactivity (Yellow) _____ 0	
8. WATER POLLUTION 8.1 Aquatic Toxicity: 90 ppm/24 hr/juvenile American shad/TL₅₀/fresh water 91 mg/l/24 hr/juvenile American shad/TL₅₀/salt water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 6%, 5 days 8.4 Food Chain Concentration Potential: None		12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: Not pertinent 12.3 Boiling Point at 1 atm: 140-390°F = 60-199°C = 333-472°K 12.4 Freezing Point: Not pertinent 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 0.7321 at 20°C (liquid) 12.8 Liquid Surface Tension: 19-23 dynes/cm = 0.019-0.023 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 49-51 dynes/cm = 0.049-0.051 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 3.4 12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.054 12.12 Latent Heat of Vaporization: 130-150 Btu/lb = 71-81 cal/g = 3.0 - 3.4 X 10⁴ J/kg 12.13 Heat of Combustion: -16,720 Btu/lb = -10,400 cal/g = 435.1 X 10⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 7.4 psia	
9. SHIPPING INFORMATION 9.1 Grades or Purity: Various octane ratings; military specifications 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum		NOTES	

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms Motor sport Petrol		Watery liquid	Colorless to pale brown or pink	Gasoline odor
Floats on water. Flammable, irritating vapor is produced.				
Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to knock down vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.				
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.			
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea or vomiting. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If in EYES, hold eyelids open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.			
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.			
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Leave warning-high flammability Evacuate area Disperse and flush			2. LABEL 2.1 Category: Flammable liquid 2.2 Class: 3	
1. CHEMICAL DESIGNATIONS 3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures 3.2 Formula: (Mixture of hydrocarbons) 3.3 IMO/UN Designation: 3.1/1203 3.4 DOT ID No.: 1203 3.5 CAS Registry No.: Data not available			4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to brown 4.3 Odor: Gasoline	
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6. FIRE HAZARDS 6.1 Flash Point: -36°F C.C. 6.2 Flammable Limits in Air: 1.4%-7.4% 6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: None 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 653°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 4 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-J-V-W																																				
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9. SHIPPING INFORMATION 9.1 Grades of Purity: Various octane ratings; military specifications 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-relief																																					

NOTES

JET FUELS: JP-5

JPV

Common Synonyms Kerosene, heavy	Liquid Colorless Fuel oil odor Floats on water.
Stop discharge if possible. Call fire department. Avoid contact with liquid. Isolate and remove discharged material. Notify local health and pollution control agencies.	
Fire	Combustible. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shorelines. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.
1. RESPONSE TO DISCHARGE (See Response Methods Handbook) Mechanical containment Should be removed Chemical and physical treatment	2. LABEL 2.1 Category: None 2.2 Class: Not pertinent
3. CHEMICAL DESIGNATIONS 3.1 CG Competibility Class: Miscellaneous Hydrocarbon Mixtures 3.2 Formula: Not pertinent 3.3 IMO/UN Designation: 3.3/2761 3.4 DOT ID No.: 2761 3.5 CAS Registry No.: Data not available	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless to light brown 4.3 Odor: Like fuel oil
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Protective gloves; goggles or face shield. 5.2 Symptoms Following Exposure: Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema. 5.3 Treatment of Exposure: ASPIRATION: enforce bed rest; administer oxygen; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water. 5.4 Threshold Limit Value: 200 ppm 5.5 Short Term Inhalation Limit: 2500 mg/m ³ for 80 min. 5.6 Toxicity by Ingestion: Grade 2; LD ₅₀ = 0.5 to 5 g/kg 5.7 Late Toxicity: Data not available 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 1 ppm 5.11 IDLH Value: Data not available	

6. FIRE HAZARDS 6.1 Flash Point: 140°F (min.) C.C. 6.2 Flammable Limits in Air: 0.8%-4.8% 6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 475°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 4 mm/min. 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available	10. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook) A-T-U																																				
7. CHEMICAL REACTIVITY 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 33	11. HAZARD CLASSIFICATIONS 11.1 Code of Federal Regulations: Combustible liquid 11.2 HAS Hazard Rating for Bulk Water Transportation: <table> <tr> <th>Category</th><th>Rating</th></tr> <tr> <td>Fire</td><td>1-2</td></tr> <tr> <td>Health</td><td></td></tr> <tr> <td>Vapor Irritant</td><td>1</td></tr> <tr> <td>Liquid or Solid Irritant</td><td>1</td></tr> <tr> <td>Poisons</td><td>1</td></tr> <tr> <td>Water Pollution</td><td></td></tr> <tr> <td>Human Toxicity</td><td>1</td></tr> <tr> <td>Aquatic Toxicity</td><td>1</td></tr> <tr> <td>Aesthetic Effect</td><td>3</td></tr> <tr> <td>Reactivity</td><td></td></tr> <tr> <td>Other Chemicals</td><td>0</td></tr> <tr> <td>Water</td><td>0</td></tr> <tr> <td>Self Reaction</td><td>0</td></tr> </table> 11.3 NFPA Hazard Classification: <table> <tr> <th>Category</th><th>Classification</th></tr> <tr> <td>Health Hazard (Blue)</td><td>0</td></tr> <tr> <td>Flammability (Red)</td><td>2</td></tr> <tr> <td>Reactivity (Yellow)</td><td>0</td></tr> </table>	Category	Rating	Fire	1-2	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	1	Water Pollution		Human Toxicity	1	Aquatic Toxicity	1	Aesthetic Effect	3	Reactivity		Other Chemicals	0	Water	0	Self Reaction	0	Category	Classification	Health Hazard (Blue)	0	Flammability (Red)	2	Reactivity (Yellow)	0
Category	Rating																																				
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Category	Classification																																				
Health Hazard (Blue)	0																																				
Flammability (Red)	2																																				
Reactivity (Yellow)	0																																				
8. WATER POLLUTION 8.1 Aquatic Toxicity: 500 ppm/"/salmon fingerling/lethal/fresh water *Time period not specified 8.2 Waterflow Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 53%, 5 days 8.4 Food Chain Concentration Potential: None	12. PHYSICAL AND CHEMICAL PROPERTIES 12.1 Physical State at 16°C and 1 atm: Liquid 12.2 Molecular Weight: Not pertinent 12.3 Boiling Point at 1 atm: 348-349°F = 176-287°C = 449-560°K 12.4 Freezing Point: <-54°F = <-48°C = <-225°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 0.82 at 15°C (liquid) 12.8 Liquid Surface Tension: (est.) 25 dynes/cm = 0.025 N/m at 20°C 12.9 Liquid Water Interfacial Tension: (est.) 50 dynes/cm = 0.05 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 12.12 Latent Heat of Vaporization: 140 Btu/lb = 76 cal/g = 3.3 X 10 ⁴ J/kg 12.13 Heat of Combustion: -16,540 Btu/lb = -10,300 cal/g = -431.24 X 10 ⁴ J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available																																				
9. SHIPPING INFORMATION 9.1 Grades of Purity: 100% 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester)	NOTES																																				

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour- square foot-F	Temperature (degrees F)	Centipoise
34	52.370	0	.444	0	.926	-35	10.600
36	52.300	10	.449	10	.924	-30	9.614
38	52.230	20	.454	20	.921	-25	8.739
40	52.160	30	.459	30	.919	-20	7.960
42	52.090	40	.464	40	.917	-15	7.266
44	52.020	50	.469	50	.915	-10	6.646
46	51.950	60	.474	60	.913	-5	6.090
48	51.880	70	.479	70	.911	0	5.592
50	51.810	80	.484	80	.909	5	5.144
52	51.740	90	.489	90	.907	10	4.740
54	51.670	100	.494	100	.905	15	4.376
56	51.600	110	.499	110	.903	20	4.046
58	51.530	120	.504	120	.901	25	3.747
60	51.460	130	.509	130	.899	30	3.476
62	51.390	140	.514	140	.897	35	3.229
64	51.330	150	.519	150	.895	40	3.004
66	51.260	160	.524	160	.893	45	2.799
68	51.190	170	.529	170	.891	50	2.612
70	51.120	180	.534	180	.889	55	2.440
72	51.050	190	.539	190	.887	60	2.282
74	50.980	200	.544	200	.885	65	2.138
76	50.910	210	.549	210	.883	70	2.005
78	50.840					75	1.883
80	50.770						
82	50.700						
84	50.630						

