GW - 140

WORK PLANS

1993

TEXAS-NEW MEXICO PIPE LINE COMPANY

DOUGLAS D. BEU
ASSISTANT DISTRICT MANAGER

PO BOX 2528
HOBBS NM 88241-2528
505-393-2135

February 10, 1993

William J. Lemay
NMOCD
P. O. Box 2088
Santa Fe NM 87504

Re: Site Investigation and Remedial Action Plan
SPS11 Site - Hobbs, NM

Dear Mr. Lemay:

Enclosed is a copy of the SPS 11 - Site Investigation and Remedial Action Plan. This action plan address our treating program and water discharge plans. It is submitted as our Water Discharge Plan as required by New Mexico Water Quality Control Commission Regulations.

We are moving forward with project implementation and hope to have the system in operation the first quarter of this year. If you have any questions, please contact J. T. Janica at 505-393-2135.

Sincerely,

Douglas D. Beu

Enclosures

JTJ:JJ

xc: Chrono
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B. Olsen - NMOCD
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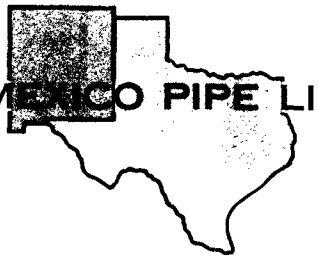

TEXAS-NEW MEXICO PIPE LINE COMPANY

SITE INVESTIGATION AND REMEDIAL ACTION PLAN

SPS11 SITE - HOBBS, NEW MEXICO

January 25, 1993

Prepared for:
Texas-New Mexico Pipe Line Company
P.O. Box 2528
Hobbs, New Mexico 88241

Work Copy

Prepared by:
Texaco Research and Development
Environmental Research Section
4545 Savannah Ave.
Port Arthur, Texas 77641

SUMMARY

The second phase of a soil and groundwater assessment in the vicinity of SPS11 was conducted by Texaco personnel during April and May, 1992. Based on the information obtained from this investigation, the following conclusions were made.

The groundwater at the site is about 55 feet below land surface and flow is to the southeast under a gradient of about 0.003 ft/ft. The aquifer is about 150 feet thick and has a transmissivity of 2000 ft^2/day. The upper part of the aquifer appears to be less permeable than the lower part. The extraction wells installed to a depth of 160 feet can sustain a pumping rate of 50 gpm with 60 feet of drawdown.

The capture zone has a stagnation point (radius of influence in the downgradient direction) of about 240 feet from an extraction well and approaches a diameter of about 1500 feet in the direction perpendicular to groundwater flow. This capture zone is felt to be adequate to contain the migration of dissolved hydrocarbons in the groundwater.

Benzene concentrations in water from monitoring and extraction wells ranged from below the detection limit to 5.27 mg/L. Organic and inorganic constituents should not cause any major maintenance problems (i.e., silting or scaling) with the water treatment equipment.

Based on the results of the field work described above, TNMPLCO personnel requested Texaco R&D-PA to develop the specifications for a groundwater treatment system. The proposed groundwater recovery and treatment system has been designed to treat a nominal combined flow of 100 gpm of groundwater pumped from the two installed recovery wells PW1 and PW2. The treatment system consists of an air stripper designed to remove any dissolved benzene as well as other organic constituents from the groundwater.

The effluent water from the air stripper sump will be pumped through a vessel containing activated carbon, insuring that no detectable concentrations of benzene are discharged into the SPS water distribution system. Automatic controls are built into the system which will shut down all of the pumps and the air stripper blower if an equipment failure occurs. The skid-mounted treatment system, excluding the submersible pumps in PW1 and PW2, will be installed adjacent to SPS Well 11. The piping and electrical conduit from the recovery wells will be buried.

The requests for bids on the proposed groundwater treatment system were sent out by Texaco R&D on September 16, 1992. The successful bidder was selected in late October, 1992. Installation and startup of the treatment system should occur by late February, 1993.

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SITE INVESTIGATION AND REMEDIAL ACTION PLAN
SPS11 SITE - HOBBS, NEW MEXICO

1.0 INTRODUCTION

This report contains the results of an April/May, 1992, site assessment and proposed remedial action plan for a crude oil spill from a pipe line belonging to Texas-New Mexico Pipe Line Company (TNMPLCO). The site is located in the NW ¼, NW ¼, SE ¼, Section 18, Township 18S and Range 36E, Lea County, New Mexico, approximately 15 miles west of Hobbs, New Mexico and 14 miles south of Lovington, New Mexico.

On April 2, 1991, water from a utility well (SPS11) belonging to Southwestern Public Service Company (SPS) was tested and found to contain 0.028 mg/L (milligrams per liter) benzene. The maximum contaminant level (MCL) for drinking water set by USEPA for benzene is 0.005 mg/L. The well was re-sampled on April 23, 1991, and the water was found to contain 0.025 mg/L benzene. The well was taken out of service in April 1991. Since a crude oil pipe line belonging to (TNMPLCO) appeared to be a potential source of contamination, TNMPLCO was advised of the problem. Surface staining by hydrocarbon was observed in the vicinity of SPS11. The staining was reportedly the result of a pipe line release prior to 1975. At that time the pipe line in the vicinity of the release was replaced.

Texaco R&D (Research and Development) developed a work plan for an initial groundwater investigation in July, 1991 which included the installation of four monitoring wells, groundwater sampling, and analysis. The four monitoring wells (MW1 through MW4) were installed in August, 1991. The wells are 70 feet deep and are screened from 50 to 70 feet (SPS11 is screened from 65 to 215 feet). No free hydrocarbon was encountered in the monitoring wells. During drilling, soils containing hydrocarbon residuals were found in MW1 and MW4. Groundwater from the monitoring wells was sampled and found to contain BTEX (benzene, toluene, ethylbenzene, and xylenes).

In January of 1992 a second work plan was prepared by Texaco R&D for the purpose of further delineating the hydrocarbon and providing information for the design of a groundwater treatment system. This work effort has involved:

- site mapping,
- making seven soil borings,
- installing four monitoring wells,
- installing two extraction wells,
- soil sampling,
- groundwater sampling,
- laboratory analysis of samples,
- aquifer testing, and
- remedial system design.

2.0 SITE INVESTIGATION METHODS AND PROCEDURES

2.1 Site mapping

The site was mapped by a land surveyor licensed in the state of New Mexico during May 1992. Coordinates for all of the wells, utilities, and major land features were determined and a base map prepared. Areas apparently impacted by the oil spill(s) were mapped using a surveyor's tape. Site features and impacted areas are shown in Figure 1. Two types of areas were delineated:

- those which appeared to have hydrocarbon impacted soil on the surface, and
- those which did not have hydrocarbon staining but were different from the surrounding areas in terms of soil color or vegetation.

2.2 Borings, Soil Sampling, and Well Installation

Borings for the monitoring wells and extraction wells were made using air rotary and mud rotary respectively during the months of April and May, 1992. Soil samples were collected from split spoons, rock cores, and drill cuttings depending on the nature of the material being penetrated. When split spoon samples could be obtained, brass liners were used to contain the sample. The samples selected for laboratory analysis were capped and taped. Rock cores and cuttings were placed in glass jars. All soil samples were labelled and placed in a cooler with ice.

Periodically, samples were collected for head space analysis. Samples were placed in plastic bags and allowed to equilibrate for ten minutes. A photoionization detector was used to measure the organic vapor concentration of the air in the container. Soil lithology was recorded as the borings were advanced. Logs of each boring are contained in Appendix A. Soil samples were collected from each boring and analyzed for BTEX and TPH (total petroleum hydrocarbon). Generally samples were collected from soil that appeared to be high in volatile hydrocarbon content, as indicated by the head space analyses, and from other horizons of interest.

Monitoring wells were installed in borings TB5, TB6, TB7, and TB9 using 4-inch schedule 40 PVC casing and screen. No monitoring well was installed in boring TB8. Monitoring wells MW6, MW7, and MW9 were installed to a depth of about 70 feet. MW5 was installed to a depth of 35 feet as a result of TB5 encountering a perched layer of water and hydrocarbon at a depth of about 30 feet.

Extraction wells, PW1 and PW2, were installed in the borings made for those wells. Both extraction wells were constructed using 8-inch schedule 80 PVC casing and screen. The extraction wells were installed to a depth of 160 feet and were constructed with 80 feet

of 0.010 inch screen. PW2 was constructed using 40 feet of 12-inch steel surface casing because of the inability to maintain circulation in that hole. Well construction details are included on the well logs (Appendix A). All wells were surveyed to determine the elevation of the top of the casing or measuring point.

2.3 Water Level Measurements

All wells were gauged with an ORS (Oil Recovery Systems) oil/water interface probe. Water and oil levels were measured to the nearest 0.01 foot and recorded. Water levels were measured on May 6, 1992 and again on July 13, 1992 (Table 1).

2.4 Groundwater Sampling

Groundwater samples were collected by TNMPLCO and Texaco R&D personnel on May 10, 1992 from wells MW1, MW2, MW3, MW4, MW6, MW7, MW9, PW1, and PW2 and submitted to an analytical laboratory for analysis for BTEX. A minimum of three well volumes were removed from the wells prior to sampling. Monitoring wells were purged by bailing; PW1 and PW2 were purged by pumping with a submersible pump. Samples were collected from the monitoring wells using a bailer; samples from PW1 and PW2 were collected from the pump discharge. Groundwater samples were placed in VOA (volatile organic analysis) bottles, labelled, and preserved by chilling and transported to Southwest Labs in Midland, Texas.

2.5 Aquifer Testing

An aquifer performance test was run on May 6 and 7, 1992 by pumping PW1 at a rate of about 50 gpm for about 24 hours. Water levels were monitored in the pumping well and in monitoring wells MW6 and MW9, which were located at distances of 200 and 50 feet, respectively, from PW1. The aquifer test configuration is shown in Figure 2 and data from this test is presented in Appendix C. The discharge rate was measured using an in-line flow meter. Two groundwater samples were collected, one near the beginning of the test and one near the end, and submitted for laboratory analysis for BTEX. A single sample was collected near the end of the test and analyzed for the following inorganic constituents:

- calcium,
- sodium,
- iron,
- carbonate,
- sulfate,
- nitrate,
- total hardness,
- pH,
- magnesium,
- potassium,
- manganese,
- bicarbonate,
- chloride,
- fluoride,
- total dissolved solids,
- total suspended solids.