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I	130	.101		N		D
	N	140	.130		O		A
	S	150	.166		T		T
	O	160	.210				A
	L	170	.264		P		
	U	180	.330		E		N
	B	190	.409		R		O
	L	200	.504		T		T
	E	210	.616		I		
		220	.750		N		A
		230	.907		E		V
		240	1.091		N		A
		250	1.306		T		I
		260	1.555				L
		270	1.843				A
		280	2.174				B
		290	2.553				L
		300	2.986				E



MATERIAL SAFETY DATA SHEET

EMERGENCY TELEPHONE (501) 862-5141

IDENTITY - Great Lakes Halon 2402
(Dibromotetrafluoroethane)

=====

SECTION I - PRODUCT INFORMATION

MANUFACTURER'S NAME - GREAT LAKES CHEMICAL CORPORATION

TELEPHONE NUMBER FOR INFORMATION - (317) 463-2511

CAS REGISTRY NO. - 124-73-2

DATE PREPARED - 7/10/86

FORMULA - $C_2Br_2F_4$

SUPERCEDES - 9/84

CHEMICAL FAMILY - Halocarbon

PREPARED BY - Research Services Department
Great Lakes Chemical Corporation
West Lafayette, Indiana 47906

=====

SECTION II

HAZARDOUS COMPONENTS (Specify Chemical Identity: Common Name(s))

<u>COMPONENT</u>	<u>OSHA PEL</u>	<u>ACGIH TLV</u>	<u>Other Limits Recommended</u>	<u>(optional)</u>
Dibromotetrafluoroethane	Not estbl.	Not estbl.	Not estbl.	99.9

GLCC Product Code: 046

=====

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point	117°F (47.3°C)
Specific Gravity (water=1)	2.18 at 70°F
Vapor Pressure (mm Hg.)	352 at 70°F
Freezing Point	-167°F (-110.5°C)
Vapor Density (AIR=1)	8.97
Evaporation Rate	Not Available
(Butyl Acetate = 1)	
Solubility in Water	Negligible
Appearance and Odor	Colorless, clear liquid with a characteristic slightly sweet odor

=====

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)	Not Flammable
Flammable Limits	Not Available
LEL	Not Available
UEL	Not Available

Extinguishing Media

Halon 2402 is a fire extinguishing material

Special Fire Fighting Procedures

None

Unusual Fire and Explosion Hazards:

Above 750°F, Halon 2402 decomposes to form hydrogen bromide, hydrogen fluoride and free bromine and possibly small amounts of carbonyl halides which are irritating and potentially toxic if fire extinguishment is prolonged.

=====

SECTION V - REACTIVITY DATA

Stability Stable x Unstable ____

=====

Incompatibility (Materials to Avoid)

None known

Hazardous Decomposition or Byproducts

On contact with flames or hot surfaces, hydrogen bromide, hydrogen fluoride, free bromine and small amounts of carbonyl halides may be emitted.

Hazardous Polymerization

May Occur _____ Will Not Occur x

Conditions to Avoid: None

=====

SECTION VI - HEALTH HAZARD DATA

Route(s) of Entry:

Inhalation? yes Skin? unknown Ingestion? yes

Health Hazards (Acute and Chronic):

The inhalation LC₁₀ for rats is 12.5 percent for 15 minutes. The four hour inhalation LC₅₀ for rats is 50,000 ppm or 5 percent. The lethal exposures involved the central nervous system and death by anesthesia. At 2500 ppm dogs exposed to Halon 2402 developed cardiac arrhythmias and some deaths from ventricular fibrillation. Concentrations of 1000 ppm and above are considered to be unsafe for human exposure. The acute health hazards are the potential for cardiac arrhythmias and anesthetic effects on the central nervous system. Chronic health hazards are not known.

Carcinogenicity:

NTP? no IARC Monographs? no OSHA Regulated? no

Signs and Symptoms of Exposure

Concentrations in excess of 2000 ppm cause central nervous system effects such as dizziness and impaired coordination and possibly cardiac arrhythmias. Prolonged exposure may lead to unconsciousness and possibly death.

Medical Conditions Generally Aggravated by Exposure

Heart conditions may be aggravated by exposure to high concentrations

Emergency and First Aid Procedures

Inhalation: Remove victim to fresh air. Give symptomatic and supportive care. Get medical attention. NOTE: Epinephrin (adrenalin) is contraindicated in the treatment of over-exposure to Halon 2402. Eyes: Flush with water for 15 minutes. Get medical attention. Skin: Flush with water. If irritation occurs get medical attention. Ingestion: Get medical attention.

=====

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

Steps To Be Taken in Case Material is Released or Spilled

Evacuate and completely ventilate area. Wear self-contained breathing apparatus for rescue operations. Material will evaporate without a residue.

Waste Disposal Method

Allow empty drums to stand until all residual material has evaporated. Offer drums for recycling or reconditioning, or puncture for disposal.

Precautions to be Taken in Handling and Storing

Avoid container damage. Keep containers tightly closed.

Other Precautions

None

=====

SECTION VIII - CONTROL MEASURES

Respiratory Protection

Use NIOSH approved self-contained breathing apparatus if exposed to concentrations of 1000 ppm or greater.

Ventilation

Local Exhaust - See mechanical

Special - None

Mechanical - All indoor areas should be well ventilated

Other - None

Protective Gloves - Neoprene

Eye Protection - Chemical safety goggles

Other Protective Equipment - None

Work/Hygienic Practices

Make sure piping is empty before doing maintenance work

=====

Information on this form is furnished solely for the purpose of compliance with OSHA's Hazard Communication Standard, 29CFR 1910.1200 and shall not be used for any other purpose.

DLMcF/db:92

hmu -- HANBY
Systems

4400 South Wayside, Suite 106

Houston, Texas 77087

(713) 649-0131

Fax: (713) 649-6237

MATERIAL SAFETY DATA SHEETS

SECTION I MATERIAL SAFETY DATA SHEET

Chemical Name: HAL-CDR
Synonyms: Color Development Reagent
Chemical Formula: Proprietary

=====

SECTION II EXPOSURE LIMITS (1)

(1) None available at time of publication.
(Aug. 87)

=====

SECTION III PHYSICAL DESCRIPTION

White Deliquescent Powder

M.W.:	133.35	L.E.L.:	N/A
M.P.:	194°C (5.2 atm)	U.E.L.:	N/A
B.P.:	182°C (752 atm)	F.P.:	Nonflammable
F.P.:	AUTO IGNITION TEMP:		Nonflammable
S.G.:	2.44(25°C/4°C)	ODOR THRESHOLD:	N/A
V.P.:		SOLUBILITY IN WATER:	69.87(15°C)
V. DEN:		SOLUBILITY IN WATER:	Soluble in ether chloroform, CCl ₄ insoluble in benzene.

*Reference to water @ 4 ° C

=====

SECTION IV INCOMPATIBILITIES AND STORAGE

Incompatible with water, moisture Store in dry, cool area.