Groundwater produced by the test was discharged to a small playa lake or "buffalo wallow" through a 550 foot long discharge line. Due to the possibility of the groundwater containing elevated levels of hydrocarbon, the produced water was treated by air sparging prior to discharge. Details of the temporary air sparging system are presented in Appendix F. Water samples of the influent and effluent to the sparge system were collected for laboratory analysis for BTEX (See Appendix B for results). A second, short-term (1-hour) pumping test was performed on PW2 on May 7, 1992. Drawdown and recovery in the pumping well and drawdown in the surrounding monitoring wells was monitored and recorded. The results are presented in Table 2. Data obtained from the 24-hour aquifer performance test were analyzed using the curve matching method presented by Neuman (1974) for analysis of data from an anisotropic water table aquifer with partially penetrating wells. This analysis is detailed in Appendix D.

Slug tests were performed on PW1 and PW2 by pumping the water level down and monitoring the recovery. Data from the slug tests were analyzed using slug test analysis methods developed by Hvorslev (1951), Ferris and Knowles (1954), Bouwer and Rice (1976), and Cooper, Bredehoeft, and Papadopulous (1967). Slug test data are presented in Appendix C and analyses are described in Appendix D.

Monitoring well MW5 was bailed on April 13, 1992 to remove as much fluid as practical. Water and oil recovery rates in the well were monitored. The water level in the well recovered quickly, however, as of September, 1992 the oil level has not recovered. The data are presented in Table 3. A sample of oil collected from MW5 was sent to the laboratory and subjected to analysis for distillation and sulfur content. An additional sample was taken from the crude line for comparison.

3.0 SITE INVESTIGATION RESULTS

3.1 Regional Hydrogeology

The site is underlain by the Ogallala Formation of Pliocene age. Sediments of the Ogallala Formation, which range in thickness from a few feet to about 300 feet, consist of sand, silt, and clay with occasional gravel deposits. The formation is generally clayey in the upper part and typically forms a caliche and sandstone layer near the surface (caprock). Massive sand beds and quartzite layers are common. In some locations coarse grained intraformational conglomerates are found at the base of the formation. The contact with the underlying Triassic rocks is an irregular erosional surface (Nicholson and Clebsch, 1961).

The sediments of the Ogallala Formation form the Ogallala Aquifer in the Lea County area. The aquifer is under water table conditions and the water table regionally follows the land surface

in dipping to the southeast (Nativ, 1988). Permeability of the formation is variable, but, as evidenced by well logs and available literature, is probably less permeable in the upper part of the geologic section and more permeable in the basal parts which contain gravel. Recharge is local; rainfall infiltrates directly into the sediment.

3.2 Site Hydrogeology

The stratigraphy at the site consists of about 200 feet of sand and sandstone overlying shale. The uppermost 30 feet is composed of caliche and sandstone. The aquifer at the site is about 150 feet in thickness and is under water table conditions. Groundwater is encountered at elevations ranging from about 3791 to 3801 feet above mean sea level or about 55 feet below land surface. Groundwater flow is to the southeast under a gradient of about 0.003 ft/ft (Figure 3). A perched layer, of apparently limited extent, exists in the vicinity of MW5 at a depth of about 30 feet below land surface. The water level gradient is generally to the southeast at about 0.003 ft/ft. Water levels in the shallow wells (MW1 - MW4, MW6, MW7, MW9) are slightly lower than in the deep wells (PW1, PW2). The water level in MW9 is higher than the surrounding monitoring wells suggesting that it may be affected by water leaking from the perched zone or that the sediment and rock is of slightly lower permeability in that area.

Analysis of aquifer performance test data from a 24-hour pumping test performed at the site on May 6 and 7, 1992 indicates that:

- a well completed at 160 feet below land surface can sustain a pumping rate of about 50 gpm with 60 feet of drawdown,
- the aquifer transmissivity is about 2000 ft2/day,
- the horizontal hydraulic conductivity is about 13 ft/day,
- the vertical hydraulic conductivity is about 0.7 ft/day, and
- the storage coefficient is about 0.05.

Details of the data analysis are contained in Appendix D.

Analysis of slug test data on PW1 and PW2 indicates that the hydraulic conductivity of the upper part of the aquifer is about 1 to 2 ft/day, or about an order of magnitude less than the average hydraulic conductivity obtained from the aquifer performance test (which should be representative of the entire aquifer thickness).

This would appear to suggest that the aquifer hydraulic conductivity increases with depth (due to decreasing clay content) or that the aquifer has a zone of high permeability (presumably an intraformational gravel) at the base.

A calculation was made to determine the capture zone of a well pumping at a rate of 50 gpm in a water table gradient of 0.003 ft/ft. The stagnation point (influence in the downgradient direction) was calculated to be about 240 feet and to approach a width of about 1500 feet in the direction perpendicular to groundwater flow. Details of the capture zone calculation are contained in Appendix E.

3.3 Laboratory Analyses

Analyses of soil samples indicated the following ranges of organic constituents:

- benzene 4.83 mg/kg to BDL (below the laboratory detection limit),
- toluene 0.55 to 0.03 mg/kg,
- ethylbenzene 6.70 mg/kg to BDL,
- xylenes 6.53 mg/kg to BDL, and
- TPH 34,600 to 101 mg/kg.

Generally, concentration of hydrocarbons were highest in soil samples taken from borings TB8 and TB9. Analysis results are summarized in Table 4 and the original laboratory data is included in Appendix B.

Samples of groundwater from the monitoring wells indicated the following ranges of constituents:

- benzene 5.27 mg/L to BDL,
- toluene 65 to 0.008 mg/L,
- ethylbenzene 1.38 mg/L to BDL, and
- xylenes 1.66 mg/L to BDL.

Generally, the concentrations were highest in MW1 and MW9. Results are summarized in Table 5. Results of laboratory analyses for inorganic constituents are summarized in Table 6. The water is relatively low in dissolved solids. Distillation analysis and sulfur content of the oil collected from MW5 are consistent with crude oil characteristics.

3.4 Hydrocarbon Occurrence

Surface soils, which are apparently stained by oil, have been mapped and are shown on Figure 1. Surface stains are generally light to dark brown crusty-appearing areas which consist of soil and highly weathered oil. Occasional small areas were noted which are tar-like in nature. Soils in the shallow subsurface which

appear to contain oil, based on visual observation, were confined to a few feet below land surface. Evidence of oil at greater depths was limited to odor, the results of head space analyses (Appendix A), and laboratory analyses (Section 3.3). Free oil was observed in TB5.

Results of the baildown test on MW5, observations in backhoe excavations, and experience at other locations, suggest that the free oil is confined to the shallow subsurface and occurred on the perched water table as a result of running down the borehole during drilling. As a result of observing free oil in TB5, the pipe line was excavated for an interval of about 200 feet in the vicinity of TB5. No leaks were detected and the pipe line appeared to be in good condition.

3.5 Conclusions of Site Investigation

The source of hydrocarbon residuals in the soil and hydrocarbon in the groundwater appears to be from a crude oil pipe line spill that occurred prior to 1975. The overall extent of the impacted groundwater and soil is limited and is located along the pipe line and near SPS11.

The aquifer at the site is about 150 feet thick and exists under water table conditions. The groundwater level is about 55 feet below land surface. Groundwater flow is to the southeast under a gradient of about 0.003 ft/ft. The aquifer transmissivity is 2000 ft^2/day. The upper part of the aquifer appears to be less permeable than the lower part. The extraction wells installed to a depth of 160 feet can sustain a pumping rate of 50 gpm with 60 feet of drawdown.

The capture zone, calculated for the situation in which the water level gradient is 0.003 ft/ft and the pumping rate is 50 gpm has a stagnation point (influence in the downgradient direction) of about 240 feet and approaches a width of about 1500 feet in the direction perpendicular to groundwater flow. This capture zone is felt to be adequate to contain the migration of dissolved hydrocarbon in the groundwater. Details of the capture zone calculation are contained in Appendix E.

Benzene concentrations in the water from monitoring and extraction wells ranged from BDL to 5.27 mg/L. Analyses for selected inorganic constituents of the groundwater indicate that the groundwater should not cause any major maintenance problems (i.e., silting or scaling) with the water treatment equipment.

4.0 REMEDIAL ACTION PLAN

Based on the results of the field work described above, it was decided by TNMPLCO personnel that a groundwater recovery and

treatment system would be installed 1) to restrict the movement of groundwater that contained dissolved organic constituents, and 2) to treat the recovered water to allow it to be injected into the SPS water distribution system. Texaco R&D-PA was requested to develop the specifications for the treatment system. The configuration of the treatment system is described below, and the specifications from which construction bids have been requested are shown in Appendix G.

4.1 Extraction, Treatment, and Injection System Design

The proposed groundwater recovery and treatment system has been designed to treat a nominal combined flow of 100 gpm of groundwater pumped from the two installed recovery wells PW1 and PW2. The treatment system consists of an air stripper designed to remove any dissolved benzene as well as other organic constituents from the groundwater. The sizing of the air stripper was based on the results of the groundwater pump tests and groundwater analyses. A commercially-available computer program called "AIRSTRIP" was used to determine the diameter, approximate packed height, and effluent water quality of the air stripper.

The effluent water from the air stripper sump will be pumped through a vessel containing activated carbon. The function of the activated carbon is to provide an added level of treatment, insuring that no detectable concentrations of benzene are discharged into the SPS water distribution system. Automatic controls are built into the system which will shut down all of the pumps and the air stripper blower if an equipment failure occurs. The skid-mounted treatment system, excluding the submersible pumps in PW1 and PW2, will be installed adjacent to SPS Well 11. The piping and electrical conduit from the recovery wells will be buried. The equipment is discussed in more detail in Appendix G.

4.2 Treatment System Installation, Startup, and Monitoring

The requests for bids on the proposed groundwater treatment system were sent out by Texaco R&D on September 16, 1992. The successful bidder was selected in late October, 1992. Construction of the treatment system is in progress and delivery to the site is expected about mid-February, 1993. Assuming all field construction has been completed and the necessary approvals have been obtained, the treatment system should be ready for startup by the end of February, 1993.