=====

SECTION V **HEALTH HAZARDS**

Target Organs: Skin, Eyes
Route of Entry: Ingestion, skin/eye contact
Symptoms: Chemical Burns/Skin, Eye Damage

=====

SECTION VI **PERSONAL PROTECTION**

PPE Gloves, goggles or safety glasses
RESPIRATOR DUST MASK
SELECTION:
FIRST AID: EYE: Irrigate immediately for 15 minutes lifting
lid periodically. GET MEDICAL ATTENTION.
SKIN: Immediately wash with large amounts of
running water for 15 minutes.

=====

FIRE FIGHTING

If material is involved in fire, use dry chemicals or CO₂ extinguisher. DO NOT get a solid stream of water on bulk material (will react violently with water).

NOTE: Contact with water or moisture liberates HCL gas.

=====

SECTION VIII **SPILL CONTROL**

NOTE: DO NOT TOUCH spilled material. Clean up dry and store waste in a moisture-free environment.

=====

SECTION I MATERIAL SAFETY DATA SHEET

Chemical Name: HAL-ER
Synonyms: Extractant Reagent
Chemical Formula: Proprietary

=====

SECTION II EXPOSURE LIMITS

<u>OSHA</u>	<u>NIOSH</u>	<u>ACGIH</u>
PEL: 10 ppm (8-hr TWA)	2ppm/1-hr Ceiling TLV	5 ppm (8-hr TWA)(Skin)
PEL: 25 ppm (Ceiling)		
IDLH: 300 ppm		

=====

SECTION III PHYSICAL DESCRIPTION

Colorless Liquid with Ether-Like Odor

M.W.: 153.8	L.E.L.: N/A
M.P.: -23°C (-9°F)	U.E.L.: N/A
B.P.: 76.7°C (170°F)	F.P.: Nonflammable
F.P.: AUTO IGNITION TEMP:	N/A
S.G.: 1.59 @ 20° C	ODOR THRESHOLD: 160 ppm
V.P.: 90 mm @ 20° C	Solubility in Water: 0.08% @ 20°C
V. DEN.: 5.5	Solubility in Other Solvents: Infinitely solu- ble in alcohol and ether.

=====

SECTION IV INCOMPATIBILITIES AND STORAGE

Incompatible with chemically active metals such as sodium, magnesium, and potassium. Store below 30 degrees C (80 degrees F).

=====

SECTION V **HEALTH HAZARDS**

Target Organs: CNS, eyes, lungs, liver, kidneys, skin
Route of Entry: Inhalation, absorption, skin/eye contact
Symptoms: CNS Depression, nausea, vomiting, liver/kidney damage, skin irritant

=====

SECTION VI **PERSONAL PROTECTION**

PPE: Gloves, goggles or safety glasses

RESPIRATOR SELECTION: 100 ppm: Supplied-air respirator/SCBA
300 ppm: Supplied-air respirator with full face piece. Escape: gas mask with organic vapor canister

FIRST AID: EYE: Irrigate immediately for 15 minutes lifting eyelid periodically. GET MEDICAL ATTENTION

SKIN: Wash with soap and water

BREATHING: Artificial respiration, immediate medical attention

INGESTION: Induce vomiting with syrup of Ipecac or give two glasses of water and place finger in back of throat. Get medical attention

=====

SECTION VII **FIRE FIGHTING**

Material is non-flammable. Irritating or poisonous gases may be produced in contact with fire or hot surfaces. Dry Chemical, CO₂, water spray or foam. DO NOT BREATHE VAPOR.

=====

SECTION VIII **SPILL CONTROL**

Do not touch spilled material. Absorb with sand or other non-combustible absorbent material. Dispose of absorbent in accordance with applicable EPA regulations.

400 South Wayside, Suite 106
Houston, Texas 77087
(713) 649-0131
Fax: (713) 649-6237

Product Code: 14728

Page: 1

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

1. INGREDIENTS: (% w/w, unless otherwise noted)

Carbon tetrachloride CAS# 000056-23-5 99.8%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 170F (76.5C)
VAP. PRESS: 91 mmHg @ 20C
VAP. DENSITY: 5.31
SOL. IN WATER: 0.08 g/100g
SP. GRAVITY: 1.589 @ 25/25C
APPEARANCE: Colorless liquid.
ODOR: Sweetish, distinctive odor.

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: None
METHOD USED: TCC

FLAMMABLE LIMITS
LFL: Not applic.
UFL: Not applic.

EXTINGUISHING MEDIA: Non-combustible.

FIRE & EXPLOSION HAZARDS: Has no ignition temperature.

FIRE-FIGHTING EQUIPMENT: Positive-pressure self-contained breathing apparatus.

(Continued on Page 2)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 14728

Page: 2

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Avoid open flames, welding arcs, or other high temperature sources which induce thermal decomposition.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Oxidizing material. Contact with aluminum or other easily oxidized non-ferrous metals.

HAZARDOUS DECOMPOSITION PRODUCTS: Involvement in fire forms hydrogen chloride and phosgene gas.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Remove all unnecessary personnel from the area. Ventilate closed areas thoroughly. Small spills - mop up, wipe up or soak up immediately. Large spills - contain liquid; transfer to closed metal containers. Keep out of water supply.

DISPOSAL METHOD: When disposing of unused contents, the preferred options are to send to licensed reclaimer, or to permitted incinerators. Any disposal practice must be in compliance with federal, state, and local regulations. Do not dump into sewers, on the ground, or into any body of water.

6. HEALTH HAZARD DATA:

EYE: May cause slight transient (temporary) eye irritation. Corneal injury is unlikely. Vapors may irritate eyes.

SKIN CONTACT: Short single exposure not likely to cause

(Continued On Page 3)

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M A T E R I A L S A F E T Y D A T A S H E E T

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Product Code: 14728

Page: 3

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

6. HEALTH HAZARD DATA: (CONTINUED)

significant skin irritation. Prolonged or repeated exposure may cause skin irritation, even a burn. Repeated contact may cause drying or flaking of skin.

SKIN ABSORPTION: A single prolonged exposure may result in the material being absorbed in harmful amounts. May cause more severe response if skin is abraded (scratched or cut). The LD50 for rabbits is 1800 mg/kg.

INGESTION: Single dose oral toxicity is moderate. The LD50 for rats is 2920 mg/kg. If aspirated (liquid enters the lung), may be rapidly absorbed through the lungs and result in injury to other body systems. Human experience indicates a mean lethal dose is in the range of 5 to 10 ml for the average adult.

INHALATION: Excessive vapor concentrations are readily attainable and may cause unconsciousness and death. The LC50 for rats is 6200 ppm in 4 hours. Excessive exposure may increase sensitivity to epinephrine and increase myocardial irritability (irregular heartbeats). One-tenth saturated atmosphere is lethal to rats in 15 minutes. High concentrations can lead to unconsciousness; lower concentrations may cause headaches, dizziness, incoordination and other central nervous system effects, as well as irritation to the upper respiratory tract.

SYSTEMIC & OTHER EFFECTS: A single excessive exposure may cause central nervous system, liver and kidney effects. Repeated excessive exposures to high amounts may cause liver, kidney, CNS and gastrointestinal effects. Repeated excessive exposures to smaller amounts may cause liver more likely than kidney effects. Alcohol consumed before or after exposure may increase adverse effects. For hazard communication purposes under OSHA Standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by NTP, IARC. Has been shown to produce

(Continued On Page 4)

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M A T E R I A L S A F E T Y D A T A S H E E T

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Product Code: 14728 Page: 4

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

6. HEALTH HAZARD DATA: (CONTINUED)

liver tumors in some laboratory animals. Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. Did not cause birth defects in animals; other effects were seen in the fetus only at doses which caused toxic effects to the mother. In animal studies, has been shown not to interfere with reproduction. Results of ~~in~~ vitro ("test tube") mutagenicity tests have been negative.

7. FIRST AID:

EYES: Irrigate immediately with water for at least 5 minutes.

SKIN: Wash off in flowing water or shower. Remove contaminated clothing and air thoroughly before reuse.

INGESTION: Do not induce vomiting. Call a physician and/or transport to emergency facility.

INHALATION: Remove to fresh air. If not breathing, give mouth-to-mouth resuscitation. If breathing is difficult, give oxygen. Call a physician.

NOTE TO PHYSICIAN: Because rapid absorption may occur through lungs if aspirated and cause systemic effects, the decision of whether to induce vomiting or not should be made by an attending physician. If lavage is performed, suggest endotracheal and/or esophageal control. Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach. Exposure may induce myocardial irritability. Do not administer sympathomimetic drugs unless absolutely necessary. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

(Continued on Page 5)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 14728 Page: 5

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90 MSDS:000097

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): OSHA PEL is 2 ppm; ACGIH TLV is 5 ppm, A2, Skin.

VENTILATION: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

RESPIRATORY PROTECTION: Use an approved air-purifying respirator. For emergency and other conditions where the exposure guideline may be greatly exceeded, use an approved positive-pressure self-contained breathing apparatus.

SKIN PROTECTION: Use protective clothing impervious to this material. Selection of specific items such as gloves, boots, apron, or full-body suit will depend on operation. Remove contaminated clothing immediately, wash skin area with soap and water, and launder clothing before reuse.

EYE PROTECTION: Use safety glasses. Where contact with liquid is likely, chemical goggles are recommended because eye contact with this material may cause discomfort, even though it is unlikely to cause injury.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Vapors of this product are heavier than air and will collect in low areas. Avoid pits, depressions, basements, and confined spaces where vapors may accumulate. Strong consideration should be given to air monitoring system where material is stored and handled routinely. Do not breathe vapors. Avoid eye and prolonged or repeated skin contact.

MSDS STATUS: Revised section 9 and regsheets.

(Continued on Page 6)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 14728

Page: 6

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

REGULATORY INFORMATION: (Not meant to be all-inclusive--selected regulations represented.)

NOTICE: The information herein is presented in good faith and believed to be accurate as the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
CARBON TETRACHLORIDE	000056-23-5	99.8 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A delayed health hazard

(Continued On Page 7)

(R) Indicates a Trademark of The Dow Chemical Company

* An Operating Unit of The Dow Chemical Company

M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 14728 Page: 7

Product Name: CARBON TETRACHLORIDE, TECHNICAL

Effective Date: 06/14/90 Date Printed: 11/21/90

MSDS:000097

REGULATORY INFORMATION (CONTINUED)

CALIFORNIA PROPOSITION 65: The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement ACT of 1986: This product contains a chemical(s) known to the State of California to cause cancer. (See Section 6 of the MSDS for details on carcinogenicity.)

CANADIAN REGULATIONS

The Workplace Hazardous Materials Information System (W.H.M.I.S.)
Classification for this product is:

D1A
D2A

The Transportation of Dangerous Goods Act (T.D.G.A.) classification for
this product is:

Carbon Tetrachloride/Class 6.1, (9.2)/UN1846/II

(R) Indicates a Trademark of The Dow Chemical Company
The Information Herein Is Given In Good Faith, But No Warranty,
Express Or Implied, Is Made. Consult The Dow Chemical Company
For Further Information.

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Attachment E
Baker Environmental, Inc.
Safety Standard Operating Procedures

ATTACHMENT E
BAKER ENVIRONMENTAL, INC.
SAFETY STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

- E-1 Confined Space Entry Program**
- E-2 Respiratory Protection Program**
- E-3 Care & Cleaning of Personal Protective Equipment**



E.1.0 - CONFINED SPACE ENTRY PROGRAM

1.1 INTRODUCTION

All confined space entries shall be performed in accordance with the following program based on the "Criteria Document for a Recommended Standard for Working in Confined Spaces," issued by NIOSH. A confined space refers to a space, which by design has limited openings for entry and exit; unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy.

Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults and pipelines. If there is a question as to whether or not an area should be considered as a confined space, appropriate safety personnel should be notified prior to entry.

1.2 HAZARD IDENTIFICATION

Identify and evaluate each hazard of the permit spaces. Hazardous substances should be identified through the use of draeger tubes and/or direct reading instruments such as HNu or OVA meters. Oxygen and explosive levels will be monitored using a Lower Explosive Level/Oxygen (LEL/O₂) meter.

1.3 HAZARD CONTROL

Establish and implement the means, procedures and practices by which the permit spaces can be entered safely. Ventilation and area cleaning should be considered in addition to personal protective equipment.

1.4 PERMIT SYSTEM

Complete the confined space entry permit, as attached. This form must be posted at the point of entry and is valid for eight consecutive hours. After eight hours, or sooner if there is reason to believe that conditions may have changed, additional readings and a new form must be filled out. Forms must be returned to the on-site Health and Safety Officer (HSO).

1.5 EMPLOYEE INFORMATION

Signs shall be posted near permit spaces to notify employees what hazards may be present and that only authorized entrants may enter.

1.6 EMPLOYEE TRAINING

All employees entering or directly involved in the confined space activities must complete a 40-hour health and safety training course in accordance with 29 CFR 1910.120. Additionally, site-specific training must be conducted regarding the hazards associated with each particular entry.

1.7 EQUIPMENT

All equipment must be inspected and maintained, to ensure the proper use of the equipment, necessary for safe entry. Respirators and emergency equipment, lanyard, harness, etc. must be thoroughly inspected prior to the confined space entry. Records of the inspection shall be kept in the project file. The equipment shall be adequately decontaminated following each entry.

1.8 RESCUE

Ensure that procedures and equipment necessary to rescue entrants from permit spaces are implemented and provided. The buddy system shall be used for all entries. The attached table provides a list of requirements with respect to each entry classification. The following items describe the three confined space entry classifications.

I CLASS A

- Immediate Danger to Life and Health (IDLH) condition exists
- Should only be entered under emergency conditions (Level A or B)
- Efforts should be made to reduce IDLH levels such as ventilation, cleaning, etc.
- IDLH conditions may include:
 - ▶ Oxygen levels below 19.5% or greater than 25%
 - ▶ LEL levels 20% or greater

II CLASS B

- Dangerous, but not IDLH conditions
- Levels of protection can range from C to A
- Range of conditions:
 - ▶ Oxygen from 19.5% to 21.5%
 - ▶ LEL levels from 10% to 19%

III CLASS C

- Low Hazard Potential
- Requires no modification of work procedures
- Range of conditions
 - ▶ Oxygen levels from 19.5% to 22%
 - ▶ LEL levels less than 10%

CONFINED SPACE ENTRY

ITEM	CLASS A	CLASS B	CLASS C
1. Permit	X	X	X
2. Atmospheric Testing	X	X	X
3. Monitoring	X	O	O
4. Medical Surveillance	X	X	O
5. Training of Personnel	X	X	X
6. Labeling and Posting	X	X	X
7. Preparation Isolate/Lockout/Tag	X	X	X
Purge and Ventilate	X	X	O
Cleaning Procedures	O	O	O
Requirements for Special Equipment/Tools	X	X	O
8. Procedures Initial Plan	X	X	X
Standby	X	X	O
Communication/Observation	X	X	X
Rescue	X	X	X
Work	X	X	X
9. Safety Requirement and Clothing Head Protection	O	O	O
Hearing Protection	O	O	O
Hand Protection	X	O	O
Foot Protection	X	O	O
Body Protection	X	O	O
Respiratory Protection	X	X	O
Safety Belts	X	X	X
Life Lines, Harness	X	X	X
10. Rescue Equipment	X	X	X
11. Recordkeeping/Exposure	X	X	X