A Texaco R&D-PA person will be onsite during the installation and startup of the treatment system. During startup, the carbon vessel effluent will be discharged to the playa lake southwest of SPS11. Over a period of six to eight hours, influent and effluent water samples will be obtained by a certified sampler every two hours for BTEX, EPA Method 602, and TPH, EPA Method 418.1, and the system will be shut down. If the water sample results are satisfactory

(effluent BTEX and TPH should be non-detectable, as determined by a state certified laboratory), the treated water discharge piping will be hooked up to the SPS distribution system. SPS will be notified of the analytical results. The treatment system will be started up and one set of influent and effluent water samples will be collected for BTEX and TPH each day for five consecutive days.

Assuming the sample results are satisfactory and the treatment system appears to be operating smoothly, the monitoring schedule will be extended to one set of samples per week for four weeks, and then monthly thereafter. If required by a state agency or SPS, the sample results will be reported as they become available. The treatment system will be inspected by TNMPLCO personnel at least once per week during its extended operation. Texaco R&D will assist TNMPLCO by reviewing the operating records to determine when non-routine maintenance such as changing the activated carbon is necessary.

4.3 Criteria for Shutting Down the Treatment System

After approximately six months of operating the treatment system, a groundwater sampling program will be conducted to include most or all of the monitoring wells in the vicinity. Water samples will be collected from each well by a certified sampler. If no significant concentrations of BTEX and TPH are detected in any of the samples, then the treatment system will be shut down. Another confirmation round of samples will be collected approximately one month later. Again, if no detectable concentrations of BTEX and TPH are found, then the TNMPLCO will request closure status from the appropriate state agency. However, if BTEX or TPH is detected in either round of samples, then the sampling cycle will be repeated at the end of another six months of operation.

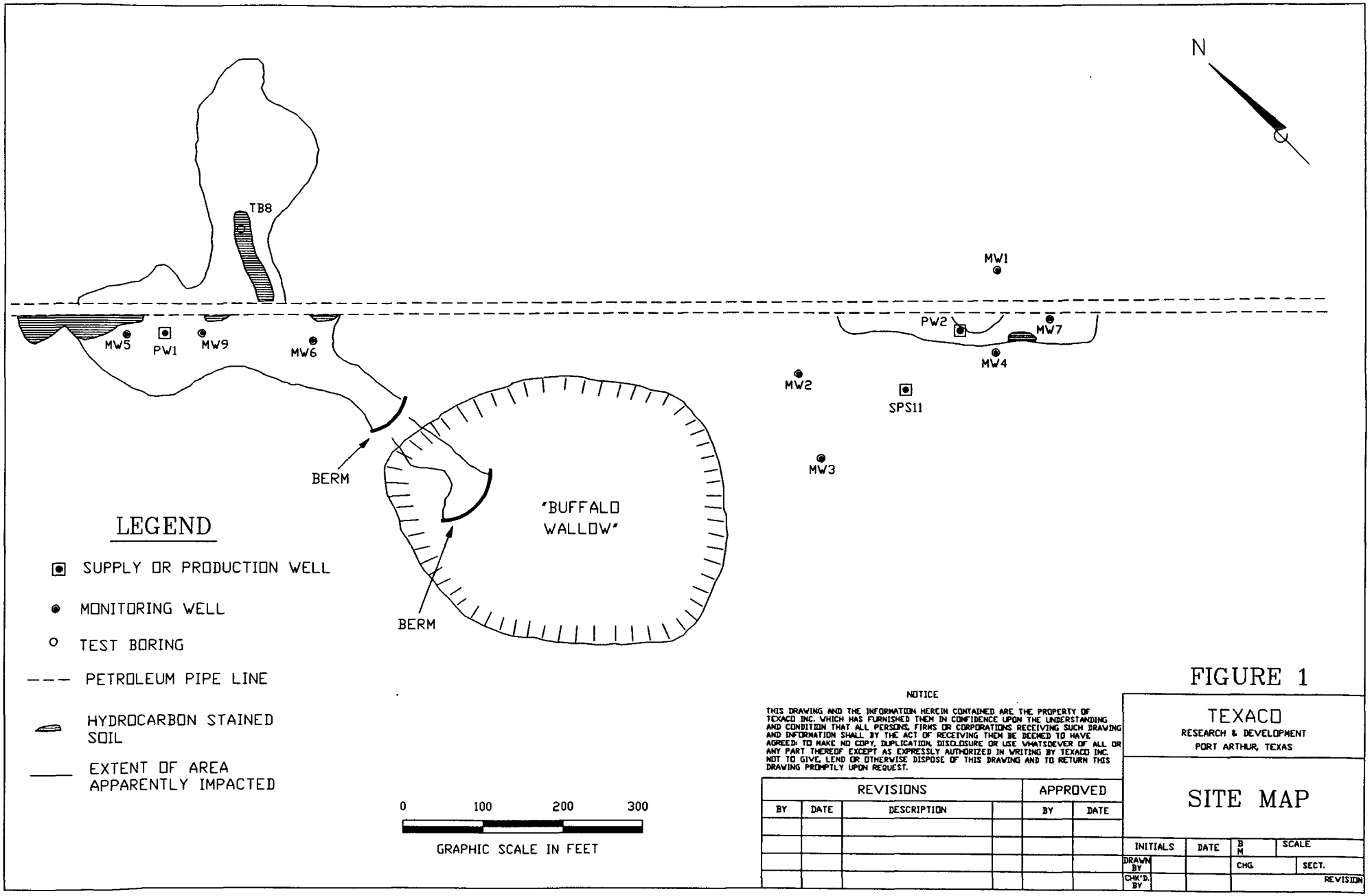


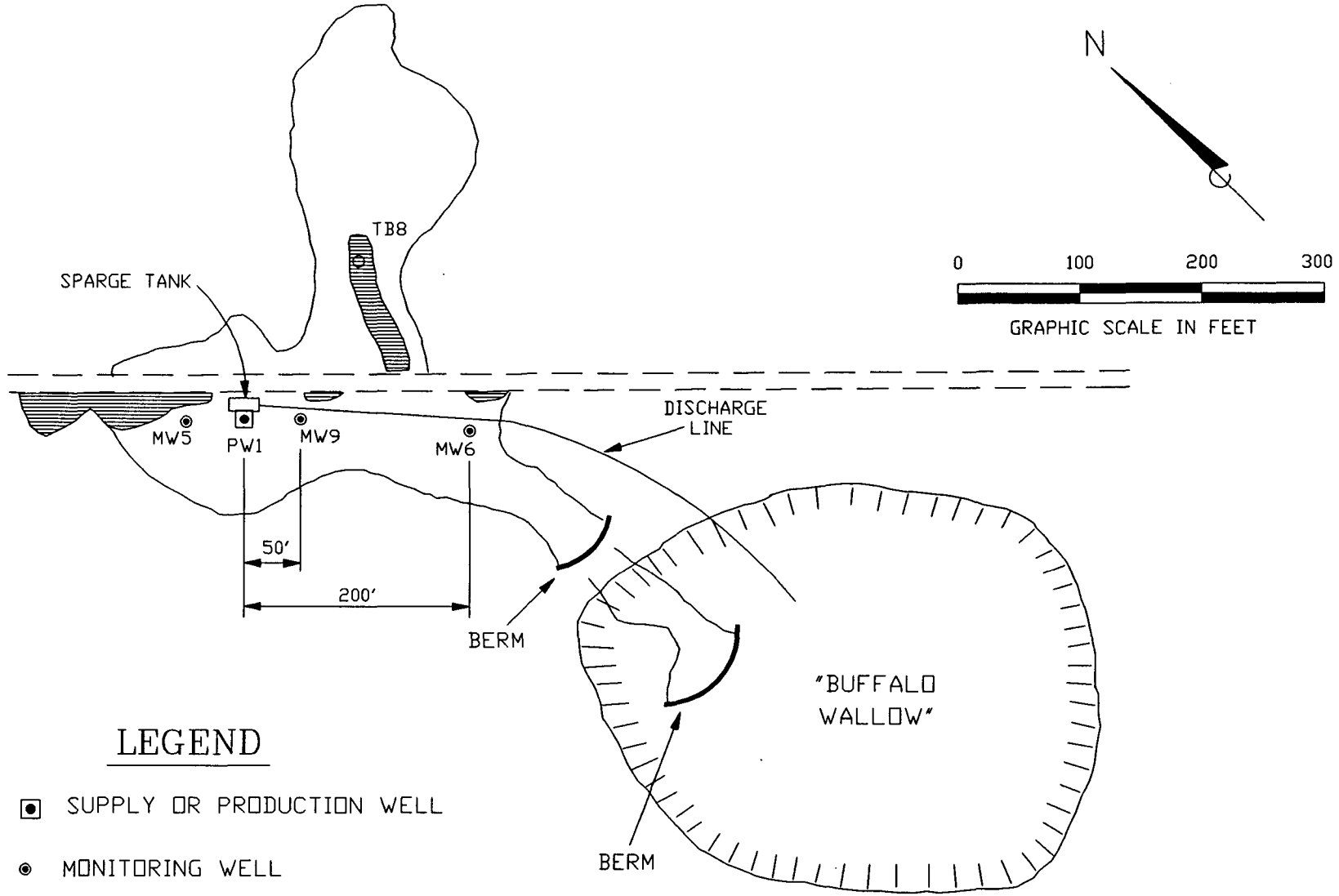
FIGURE 1

REVISIONS				APPROVED	
BY	DATE	DESCRIPTION		BY	DATE

TEXACO
RESEARCH & DEVELOPMENT
PORT ARTHUR, TEXAS

SITE MAP

INITIALS	DATE	B M	SCALE
DRAWN BY		CHG.	SECT.
CHK'D. BY		REVISION	



LEGEND

- SUPPLY OR PRODUCTION WELL
- MONITORING WELL
- TEST BORING
- PETROLEUM PIPE LINE
- HYDROCARBON STAINED SOIL
- EXTENT OF APPARENTLY IMPACTED AREA