X - Indicates requirements

O - Indicates determination by the qualified individual

CONFINED SPACE ENTRY PERMIT
HAZARDOUS AREA ENTRY PERMIT

LOCATION and DESCRIPTION

Confined Space _____

Date _____

PURPOSE of Entry _____

Time _____ M

JOB/SITE _____

Expiration _____ M

PERSON in Charge of Work _____

SAFETY REQUIREMENTS	Yes	No		Yes	No
Lock Out - De-Energize			Escape Harness		
Lines Broken - Capped or Blanked			Tripod Emergency Escape Unit		
Purge - Flush and Vent			Lifelines		
Ventilation			Fire Extinguishers		
Secure Area			Lighting		
Breathing Apparatus			Protective Clothing		
Resuscitator - Inhalator			Respirator		

TEST(S) TO BE TAKEN Valid for One 8-Hour Entry	Yes	No	CONCENTRATION	INSTRUMENT USED AND DATE CALIBRATED
% Oxygen				
% L.E.L.*				
Carbon Monoxide				
Aromatic Hydrocarbon				
Hydrocyanic Acid				
Hydrogen Sulfide				
Sulfur Dioxide				
Ammonia				
Other:				
Other:				

L.E.L. = Lower Explosion Level

GAS TESTER _____
Name

Note: Continuous/periodic tests shall be established before beginning job. Any questions pertaining to test requirements contact the On-Site Health and Safety Officer.

SAFETY STANDBY PERSON(S)	Name	Check No.

AMBULANCE: _____

FIRE: _____

Supervisor authorizing all above conditions specified _____

E.2.0 - RESPIRATORY PROTECTION PROGRAM

2.1 INTRODUCTION

In accordance with OSHA requirements (29 CFR 1910.134), this document represents Baker Environmental, Inc.'s (Baker's) program governing the selection and use of respiratory protection for its employees. It is Baker's policy to provide its employees with the proper protective equipment, training, and medical surveillance necessary to protect individuals from any potential hazards which may be present during the tasks performed throughout the course of each individual's employment. This program specifically describes the procedures that have been established and implemented for the use of respiratory protection equipment. The effectiveness of this program shall be re-evaluated on an annual basis and appropriate changes shall be made if it is deemed necessary.

2.2 EMPLOYER RESPONSIBILITY

Baker shall provide to its employees the respiratory protection equipment which is applicable and suitable for the purpose intended when such equipment is necessary to protect the health of the employee.

2.3 EMPLOYEE RESPONSIBILITY

The employee shall use the provided respiratory protection equipment in accordance with instructions and training received and shall report any malfunction of the equipment to a responsible person. The employee shall not wear contact lenses in atmospheres where respiratory protection is required.

2.4 HAZARD ASSESSMENT

The key elements of a respiratory protection program must start with an assessment of the inhalation hazards present in the work area. Because Baker's services involve a variety of environmental and industrial hygiene studies, it is not practical to identify all the possible inhalation hazards that all the employees could be exposed to within the scope of this

document. Therefore, it is essential that a task specific assessment shall be conducted prior to the initiation of any activities on a given project. This task specific assessment may be part of site-specific health and safety plan.

After a task specific assessment is completed, and it is determined that exposure concentrations exceed or may exceed the recommended limits, engineering and administrative controls should be implemented, when feasible, as soon as possible.

If the exposure cannot be reduced or it is not feasible to reduce the exposure below the recommended limits, respirators will be selected by the site Health and Safety Officer on the basis of:

- Toxicity
- Maximum Expected Concentration
- Oxygen Levels
- Warning properties of the substance(s) involved
- Sorbent Limitations
- Facepiece Fit
- Mobility Requirements
- Type of Use (routine, escape, or emergency entry)

2.5 TRAINING

Each respirator wearer shall be given training, by a qualified individual, that will include explanations and discussions of:

- The respiratory hazard(s) and what may occur if the respirator is not used properly.
- The reasons for selecting a particular type of respirator.
- The function, capabilities, and limitations of the selected respirator.
- The method of donning the respirator and checking its fit and operation.
- The proper wearing of the respirator.
- Respirator maintenance.
- Recognizing and handling emergency situations.

Respirator training will be conducted on an annual basis, at a minimum. Records of the training and fit-testing will be maintained for a minimum of 30 years following termination of employment for each employee.

2.6 TYPES OF RESPIRATORS

Baker provides employees with half-face and full-face air purifying respirators, positive pressure 30-minute Self-Contained Breathing Apparatus (SCBAs), positive pressure supplied airline respirators, and 5-minute escape SCBAs. Only respiratory equipment approved by the appropriate approval agencies (e.g., NIOSH, MSHA) will be distributed to Baker employees. All Baker employees who regularly perform tasks requiring respiratory protection will be issued their own half-face or full-face respirator, provided the employee can achieve a proper fit and is medically capable of wearing the equipment.

Because 30-minute SCBAs, positive pressure supplied airline respirators, and 5-minute escape SCBAs are used on a less frequent interval, this equipment will be distributed on an as needed basis.

2.7 CLEANING AND MAINTENANCE

Respirator maintenance will be performed by each trained individual on a regular basis. The maintenance shall be carried out on a schedule which ensures that each respirator wearer is provided with a respirator that is clean and in good operating condition.

Respiratory equipment that is used on an as needed basis shall be maintained by qualified personnel. This equipment shall be cleaned and sanitized after each use. Inspections shall be conducted before and after each use.

Respiratory equipment that has been issued to an employee shall be cleaned and sanitized by the wearer on a schedule (specified by OSHA in 29 CFR 1910.134) which ensures that it will be maintained in clean and good operating condition. Inspections shall be conducted on a regular basis during usage and prior to each project requiring the potential usage of the equipment.

All respirators shall be stored in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. They shall be stored to prevent distortion of rubber or other elastomer parts.

Parts replacement and repairs shall be done only by appropriate personnel. Equipment requiring repairs shall be reported to appropriate Baker personnel. Examples of inspection forms are included at the end of this text.

2.8 FIT-TESTING

Each respirator wearer shall be provided with a respirator that can properly form a secure face to mask seal. Each wearer shall be fit-tested prior to issuance of the respirator using either an irritant smoke or odorous vapor, or other suitable test agent. Retesting shall be performed, at a minimum, on an annual basis or if a different model respirator, other than the model he/she was previously fit-tested for, is to be used by the wearer.

Facial hair, which interferes with the normally effective face to mask seal is prohibited by employees who are required to wear respiratory equipment. Each respirator wearer shall be required to check the seal of the respirator by appropriate means prior to entering a harmful atmosphere.

2.9 MEDICAL SURVEILLANCE

Personnel that will or may be assigned to tasks requiring use of respirators shall participate in a medical surveillance program on an annual basis. The medical surveillance program shall include, but may not be limited to, a physical and a pulmonary function test conducted by the company's physician and at the expense of the company. Test parameters included in Baker's medical surveillance program is included as Attachment A in each site-specific Health and Safety Plan.

[illegible]

[illegible]

E.3.0 - CARE AND CLEANING OF PERSONAL PROTECTIVE EQUIPMENT

3.1 INTRODUCTION

The following procedures cover the care and cleaning of level D and C personal protective equipment. Note: These are general procedures that apply to most situations and are not all inclusive. Procedures are subject to change at the direction of the on-site HSO.

3.2 EQUIPMENT CARE

3.2.1 Chemical Resistant Suit (Level C)

- Before donning, inspect suit for holes or tears; check to see that zippers are operable; and look for signs of suit degradation.
- When wearing, avoid contact with contaminated material where possible; be aware of sharp objects that can tear suit; periodically look over suit to check for major rips or tears.
- While decontaminating, remove gross excess of material from suit; remove suit so that material does not contact inner suit; place clothing in properly labeled disposal containers.

3.2.2 Gloves (inner/outer)

- Look for rips, tears, or degradation of material. Replace as necessary or at the direction of the on-site HSO.

3.2.3 Chemically Resistant Boots

Non-disposable boots are to be examined on a daily basis before and after use. Disposable boots should be examined prior to donning and while in use. Dispose of according to site procedures.

3.2.4 Hard Hats

Should be visually inspected before donning for fit, cracks, and overall condition.

3.2.5 Respirators

Procedures for care of respiratory protective equipment are covered in Attachment E - Baker SOPs.

3.3 EQUIPMENT CLEANING

General procedures for cleaning of equipment are listed below. Site-specific concerns will be addressed by the on-site HSO prior to start-up. Cleaning of Respiratory Equipment is covered under Attachment E - Baker SOPs.

3.3.1 Gross Physical Removal

Large amounts of contaminated soil is scraped off with a tongue depressor, or wiped off using a disposable wipe.

3.3.2 Physical/Chemical Removal

The residual contamination will be scrubbed with a soft-bristled, long-handled brush using detergent solution.

3.3.3 Rinsing/Dilution

The detergent solution and residual contaminants will be rinsed with tap water using a pressurized sprayer.

APPENDIX H
SOIL GAS SURVEY REPORT



PREPARED FOR:

**Baker Environmental, Inc.
Airport Office Park, Building 3
420 Rouser Road
Coraopolis, Pennsylvania 15108
(800) 553-1153**

Tracer Tight™ LEAK TEST

**5,200 FEET OF JP5 PIPELINE
CAMPBELL STREET FUEL FARM
NEW RIVER MARINE CORPS AIR STATION
CAMP LEJEUNE
JACKSONVILLE, NORTH CAROLINA**

DECEMBER 1991

SUBMITTED BY:

[Signature]

[Signature]

TRACER RESEARCH CORPORATION

**LEJUN715.REP
2-91-715-T**



INTRODUCTION 1

CONCEPT OF OPERATION AND IMPLEMENTATION 1

FUEL SYSTEM INOCULATION 2

PROBE INSTALLATION 2

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INTRODUCTION

Tracer Research Corporation (*TRACER*) performed Tracer Tight™ leak testing on 5,200 feet of pipeline associated with the Campbell Street Fuel Farm, located at the New River Marine Corps Air Station at Camp LeJeune in Jacksonville, North Carolina. Tracer (1301) was added to the fuel system on November 19, 1991, probes were installed December 9 and 10, 1991, and testing was conducted from December 16 through December 18, 1991.

CONCEPT OF OPERATION AND IMPLEMENTATION

The Tracer Tight™ leak detection method relies upon the addition of a highly volatile liquid chemical tracer to the fuel in the tank. If a leak occurs in the underground fuel system, fuel is released into the surrounding soil. The tracer escapes from the fuel by vaporization and disperses into the soil by molecular diffusion. Samples of the soil vapors in the immediate vicinity of the underground pipes are collected and analyzed for the tracer. For this method to be effective, the tracer is placed in the tank at least two weeks prior to the probe sampling. This process of leak detection by placing a liquid tracer in a liquid product, followed by detection of the tracer underground in the vapor phase, is protected under *TRACER* patents.

In this case, samples were collected from permanent probes which were installed in the vicinity of the pipeline. Each probe had an effective detection radius of approximately 15 feet. This means that a given probe could detect a leak anywhere within the area described by the 15-foot radius around the probe.



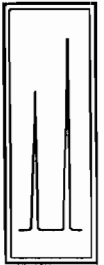
FUEL SYSTEM INOCULATION

Two underground storage tanks in the fuel system at the Campbell Street Fuel Farm were inoculated with tracer on November 19, 1991. Tank #1 (202,000 gallons) was inoculated with 16 pounds of 1301 tracer and Tank #4 (101,000 gallons) was inoculated with 8.5 pounds of 1301 tracer. The final concentration of tracer in each tank was approximately 10 ppm. Inoculated fuel from these two tanks was circulated through the pipeline.

PROBE INSTALLATION

One hundred and fifty five probes were installed on approximately 25-foot centers along the 5,200 feet of tested pipeline. The probes were installed 12 inches to the side of the pipeline and approximately three feet below grade at each sample location. Sections of the pipeline which were under the aircraft parking apron or taxiway had one probe installed at each end of the apron or taxiway. When necessary, an additional probe was installed midway along the pipeline under the apron or taxiway.

Probes were installed using two different methods, depending on the type of cover at each sample location. If the area was covered by concrete or pavement, a hole, 1.5" in diameter, was drilled through the concrete or pavement. A steel pilot probe, 3/4" in diameter, was then driven to the desired depth and removed. A schedule 40 slotted PVC permanent probe, 3/4" in diameter, replaced the pilot probe. If the area was covered by soil, the probe was installed using the same procedure, except no hole was drilled. A concrete pad, 12" in diameter, was poured around the top of the probes installed in the areas of soil cover.



SAMPLING OF INSTALLED PIPELINE

A sample was collected from each probe by evacuating the probe with an attached vacuum pump for 30 to 90 seconds, depending on the flow established by the vacuum. After the appropriate evacuation time, a soil gas sample was extracted with a syringe. The sample was immediately analyzed for 1301 tracer and Total Volatile Hydrocarbons (TVHC) on a gas chromatograph in the *Tracer* analytical van. A sample was collected and analyzed from each of the one hundred and fifty five sample locations along the pipeline.

Criteria for classification of leakage:

The following criteria are used for the classification of leakage when tracer is detected.

Pass - Leak rate less than 0.05 gallons per hour.

Tracer

Depth below grade

less than 0.1 ug/L

At 5-6 feet

less than 1.0 ug/L
but greater than 0.1 ug/L

If concentration decreases with an
increase in depth.

FAIL - Leak rate equal to or greater than 0.05 gallons per hour.

Tracer

Depth below grade

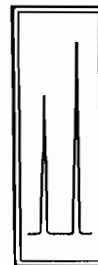
greater than or equal to 1.0 ug/L

At any depth

greater than or equal to 0.1 ug/L
but less than 1.0 ug/L

If concentration sustains or increases
with an increase in depth.*

*Sustaining concentrations are those concentrations that are within 50% of the concentration detected at the shallow depth.

Summary: JP5 Pipeline (Figures 1-3)

Tracer 1301 was detected in two of the one hundred and fifty five samples collected along the six-inch JP5 pipeline. No 1301 tracer (<0.0006 ug/L) was detected in the remaining samples. Small amounts of 1301 tracer were detected in the samples collected from locations 33 (0.03 ug/L) and 106 (0.005 ug/L). See Figures 2 and 3. Concentrations of tracer greater than 0.1 ug/L indicate leakage.

Total volatile hydrocarbon concentrations ranged from non-detect (<0.5 ug/L) to $8,300$ ug/L in the sample collected at Location 106. No TVHCs were detected in the majority of the samples collected.

Conclusion of Results:

The data collected at the Camp LeJeune site indicate that the pipeline passes. The small amounts of 1301 detected in two of the samples collected along the pipeline do not indicate leakage. Slight surface spillage of inoculated fuels from hydrants along the pipeline could be a possible source of the 1301 detected. Sections of the abandoned five-inch JP5 pipeline are in the same trench as the tested six-inch JP5 pipeline and could be a possible source for the TVHC detected.