FIGURE 2

REVISIONS				APPROVED	
BY	DATE	DESCRIPTION		BY	DATE

TEXACO
RESEARCH & DEVELOPMENT
PORT ARTHUR, TEXAS

AQUIFER PERFORMANCE TEST LOCATION AND CONFIGURATION

INITIALS	DATE	B M	SCALE
DRAWN BY		CHG.	SECT.
CHK'D. BY			REVISION

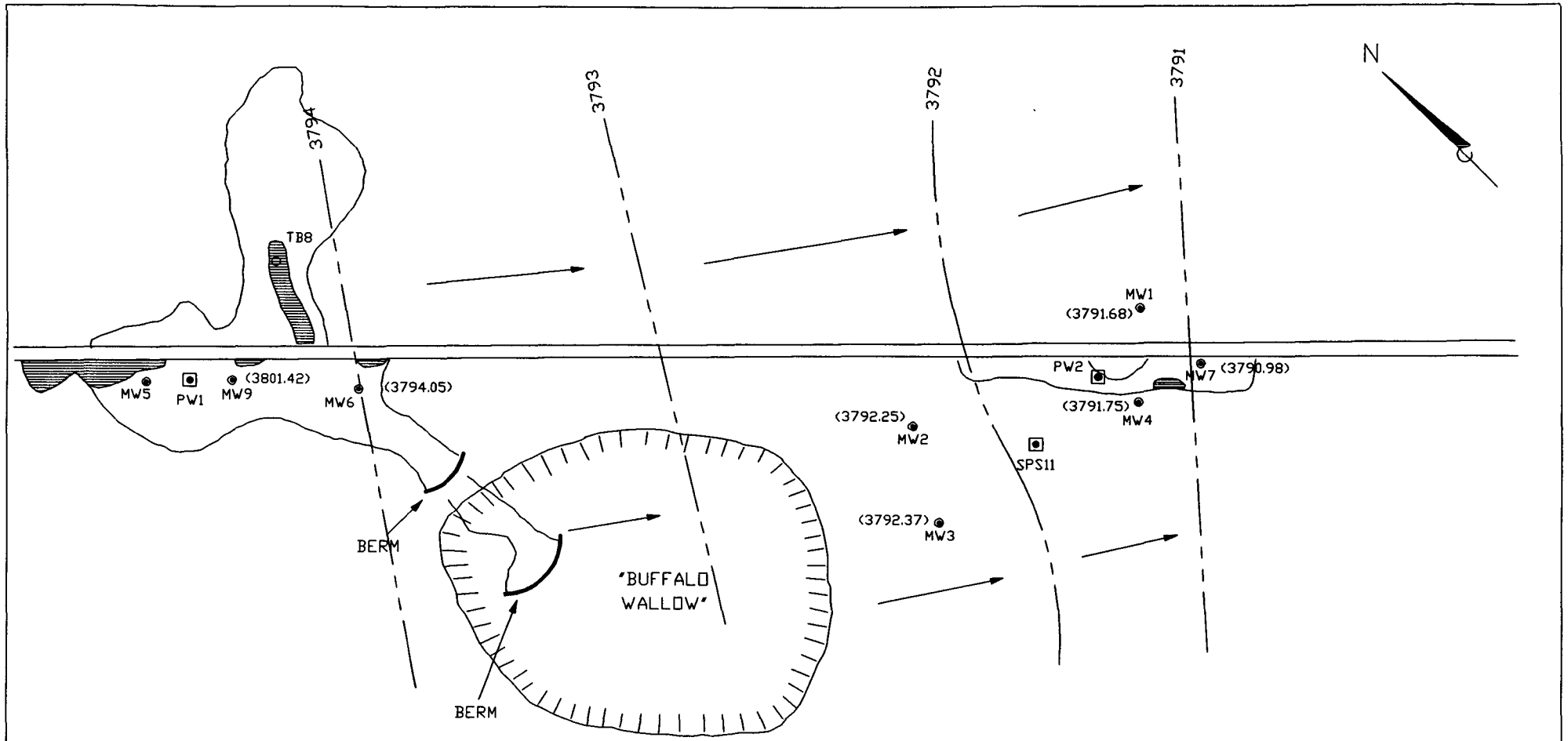


FIGURE 3

LEGEND

— 3791 — GROUNDWATER ELEVATION CONTOUR

→ DIRECTION OF GROUNDWATER FLOW

0 100 200 300

GRAPHIC SCALE IN FEET

REVISIONS				APPROVED	
BY	DATE	DESCRIPTION		BY	DATE

TEXACO
RESEARCH & DEVELOPMENT
PORT ARTHUR, TEXAS

JULY 13, 1992
WATER TABLE MAP

INITIALS	DATE	B M	SCALE
DRAWN BY		CHG.	SECT.
CHK'D. BY			REVISION

Table 1. Groundwater Levels

May 6, 1992			
WELL NUMBER	MEASURING POINT ELEVATION (ft-msl)	DEPTH TO WATER (ft)	GROUNDWATER ELEVATION (ft-msl)
MW1	3847.61	55.37	3792.24
MW2	3848.68	56.06	3792.62
MW3	3849.23	56.48	3792.75
MW4	3847.58	55.36	3792.22
MW6	3850.28	55.78	3794.50
MW7	3847.13	55.65	3791.48
MW9	3856.60	54.69	3801.91
PW1	3849.08	54.28	3794.80
PW2	3847.23	55.27	3791.96
July 13, 1992			
MW1	3847.61	55.93	3791.68
MW2	3848.68	56.43	3792.25
MW3	3849.23	56.86	3792.37
MW4	3847.58	55.83	3791.75
MW6	3850.28	56.23	3794.05
MW7	3847.13	56.15	3790.98
MW9	3856.60	55.18	3801.42
PW1	3849.08	54.46	3794.62
PW2	3847.23	55.76	3791.47

msl mean sea level

Table 2. Water Level Drawdown at PW2

May 7, 1992 - One Hour Test				
WELL NUMBER	STATIC WATER LEVEL (ft)	PUMPING WATER LEVEL (ft)	WATER LEVEL DRAWDOWN (ft)	RADIUS TO PUMPING WELL (ft)
MW1	55.37	55.57	0.20	90
MW2	56.06	56.08	0.02	210
MW3	56.48	56.51	0.03	240
MW4	55.36	55.98	0.62	60
MW7	55.65	55.86	0.21	110

Table 3. Bail Down Test Data for MW5.

DATE	TIME	DEPTH TO WATER (ft)	DEPTH TO OIL (ft)	OIL THICKNESS (ft)
4/13/92		38.35	36.87	1.48
4/13/92	14:33	39.89	39.46	0.43
	14:38	39.80	39.41	0.39
	15:02	39.59	39.21	0.38
	15:19	39.54	39.15	0.39
	15:42	39.38	39.03	0.35
	16:12	39.23	38.86	0.37
	17:05	38.96	38.58	0.38
4/14/92	10:40	38.15	37.76	0.39
4/23/92	12:30	38.56	38.15	0.41
4/29/92	18:10	36.63	36.34	0.29
7/7/92	14:00	26.48	NA	0.00

Table 4. Soil Analyses

BORING NUMBER	SAMPLE DEPTH (feet)	CONCENTRATION (mg/kg)				
		B	T	E	X	TPH
TB5	10-15	BDL	0.25	0.09	0.51	13,100
TB5	48-50	4.83	0.50	0.16	0.28	214
TB6	48-50	BDL	0.03	BDL	BDL	101
TB7	42-45	BDL	0.05	0.02	0.16	980
TB7	51-53	BDL	0.03	BDL	BDL	123
TB8	10-15	2.27	0.16	6.70	6.53	11,800
TB8	30-35	BDL	0.02	BDL	BDL	116
TB9	44-50	BDL	0.55	2.41	3.86	34,600
TB9	63-65	BDL	0.02	BDL	BDL	101

B benzene
T toluene
E ethylbenzene
X xylenes
TPH total petroleum hydrocarbons
BDL below detection limit

Table 5. Groundwater Analyses: Organic Constituents

WELL NUMBER	CONCENTRATION (mg/L)			
	B	T	E	X
MW1	4.92	2.06	1.20	1.13
MW2	0.005	0.014	BDL	BDL
MW3	BDL	0.010	BDL	BDL
MW4	BDL	0.008	BDL	BDL
MW6	0.13	0.011	BDL	BDL
MW7	1.59	0.59	0.47	0.31
MW9	5.27	4.65	1.38	1.66

B benzene
T toluene
E ethylbenzene
X xylenes
BDL below detection limit

Table 6. Groundwater Analyses: Inorganic Constituents

PARAMETERS	CONCENTRATIONS (mg/L)	
	PW1	PW2
Calcium	59	62
Magnesium	17	17
Sodium	30	37
Potassium	3	3
Iron	BDL	BDL
Manganese	BDL	BDL
Carbonate	0	0
Bicarbonate	206	214
Sulfate	33	26
Chloride	43	71
Total Hardness	204	228
Total Dissolved Solids	290	324
Total Suspended Solids	2	
pH	7.18	7.33

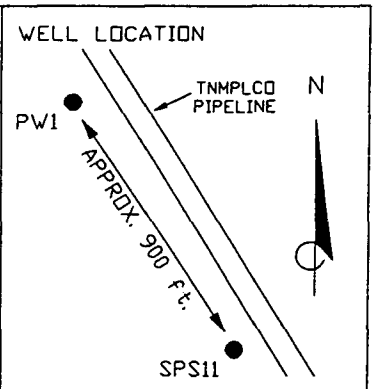
APPENDIX A

BORING LOGS AND WELL CONSTRUCTION DIAGRAMS

TEXACO

LOCATION	WELL No.	PAGE 1 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING



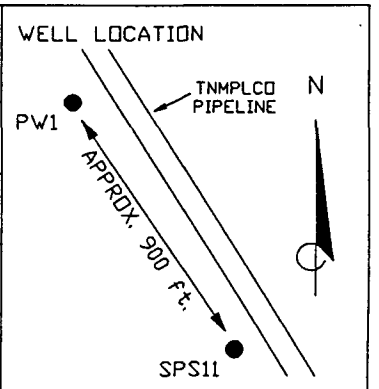
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
BACKFILL; THREADED COUPLING			0-1 DARK HYDROCARBON STAINED	-	-	0-		-	-	GR
			TOPSOIL, FINE SAND.			5				
	1		1-5 CALICHE AND SANDSTONE,							
	2		PINKISH WHITE (7.5 YR 8/2), DRY,							
			STRONG HYDROCARBON ODOR.							
	3									
	4									
	5									
			5-10 SAME AS ABOVE	-	-	5-		-	-	GR
						10				
	6									
	7									
	8									
	9									
	10									
			10-15 SAND AND SANDSTONE, PINK	-	-	10-		-	-	GR
	11		(5 YR 7/4), SANDSTONE HARD, WELL			15				
			CEMENTED; SAND, FINE TO V. FINE,							
			MOISTURE CONTENT LOW.							
	12									
	13									
	14									
	15									
			15-20 SAME AS ABOVE	-	-	15-		-	-	GR
						20				
	16									
	17									
	18									
	19									