**CERTIFICATION**

2-91-715-T

Location: Camp LeJeune
Jacksonville, North Carolina

Date: December 1991

Name	Pipeline Length	Product	Tracer	PASS/FAIL
JP5	5,200 feet	JP5	1301	Pass

Tracer Research Corporation certifies that the tank and pipe systems listed in the above table have been tested by means of Tracer Tight™, which meets the criteria set forth in NFPA 329 for a precision leak test. According to EPA standard test procedures for evaluating leak detection methods, the Tracer Tight™ method is capable of detecting leaks of 0.05 gallons per hour with a Probability of Detection (P_D) of 0.97 and Probability of False Alarm (P_{FA}) of 0.029.

Submitted by:

Pete Relva
Tracer Research Corporation

The classification of leakage is based on the concentration of tracer detected. Measurement of hydrocarbons outside of the tank is provided for the benefit of the tank owner.

Pass - Leak rate less than 0.05 gallons per hour.Criteria: TracerDepth below grade

less than 0.1 ug/L

At 5-6 feet

less than 1.0 ug/L
but greater than 0.1 ug/L

If concentration decreases with an increase in depth.

FAIL - Leak rate equal to or greater than 0.05 gallons per hour.Criteria: TracerDepth below grade

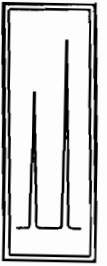
greater than or equal to 1.0 ug/L

At any depth

greater than or equal to 0.1 ug/L
but less than 1.0 ug/L

If concentration sustains or increases with an increase in depth.*

*Sustaining concentrations are those concentrations which are within 50% of the concentration detected at the shallow depth.



APPENDIX A: ANALYTICAL DATA

BAKER ENVIRONMENTAL/CAMP LEJUNE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T

12/16/91

CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
AIR	<0.0001	<0.3
1-2.5'	<0.0006	<0.5
2-2.5'	<0.0006	<0.5
3-2.5'	<0.0006	<0.5
4-2.5'	<0.0006	<0.5
5-2.5'	<0.0006	<0.5
6-2.5'	<0.0006	<0.5
7-2.5'	<0.0006	<0.5
8-2.5'	<0.0006	<0.5
9-2.5'	<0.0006	<0.5
10-2.5'	<0.0006	<0.5
11-2.5'	<0.0006	<0.5
12-2.5'	<0.0006	<0.5
13-2.5'	<0.0006	<0.5
14-2.5'	<0.0006	<0.5
15-2.5'	<0.0006	<0.5
16-2.5'	<0.0006	<0.5
17-2.5'	<0.0006	<0.5
18-2.5'	<0.0006	<0.5
19-2.5'	<0.0006	<0.5
20-2.5'	<0.0006	<0.5
21-2.5'	<0.0006	<0.5
22-2.5'	<0.0006	<0.5
23-2.5'	<0.0006	<0.5

Analyzed by: D. Bonner

Proofed by: PWR



Tracer Research Corporation

BAKER ENVIRONMENTAL/CAMP LEJUENE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T
12/16/91
CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
24-25'	<0.0006	<0.5
25-25'	<0.0006	<0.5
26-25'	<0.0006	8
27-25'	<0.0006	<0.5
28-25'	<0.0006	<0.5
29-25'	<0.0006	<0.5
30-25'	<0.0006	<0.5
31-25'	<0.0006	<0.5
32-25'	<0.0006	<0.5
33-25'	0.03	<0.5
34-25'	<0.0006	<0.5
35-25'	<0.0006	<0.5
36-25'	<0.0006	<0.5
37-25'	<0.0006	<0.5
38-25'	<0.0006	<0.5
39-25'	<0.0006	<0.5
40-25'	<0.0006	<0.5
41-25'	<0.0006	<0.5
42-25'	<0.0006	<0.5
43-25'	<0.0006	<0.5
44-25'	<0.0006	<0.5
45-25'	<0.0006	<0.5
46-25'	<0.0006	230
47-25'	<0.0006	12
48-25'	<0.0006	<0.5
49-25'	<0.0006	<0.5
50-25'	<0.0006	<0.5
51-25'	<0.0006	<0.5

Analyzed by: D. Bonner
Proofed by: PWR



BAKER ENVIRONMENTAL/CAMP LEJUNE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T
 12/16/91
 CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
52-2.5'	<0.0006	<0.5
53-2.5'	<0.0006	<0.5
54-2.5'	<0.0006	<0.5
55-2.5'	<0.0006	<0.5
56-2.5'	<0.0006	<0.5
57-2.5'	<0.0006	<0.5
58-2.5'	<0.0006	<0.5
59-2.5'	<0.0006	<0.5
60-2.5'	<0.0006	<0.5
AIR	<0.0001	NA

NA = Not Analyzed
 Analyzed by: D. Bonner
 Proofed by: PUR



Treco Research Corporation

BAKER ENVIRONMENTAL/CAMP LEJUENE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T

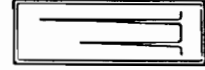
12/18/91

CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
AIR	<0.0001	<0.2
61-2.5'	<0.0006	<0.4
62-2.5'	<0.0006	<0.4
63-2.5'	<0.0006	<0.4
64-2.5'	<0.0006	<0.4
65-2.5'	<0.0006	<0.4
66-2.5'	<0.0006	<0.4
67-2.5'	<0.0006	<0.4
68-2.5'	<0.0006	<0.4
69-2.5'	<0.0006	<0.4
70-2.5'	<0.0006	<0.4
71-2.5'	<0.0006	<0.4
72-2.5'	<0.0006	<0.4
73-2.5'	<0.0006	<0.4
74-2.5'	<0.0006	<0.4
75-2.5'	<0.0006	<0.4
76-2.5'	<0.0006	<0.4
77-2.5'	<0.0006	<0.4
78-2.5'	<0.0006	<0.4
79-2.5'	<0.0006	<0.4
80-2.5'	<0.0006	<0.4
81-2.5'	<0.0006	<0.4
82-2.5'	<0.0006	<0.4
83-2.5'	<0.0006	<0.4
84-2.5'	<0.0006	<0.4
85-2.5'	<0.0006	<0.4
86-2.5'	<0.0006	<0.4
87-2.5'	<0.0006	<0.4

Analyzed by: D. Bonner

Proofed by: AWP



Tracer Research Corporation

BAKER ENVIRONMENTAL/CAMP LEJUENE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T
12/18/91
CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
88-2.5'	<0.0006	<0.4
89-2.5'	<0.0006	<0.4
90-2.5'	<0.0006	<0.4
91-2.5'	<0.0006	<0.4
92-2.5'	<0.0006	<0.4
93-2.5'	<0.0006	1
94-2.5'	<0.0006	<0.4
95-2.5'	<0.0006	13
96-2.5'	<0.0006	41
97-2.5'	<0.0006	<0.4
98-2.5'	<0.0006	<0.4
99-2.5'	<0.0006	<0.4
100-2.5'	<0.0006	<0.4
AIR	<0.0006	<0.4
101-2.5'	<0.0006	<0.4
102-2.5'	<0.0006	<0.4
103-2.5'	<0.0006	<0.4
104-2.5'	<0.0006	<0.4
105-2.5'	<0.0006	250
106-2.5'	0.005	8300
107-2.5'	<0.0006	24
108-2.5'	<0.0006	<0.4
109-2.5'	<0.0006	<0.4
110-2.5'	<0.0006	<0.4

Analyzed by: D. Bonner
Proofed by: PWR

BAKER ENVIRONMENTAL/CAMP LEJUENE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T
12/18/91
CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
111-2.5'	<0.0006	80
112-2.5'	<0.0001	9
113-2.5'	<0.0006	<0.4
114-2.5'	<0.0006	<0.4
115-2.5'	<0.0006	<0.4
116-2.5'	<0.0006	<0.4
117-2.5'	<0.0006	<0.4
118-2.5'	<0.0006	<0.4
119-2.5'	<0.0006	<0.4
120-2.5'	<0.0006	<0.4
121-2.5'	<0.0006	<0.4
122-2.5'	<0.0006	<0.4
123-2.5'	<0.0006	<0.4
124-2.5'	<0.0006	<0.4
125-2.5'	<0.0006	<0.4
126-2.5'	<0.0006	<0.4
127-2.5'	<0.0006	<0.4
128-2.5'	<0.0006	<0.4
129-2.5'	<0.0006	<0.4
130-2.5'	<0.0006	<0.4
131-2.5'	<0.0006	<0.4
132-2.5'	<0.0006	<0.4
133-2.5'	<0.0006	<0.4
134-2.5'	<0.0006	<0.4
135-2.5'	<0.0006	<0.4
136-2.5'	<0.0006	<0.4
137-2.5'	<0.0006	<0.4
138-2.5'	<0.0006	<0.4

Analyzed by: D. Bonner
Proofed by: Perp

BAKER ENVIRONMENTAL/CAMP LEJUENE/JACKSONVILLE, NORTH CAROLINA/JOB #2-91-715-T
12/18/91
CONDENSED DATA

SAMPLE	1301 ug/l	TVHC ug/l
139-2.5'	<0.0006	<0.4
140-2.5'	<0.0006	<0.4
141-2.5'	<0.0006	<0.4
142-2.5'	<0.0006	<0.4
143-2.5'	<0.0006	<0.4
144-2.5'	<0.0006	<0.4
145-2.5'	<0.0006	<0.4
146-2.5'	<0.0006	1
147-2.5'	<0.0006	<0.4
148-2.5'	<0.0006	13
149-2.5'	<0.0006	40
150-2.5'	<0.0006	<0.4
151-2.5'	<0.0006	<0.4
152-2.5'	<0.0006	<0.4
153-2.5'	<0.0006	<0.4
154-2.5'	<0.0006	<0.4
155-2.5'	<0.0006	<0.4
AIR	<0.0001	<0.2

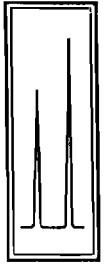
Analyzed by: D. Bonner
Proofed by: PWR



Tracer Research Corporation



APPENDIX B: FIGURES



APPENDIX C: THIRD PARTY VERIFICATION



Results of U.S. EPA Standard Evaluation Nonvolumetric Tank Tightness Testing Method

This form tells whether the tank tightness testing method described below complies with the performance requirements of the federal underground storage tank regulation. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA's "Standard Test Procedure for Evaluating Leak Detection Methods: Nonvolumetric Tank Tightness Testing Methods." The full evaluation report also includes a form describing the method and a form summarizing the test data.

Tank owners using this leak detection system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with State and local agencies to make sure this form satisfies their requirements.

Method Description

Name: Tracer Research Corporation
 Vendor: Tracer Research Corporation
3855 North Business Center Drive
(street address)
Tucson Arizona 85705 (602) 888-9400
(city) (state) (zip) (phone)

Evaluation Results

This method, which declares a tank to be leaking when a threshold amount of Tracer chemical is detected as a vapor in the soil outside the tank has an estimated probability of false alarms [P(FA)] of 2.9 % based on the test results of 1 false alarms out of 34 tests. A 95% confidence interval for P(FA) is from 0 to 8.5 %.

The corresponding probability of detection [P(D)] of a 0.005 gallon per hour leak is 97.1 % based on the test results of 33 detections out of 34 simulated leak tests. A 95% confidence interval for P(D) is from 91.5 to 100 %.

Does this method use additional modes of leak detection? ☐ Yes ☒ No
 If Yes, complete additional evaluation results on page 3 of this form.

Based on the results above, and on page 3 if applicable, this method ☒ does ☐ does not meet the federal performance standards established by the U.S. Environmental Protection Agency (0.10 gallon per hour at P(D) of 95% and P(FA) of 5%).

Test Conditions During Evaluation

The evaluation testing was conducted in a varying size gallon ☒ steel ☒ fiberglass tank that was _____ inches in diameter and _____ inches long, installed in _____ backfill.

The ground-water level was varying inches above the bottom of the tank.



Nonvolumetric TTT Method Tracer Tight (TM)
Version _____

Test Conditions During Evaluation (continued)

The tests were conducted with the tank varying percent full.

The temperature difference between product added to fill the tank and product already in the tank ranged from N/A N/A °F, with a standard deviation of N/A °F.

The product used in the evaluation was varying gasoline, diesel, jet fuel and heating oil.

This method may be affected by other sources of interference. List these interferences below and give the ranges of conditions under which the evaluation was done. (Check None if not applicable.)

☐ None

Interferences

Range of Test Conditions

Limitations on the Results

- * The performance has not been substantially changed.
- * The vendor's instructions for using the method are followed.
- * The tank contains a product identified on the method description form.
- * The tank capacity is _____ gallons or smaller.
- * The difference between added and in-tank product temperatures is no greater than + or - _____ degrees Fahrenheit.

☐ Check if applicable:

Temperature is not a factor because Tracer detection outside of tank does not depend on fuel temperature inside tank. Temperature does not affect the amount of Tracer released.

- * The waiting time between the end of filling the test tank and the start of the test data collection is at least _____ hours.
- * The waiting time between the end of "topping off" to final testing level and the start of the test data collection is at least <x hours.
- * The total data collection time for the test is at least _____ hours.
- * The product volume in the tank during testing is 0-100 % full.
- * This method ☐ can ☐ cannot be used if the ground-water level is above the bottom of the tank.

Other limitations specified by the vendor or determined during testing:

1. After Tracer chemical is added, you must wait at least 14 days to collect samples from vapor probes. 2. Alternative approaches must be used if top of tank is under water. These approaches are available through Tracer Research Corp.



Nonvolumetric TTT Method Tracer Tight (TM)
Version _____

- > **Safety Disclaimer:** This test procedure only addresses the issue of the method's ability to detect leaks. It does not test the equipment for safety hazards.

Additional Evaluation Results (if applicable)

This method, which declares a tank to be leaking when _____ has an estimated probability of false alarms [P(FA)] of _____ % based on the test results of _____ false alarms out of _____ tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(FA) is from 0 to _____ %.

The corresponding probability of detection [P(D)] of a _____ gallon per hour leak is _____ % based on the test results of _____ detections out of _____ simulated leak tests. Note: A perfect score during testing does not mean that the method is perfect. Based on the observed results, a 95% confidence interval for P(D) is from 0 to _____ %.

> Water detection mode (if applicable)

Using a false alarm rate of 5%, the *minimum water level* that the water sensor can detect with a 95% probability of detection is N/A inches.

Using a false alarm rate of 5%, the *minimum change in water level* that the water sensor can detect with a 95% probability of detection is N/A inches.

Based on the minimum water level and change in water level that the water sensor can detect with a false alarm rate of 5% and a 95% probability of detection, the *minimum time* for the system to detect an increase in water level at an incursion rate of 0.10 gallon per hour is N/A minutes in a N/A - gallon tank.

Certification of Results

I certify that the nonvolumetric tank tightness testing method was installed and operated according to the vendor's instruction. I also certify that the evaluation was performed according to the standard EPA test procedure to nonvolumetric tank tightness testing methods and that the results presented above are those obtained during the evaluation.

H. Kendall Wilcox
(printed name)

Ken Wilcox Associates
(organization performing evaluation)

H. Kendall Wilcox

(signature)

Blue Springs, Missouri 64015
(city, state, zip)

October 4, 1990
(date)

(816) 229-0860
(phone number)

Nonvolumetric TTT Method - Results Form