12-INCH BOREHOLE; 8-INCH SCHEDULE 80 PVC CASING; CEMENT GROUT

TEXACO

LOCATION	WELL No.	PAGE 2 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING



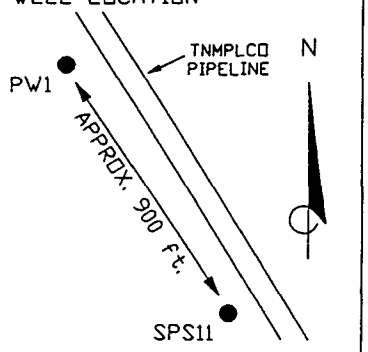
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-25 SANDSTONE, PINK (5 YR 7/4)	-	-	20-		-	-	GR
			VERY HARD, FINE GRAINED, DRY.			25				
	25		25-30 SAND AND SANDSTONE, PINK	-	-	25-		-	-	GR
			(5 YR 7/4); SANDSTONE SOFT;			30				
			SAND FINE TO V. FINE, MOISTURE							
			CONTENT LOW TO MODERATE.							
	30		30-35 SAME AS ABOVE	-	-	30-		-	-	GR
						35				
	35		35-40 SAME AS ABOVE	-	-	35-		-	-	GR
						40				
	40									

TEXACO

LOCATION	WELL No.	PAGE
TNMPLCO HOBBS, NM - SPS11	PW1	3 of 8

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION

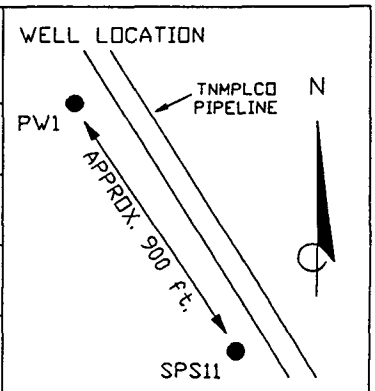


WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	40		40-45 SAME AS ABOVE	-	-	40- 45		-	-	GR
	45		45-50 SAME AS ABOVE	-	-	45- 50		-	-	GR
	50		50-55 SAME AS ABOVE, MOISTURE CONTENT INCREASING	-	-	50- 55		-	-	GR
BENTONITE SEAL FILTER PACK	55		55-60 SAME AS ABOVE, MODERATE MOISTURE CONTENT.	-	-	55- 60		-	-	GR
	60									

TEXACO

LOCATION	WELL No.	PAGE 4 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

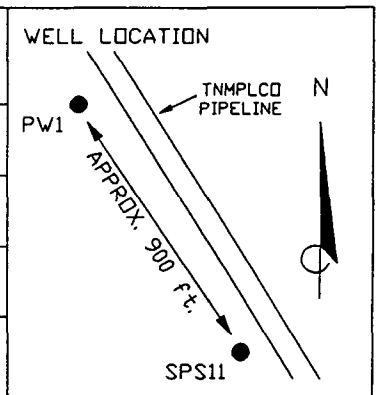


WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
FILTER PACK; 8-INCH SCHEDULE 80 PVC SCREEN - 10 SLOT	60		60-65 SAME AS ABOVE; VERY HARD SANDSTONE LAYER AT 63 TO 64 FT.	-	-	60-65		-	-	GR
	65		65-70 SAME AS ABOVE, SATURATED	-	-	65-70		-	-	GR
	70		70-75 SAME AS ABOVE	-	-	70-75		-	-	GR
	75		75-80 SAME AS ABOVE	-	-	75-80		-	-	GR
	80									

TEXACO

LOCATION	WELL No.	PAGE 5 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING



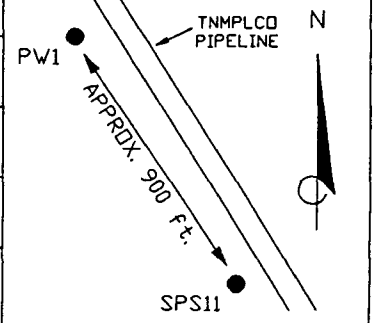
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	80		80-85 SAME AS ABOVE	-	-	80-85		-	-	GR
	85		85-90 SAME AS ABOVE	-	-	85-90		-	-	GR
	90		90-95 SAME AS ABOVE	-	-	90-95		-	-	GR
	95		95-100 SAME AS ABOVE	-	-	95-100		-	-	GR
	100									

TEXACO

LOCATION	WELL No.	PAGE 6 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



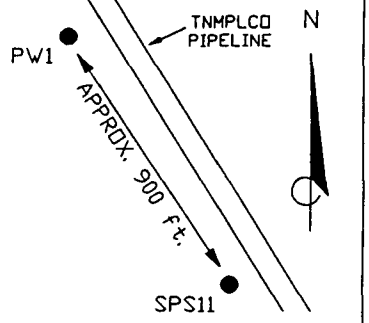
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	100		100-120 SAME AS ABOVE	-	-	100- 105		-	-	GR
	105			-	-	105- 110		-	-	GR
	110			-	-	110- 115		-	-	GR
	115			-	-	115- 120		-	-	GR
	120									

TEXACO

LOCATION	WELL No.	PAGE of
TNMPLCO HOBBS, NM - SPS11	PW1	7 8

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION

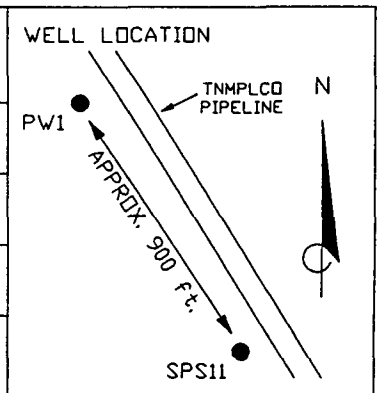


WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	120		120-140 SAME AS ABOVE	-	-	120-125		-	-	GR
	125			-	-	125-130		-	-	GR
	130			-	-	130-135		-	-	GR
	135			-	-	135-140		-	-	GR
	140									

TEXACO

LOCATION	WELL No.	PAGE 8 of 8
TNMPLCO HOBBS, NM - SPS11	PW1	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-28-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

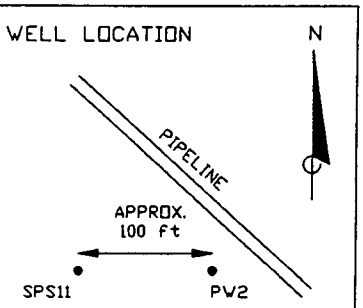


WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	140		140-160 SAME AS ABOVE	-	-	140-145		-	-	GR
	145			-	-	145-150		-	-	GR
	150			-	-	150-155		-	-	GR
	155			-	-	155-160		-	-	GR
	160		TD = 160 ft							

TEXACO

LOCATION: HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11		WELL No.: PW-2	PAGE 1 of 8
DRILLING METHOD: AIR/MUD ROTARY		SAMPLING METHOD: CUTTINGS	
DRILLING START: 4-30-92 FINISH: 5-5-92		DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING	
STATIC DTW	TIME	LOGGED BY: J. HOLLY	
WELL FINISH: PVC CASING		MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING	

WELL LOCATION



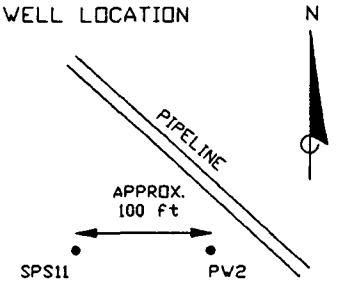
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
BACKFILL; THREADED COUPLING; 12-INCH BOREHOLE; 8-INCH SCHEDULE 80 PVC CASING; CEMENT GROUT	0		0-5 CALICHE AND SANDSTONE, HARD, DRY							GR
	5		5-10 CALICHE, MODERATELY HARD, DRY							GR
	10		10-15 SAME AS ABOVE							GR
	15		15-20 SANDSTONE, HARD, DRY							GR
	20									

TEXACO

LOCATION	WELL No.	PAGE 2 of 8
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



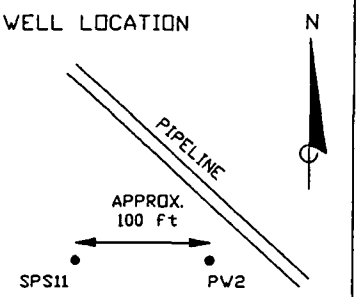
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-25 SAME AS ABOVE							GR
	25		25-30 SAME AS ABOVE, SOFTER AT 29 ft							GR
	30		30-35 SAND AND SANDSTONE, SOFT, FAINT HYDROCARBON ODOR, DAMP							GR
	35		35-40 SAME AS ABOVE							GR
	40									

TEXACO

LOCATION	WELL No.	PAGE 3 of 8
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION

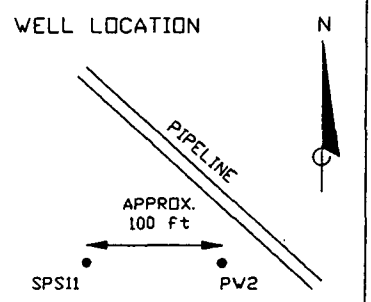


WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	40		40-45 SAME AS ABOVE							GR
	45		45-50 SAME AS ABOVE							GR
	50		50-55 SAME AS ABOVE, STRONGER HYDROCARBON ODOR							GR
BENTONITE SEAL	55		55-60 SAME AS ABOVE, MODERATE MOISTURE CONTENT							GR
FILTER PACK	60									

TEXACO

LOCATION: HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11		WELL No. PW-2	PAGE 4 of 8
DRILLING METHOD: AIR/MUD ROTARY		SAMPLING METHOD: CUTTINGS	
DRILLING START: 4-30-92 FINISH: 5-5-92		DRILLED BY: LANE SCARBOROUGH, SCARBOROUGH DRILLING	
STATIC DTW	TIME	LOGGED BY: J. HOLLY	
WELL FINISH: PVC CASING		MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING	

WELL LOCATION



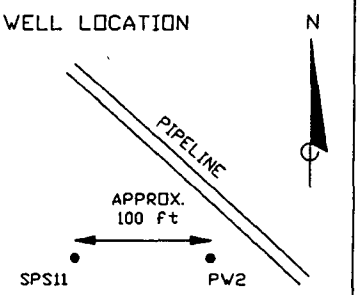
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
FILTER PACK; 8-INCH SCHEDULE 80 PVC SCREEN - .10 SLOT	60		60-65 SAME AS ABOVE, WET							GR
			NO HYDROCARBON ODOR							
	65		65-70 SAME AS ABOVE							GR
	70		70-75 SAME AS ABOVE							GR
	75		75-80 SAME AS ABOVE							GR
	80									

TEXACO

LOCATION	WELL No.	PAGE 5 of 8
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH, SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



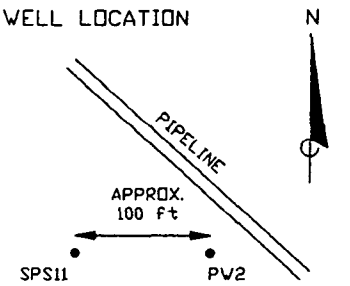
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	80		80-100 SAME AS ABOVE							
	85									
	90									
	95									
	100									

TEXACO

LOCATION	WELL No.	PAGE 6 of 8
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



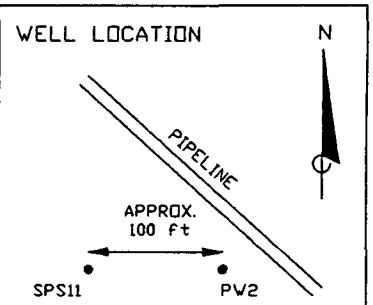
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	100		100-120 SAME AS ABOVE							
	105									
	110									
	115									
	120									

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	7 of 8

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH, SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



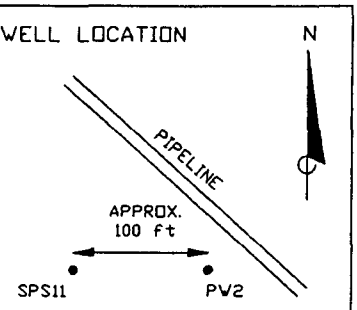
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	120		120-140 SAME AS ABOVE							
	125									
	130									
	135									
	140									

TEXACO

LOCATION	WELL No.	PAGE 8 of 8
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	PW-2	

DRILLING METHOD: AIR/MUD ROTARY	SAMPLING METHOD: CUTTINGS
DRILLING START: 4-30-92 FINISH: 5-5-92	DRILLED BY: LANE SCARBOROUGH SCARBOROUGH DRILLING
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: TOP OF 8-INCH PVC CASING

WELL LOCATION



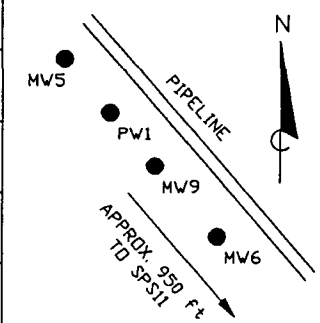
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	140		140-160 SAME AS ABOVE							
	145									
	150									
	155									
			TD = 160 ft							
	160									

No well loss for MW-1-4

TEXACO

LOCATION: HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11		WELL No.: MW-5	PAGE 1 of 3
DRILLING METHOD: AIR ROTARY		SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL	
DRILLING START: 4-6-92 FINISH: 4-6-92		DRILLED BY: SCARBOROUGH	
STATIC DTW:	TIME:	LOGGED BY: J. HOLLY	
WELL FINISH: PVC CASING		MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE	

WELL LOCATION



WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	0		0-5 CLAYEY SILT, SANDY IN PARTS, STRONG BROWN (7.5 4R 5/6) BECOMING DARKER WITH DEPTH (HYDROCARBON STAINED)							
	5		5-10 CALICHE, V. PALE BROWN (104R 7/4) WITH SOME OF THE ABOVE SOIL	150	1	0.5		-	-	GR
CUTTINGS	10		10-15 CALICHE (AS ABOVE)	120	2	5-10		-	-	GR
	15		15-21 CALICHE - AS ABOVE	180	3	10-15		-	-	GR
CEMENT GROUT	20			130	4	15-20		-	-	GR

No seal

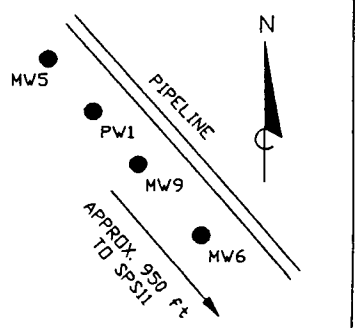
Texaco R&D Department Port Arthur

TEXACO

LOCATION	WELL No.	PAGE 2 of 3
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-5	

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-6-92 FINISH: 4-6-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
BENTONITE SEAL	20		21-25 SANDSTONE, LIGHT BROWN (7.5 4R 6/4)							
			HARD, WELL CEMENTED							
4-INCH PVC CASING				90	5	20-25		-	-	GR
	25		25-28 SAME AS ABOVE							
4-INCH PVC SCREEN			28-30 SAND, PINKISH GRAY (7.5 4R 7/2)							
				150	6	25-30		-	-	GR
FILTER PACK	30		30-30.4 SANDSTONE AND SAND - SATURATED	150	7			-	0.2	SS
			30.4 - 33 SANDSTONE LIGHT BROWN							
8-INCH BOREHOLE			(7.5 4R 6/4) WET							
				200	8				2	C
			33-36 SANDSTONE AND SAND -							
			AS ABOVE LAYERS; DAMP							
BENTONITE PLUG	35									
				210	9				1.5	C
4-INCH BOREHOLE			36-39 SAME AS ABOVE							
CUTTINGS										
				210	10				1.5	C
			39-42 SAME AS ABOVE, MORE							
	40		SAND, STRONG HYDROCARBON ODOR							

Texaco R&D Department Port Arthur

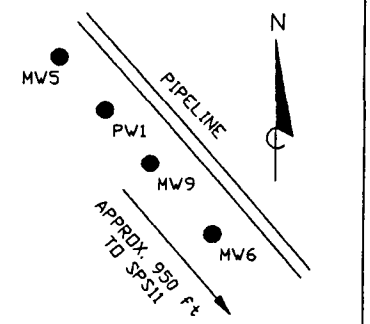
25 feet of cuttings, no grout
created potential conduit

TEXACO

LOCATION	WELL No.	PAGE 3 of 3
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-5	

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-6-92 FINISH: 4-6-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: PVC CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



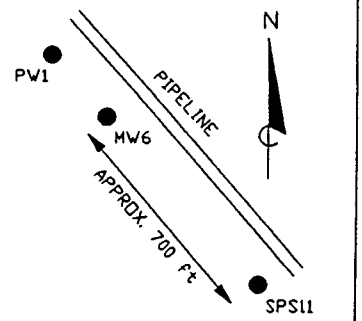
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
BACKFILLED WITH CUTTINGS	40									
				260	11				2	C
			42-45 SAME AS ABOVE, SLIGHTLY LESS SAND. WATER AND OIL RUNNING IN HOLE AT ~ 30' ON CORE BARREL AND DRIL STEM							
				260	12				2	C
	45		45-48 SAND SAME AS ABOVE HARD SANDSTONE & GRAVEL LENS AT 47.8 - 48 PINKISH COLOR, WELL INDURATED							
				180	13				3	C
			48-50 CLAYEY SAND, LIGHT BROWN (7.5 4R 6/4), V. FINE SAND, SLIGHTLY PLASTIC SLIGHTLY COHESIVE; MODERATE MOISTURE CONTENT. - OIL ON SAMPLER (FROM 30ft)	210	14				2	SS
	50									
4-INCH BOREHOLE			53-55 SAME AS ABOVE; SATURATED							
				110	15				2	SS
	55									
			58-60 SAME AS ABOVE; SATURATED							
	60			3	16				2	SS

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-6	1 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-7-92 FINISH: 4-7-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING STEEL CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



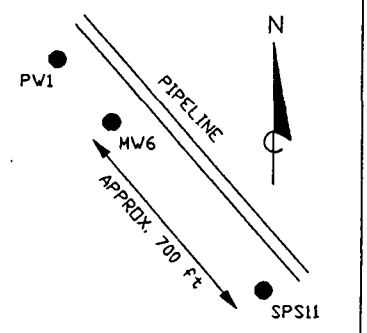
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	0		0-3 SANDSTONE/CALICHE BROWN (7.5 4R 5/2)							
			HARD DENSE							
			3-5 CALICHE, V. PALE BROWN (10 4R 7/3)							
			DAMP							
				1					-	GR
	5		5-10 CALICHE SAME AS ABOVE; DAMP							
				0.6						GR
	10		10-15 SANDSTONE PINKISH GRAY (5 4R 6/2)							
			FINE GRAINED, V. HARD & WELL INDURATED							
			SLOW DRILLING - DRY							
				0.6						GR
	15		15-20 SAME AS ABOVE							
	20			1						GR

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-6	2 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-7-92 FINISH: 4-7-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING STEEL CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



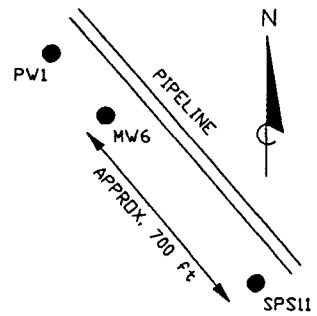
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-25 SAME AS ABOVE							
				0.6						GR
	25		25-28 SAME AS ABOVE							
			28-30 SANDSTONE, PINK (7.5 4R 7/4)							
			V. FINE, POORLY INDURATED, DAMP							
				1.2						GR
	30		30-33 SAME AS ABOVE							
				0.6					1.5	C
			33-36 SAME AS ABOVE							
	35									
				0.6					1	C
			36-39 SAME AS ABOVE							
				0.2					1.5	C
			39-42 SAME AS ABOVE, HARD AND							
	40		SOFT LAYERS							

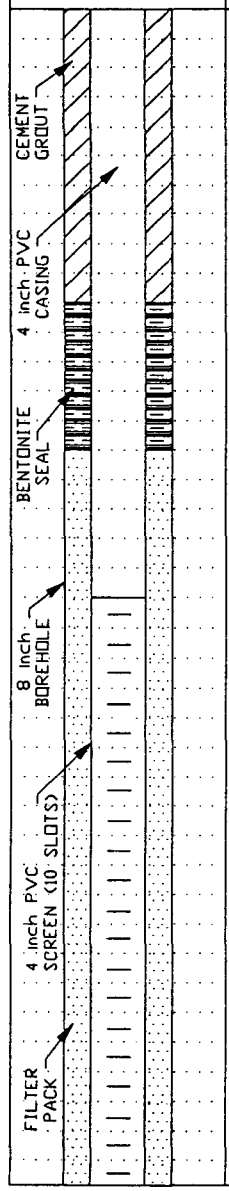
TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-6	3 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-7-92 FINISH: 4-7-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING STEEL CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION





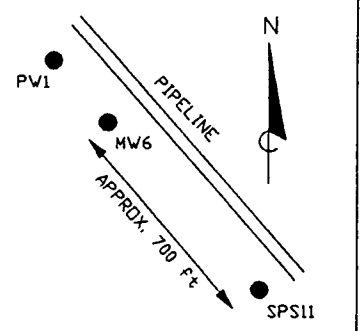
DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
40									
			0.4					0.8	C
		42-45 SAME AS ABOVE, LOST CORE							
		SAMPLE PID ON CUTTINGS							
			1					-	G
45		45-48 ATTEMPTED TO SS SAMPLE, TOO							
		HARD RECOVERY OIL ft.							
		CORE; 45-48							
		THIN LAYER OF V. HARD SANDSTONE, WELL							
		INDURATED THIN SAND. - NO RECOVERY							
			0.8					-	C/G
		48-51 SANDSTONE AS ABOVE							
		POORLY INDURATED, DAMP THIN LAYER							
		OF V. HARD SANDSTONE							
			1.6					0.5	SS
50									
			0.6					1	C
		51-54							
		SS 51-53 - SAME V. POORLY							
		INDURATED							
			0.8					0.5	SS
			0.6					1	C
		54-56							
		SAME AS ABOVE; WET							
55									
			2.5					1.5	SS
		56-59							
		SAME AS ABOVE; V. HARD							
		SANDSTONE LAYER AT ~ 57							
			0.6					2	C
		59-61 SILTY SAND, AS ABOVE, SLIGHTLY							
60		CLAYEY, LOW COHESIVENESS, SATURATED							

TEXACO

LOCATION	WELL No.	PAGE 4 of 4
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-6	

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-7-92 FINISH: 4-7-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING STEEL CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



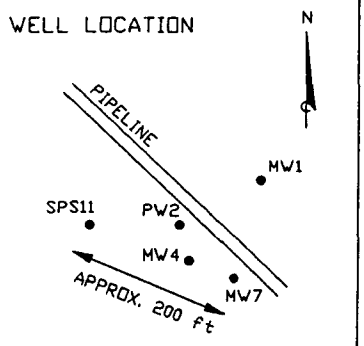
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	60		WATER LEVEL ON DRILL STEM AT ABOVE							
			55-56 ft	0.4					2.0	SS
			63-65 SAME AS ABOVE, HARDER							
				0.4					2.0	SS
	65									
			68-70 SAME AS ABOVE, SOFTER							
				0.6					2.0	SS
	70									
	75									
	80									

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-7	1 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



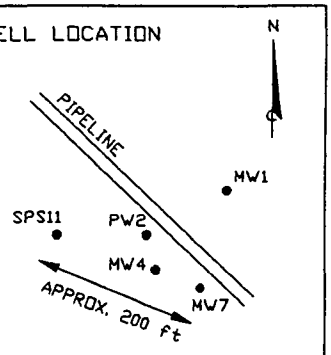
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	0		0-0.6 SOIL-OIL STAINED, DARK BROWN							
			0.6-5 CALICHE, V.PALE BROWN (10 4R 7/3)							
			DAMP, MODERATELY HARD							
				20						GR
	5		5-10 SAME AS ABOVE; CONTAINS							
			SOME FINE GRAINED, HARD SANDSTONE							
				2						GR
	10		10-15 SAME AS ABOVE; SOFTER							
				1.6						GR
	15		15-20 SAME AS ABOVE							
	20			1						GR

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-7	2 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



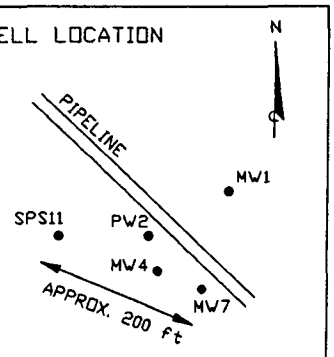
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-25 SANDSTONE & CALICHE							
			SANDSTONE, PINK (7.5 4r 7/4), HARD,							
			FINE GRAINED, WELL INDURATED, INTERLAYERED							
			WITH CALICHE							
				1.4						GR
	25		25-30 CALCICHE WITH HARD LAYERS							
			OF SANDSTONE							
				0.5						GR
	30		30-33 SANDSTONE PINK (7.5 4R 7/4)							
			V. FINE TO FINE; POORLY INDURATED;							
			DAMP							
				0.2					2.5	C
			33-36 SAME AS ABOVE							
	35									
				9					1	C
			36-39 SAME AS ABOVE; HARDER							
				30					2	C
			39-42 SAME AS ABOVE							
	40									

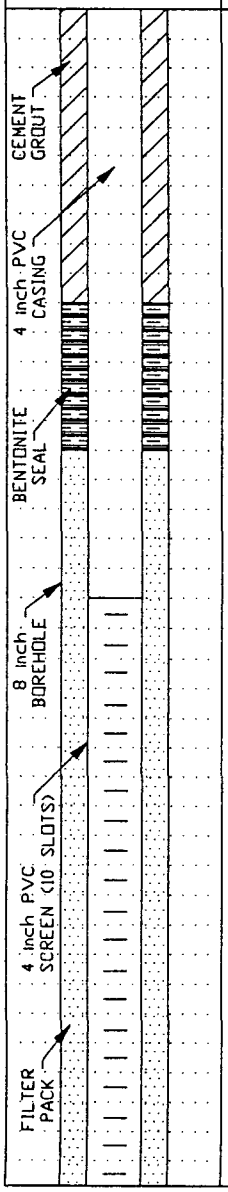
TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-7	3 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION





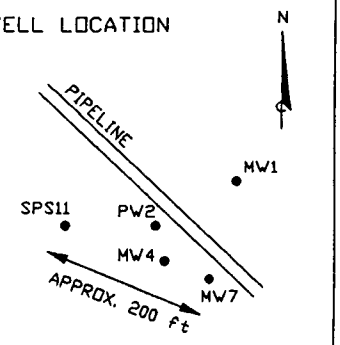
DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
40									
			100					0.5	C
		42-45 SAME AS ABOVE							
			100					1	C
45		45-48 SAME AS ABOVE							
			115					0.5	C
		48-51 SAME AS ABOVE; SOFTER							
50									
			40					0	C/GR
		51-53 SAND, PINK (7.5 4R 7/4)							
		V. FINE TO FINE, NON COHESIVE, DAMP							
			200					1.8	SS
		53-55 SAME AS ABOVE							
		SAMPLER WET							
			100					2.0	SS
55		55-57 SAME AS ABOVE; SATURATED							
			3					1.7	SS
		58-60 SAME AS ABOVE							
60			2					1.5	SS

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-7	4 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



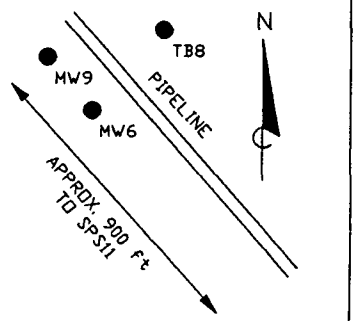
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	60									
			63-65 SAME AS ABOVE							
				0.3					2.0	SS
	65									
			68-70 SAME AS ABOVE							
				1.5					2.0	SS
	70									
	75									
	80									

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	TB-8	1 of 2

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: NONE	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



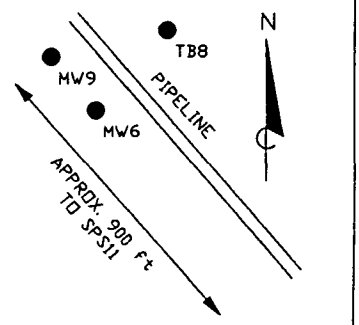
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
GROUT; 4-INCH BOREHOLE	0		0-5 CALICHE, LIGHT GRAY (2.5 4R 7/2) MODERATELY SOFT, MOIST							
	5			250						G
			5-10 CALICHE, V. PALE BROWN (10 4R 7/4) MODERATELY SOFT, MOIST							
	10			300						G
			10-15 CALICHE, PINK (7.5 4R 8/4) MODERATELY SOFT, MOIST							
	15			30						G
			15-20 SAME AS ABOVE							
	20			40						G

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	TB-8	2 of 2

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-8-92 FINISH: 4-8-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: NONE	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



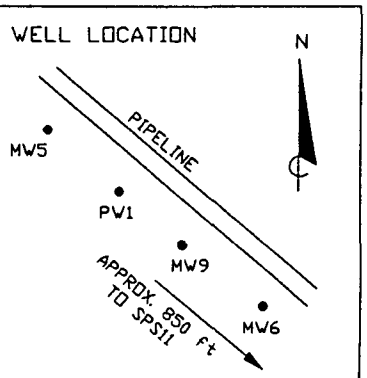
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-23 SAME AS ABOVE							
			23-25 SANDSTONE, PINK (7.5 4R 8/4)							
			FINE GRAINED, V. HARD, DRY							
				13						G
	25		25-28 SAME AS ABOVE							
			28-30 SAND, PINK (7.5 4R 8/4), V. FINE							
			TO FINE, NON COHESIVE, SLIGHTLY MOIST							
				8						G
	30		30-35 SAME AS ABOVE							
				2						G
	35									
	40									

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-9	1 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-9-92 FINISH: 4-9-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



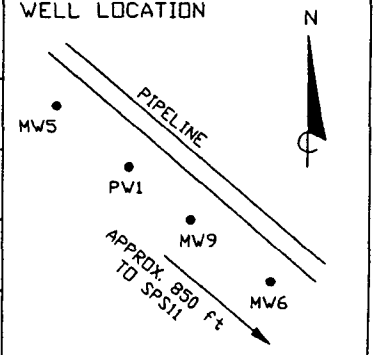
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	0		0-1 SOIL, HYDROCARBON STAINED, DARK							
			BROWN							
			1-5 CALICHE							
				9						GR
	5		5-10, CALICHE, V. PALE BROWN (10 4R 7/4)							
			MODERATELY HARD, DRY HYDROCARBON ODOR							
				80						GR
	10		10-15 CALICHE, PINK (7.5 4R 8/4)							
			10-12 SAME AS ABOVE							
			12-15 SANDSTONE PINKISH GRAY (5 4R 2/2)							
			FINE GRAINED, HARD, WELL INDURATED							
			DRY							
				10						GR
	15		15-20 SAME AS ABOVE							
	20			4						GR

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-9	2 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-9-92 FINISH: 4-9-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



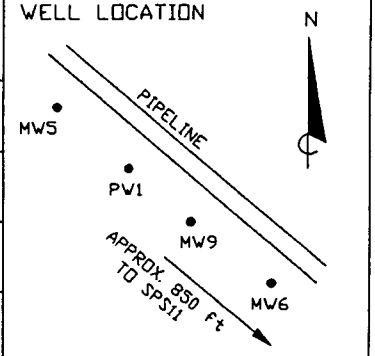
WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	20		20-25 SAME AS ABOVE							
				6						GR
	25		25-30 SAME AS ABOVE THIN SAND LAYER AT 29'							
				5						GR
	30		30-33 SANDSTONE, PINK (7.5 4R 7/4) POORLY TO MODERATELY INDURATED, EASY DRILLING - FINE TO V. FIRM GRAINED							
				1					3	C
			33-36 SAME AS ABOVE							
	35									
				1.2					1.5	C
			38-41 SAME AS ABOVE							
	40									

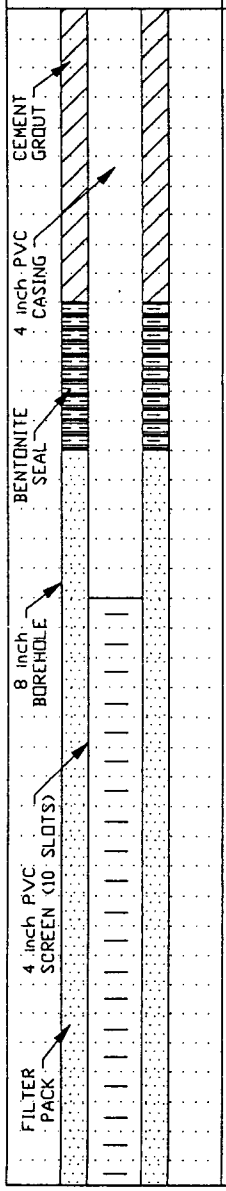
TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-9	3 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-9-92 FINISH: 4-9-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION





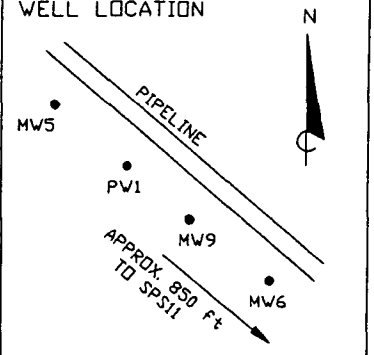
DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
40									
			40					2	C
		44-47 SAME AS ABOVE, SLIGHT HYDROCARBON ODOR							
45									
			120					1	C
		47-50 SAME AS ABOVE; HARD WELL INDURATED SANDSTONE AT 48-48.5 ft							
			150					0.2	C/GR
50									
		54-56 SAME AS ABOVE, SILTY IN PART, SATURATED							
55		WATER LEVEL ~ 54	30					2.0	SS
60									

TEXACO

LOCATION	WELL No.	PAGE
HOBBS NM; TNMPLCO PIPELINE AND SPS WELL NO. 11	MW-9	4 of 4

DRILLING METHOD: AIR ROTARY	SAMPLING METHOD: CUTTINGS (GRAB); SPLIT SPOON; CORE BARREL
DRILLING START: 4-9-92 FINISH: 4-9-92	DRILLED BY: SCARBOROUGH
STATIC DTW: TIME:	LOGGED BY: J. HOLLY
WELL FINISH: 8-INCH LOCKING PROTECTIVE CASING	MEASURING POINT DESCRIPTION: 4" PVC SCH 40 2.5ft ABOVE LAND SURFACE

WELL LOCATION



WELL CONSTRUCTION	DEPTH FEET	USCS CLASS	DESCRIPTION: NAME, COLOR, PERCENT FINES, PERCENT AND CHARACTER OF COARSE GRAINS, PLASTICITY, ODOR, REMARKS	PID (ppm)	SAMPLE No.	SAMPLE DEPTH	DEPTH	BLOWS	RECOV.	TYPE
	60									
			63-65 SAME AS ABOVE	7					2.0	SS
	65									
			68-70 SAME AS ABOVE	1.2					2.0	SS
	70									
	75									
	80									

APPENDIX B

LABORATORY ANALYSES

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Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services
1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Water	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77645-1
Delivered by	Jim Holly	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 1, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Water
Date of Analysis	4-13-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.004 mg/L

Compound	mg/L
Benzene	4.92
Toluene	2.06
Ethyl Benzene	1.20
Total Xylenes	1.13

Copies: Texas-New Mexico Pipeline Co.
Attn: Jim Holley

Reviewed by

SOUTHWESTERN LABORATORIES

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Report of tests on	Water	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77645-2
Delivered by	Jim Holly	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 2, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Water
Date of Analysis	4-13-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.004 mg/L

Compound	mg/L
Benzene	0.005
Toluene	0.014
Ethyl Benzene	* 0.004
Total Xylenes	* 0.004

* Denotes "less than"

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Report of tests on	Water	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77645-3
Delivered by	Jim Holly	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 3, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Water
Date of Analysis	4-13-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.004 mg/L

Compound	mg/L
Benzene	* 0.004
Toluene	0.010
Ethyl Benzene	* 0.004
Total Xylenes	* 0.004

* Denotes "less than"

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Report of tests on	Water	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77645-4
Delivered by	Jim Holly	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 4, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Water
Date of Analysis	4-13-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.004 mg/L

Compound	mg/L
Benzene	* 0.004
Toluene	0.008
Ethyl Benzene	* 0.004
Total Xylenes	* 0.004

* Denotes "less than"

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Report of tests on	Water	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77645-5
Delivered by	Jim Holly	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 6, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Water
Date of Analysis	4-13-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.004 mg/L

Compound	mg/L
Benzene	0.13
Toluene	0.011
Ethyl Benzene	* 0.004
Total Xylenes	* 0.004

* Denotes "less than"

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Attn: Jim Holley

LXC
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SOUTHWESTERN LABORATORIES
Wm. E. Johnston

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Report of tests on	Water	**File No.**	6839101
Client	Texas-New Mexico Pipeline Co.	**Report No.**	77645-6
Delivered by	Jim Holly	**Report Date**	4-21-92
		Date Received	4-10-92

Identification SPS 11, MW 7, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	**Matrix**	Water
Date of Analysis	4-13-92	**Method**	SW846 5030/8020A
Analyst	L. Duty	**MDL**	0.004 mg/L

Compound	mg/L
Benzene	1.59
Toluene	0.59
Ethyl Benzene	0.47
Total Xylenes	0.31

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Attn: Jim Holley

XXC
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SOUTHWESTERN LABORATORIES
Allan B. Johnston

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Report of tests on	Water	**File No.**	6839101
Client	Texas-New Mexico Pipeline Co.	**Report No.**	77645-7
Delivered by	Jim Holly	**Report Date**	4-21-92
		Date Received	4-10-92

Identification SPS 11, MW 8, Sampled 4-10-92 by J. Holly & E. Richate

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	**Matrix**	Water
Date of Analysis	4-13-92	**Method**	SW846 5030/8020A
Analyst	L. Duty	**MDL**	0.004 mg/L

Compound	mg/L
Benzene	5.27
Toluene	4.65
Ethyl Benzene	1.38
Total Xylenes	1.66

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Attn: Jim Holley

K.H.C.
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SOUTHWESTERN LABORATORIES

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1703 West Industrial • P.O. Box 2150, Midland, Texas 79702 • 915/683-3349

Analysis Request and Chain of Custody Record

Project no.	Client/Project	Sample Date
SPS 11	TNMPLCO	4-10-92

Field Sample No./ Identification	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LAB I.D. NO.
MW1			40 ml	WATER		TPH BTEX	
MW2			"	"		" "	
MW3			"	"		" "	
MW4			"	"		" "	
~~MW5~~			"	"			
MW6			"	"		" "	
MW7			"	"		" "	
MW9			"	"		" "	

Samplers: (Print)	Relinquished by: (Signature)	Date: 4-6-92 Time: 1753	Received by: (Signature)	Date: 4-10-92 Time: 5:53p	COC Seal No.
J. Holly / E. Richards					
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
Texaco R&D TNMPLCO	Relinquished by: (Signature)	Date: Time:	Received by Laboratory: (Signature)	Date: Time:	Intact:
Results by	REMARKS:		Data Results To: 505. 1. Fax 397-0486		Laboratory No.
Rush Charges Authorized Yes X No			2.		

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Report of tests on	Water	**File No.**	6839101
Client	Texas New Mexico Pipeline	**Report No.**	77909-14
Delivered by	Jim Holly	**Report Date**	5-18-92
		Date Received	5-8-92
Identification	Sampled May 6/7, 1992 by J. Holly		

REPORT OF ORGANICS ANALYSIS

Date of BTEX Analysis	5-8-92	**Method**	SW846 5030/8020A
BTEX Analyst	L. Duty	**MDL**	0.004 mg/L

Lab Number	Sample Identification	Results, mg/L Benzene	Toluene	Ethylbenzene	Xylenes
77909	PW1-1	*0.004	0.005	*0.004	*0.004
77910	PW1-2	*0.004	*0.004	*0.004	*0.004
77911	PW1-3	*0.004	*0.004	*0.004	*0.004
77912	PW1-4	*0.004	*0.004	*0.004	*0.004
77914	PW2	0.048	0.054	0.022	0.024

* Denotes "less than"

Copies:
Attn: Texas New Mexico Pipe Line
Attn: J. T. Janica

LLC
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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-2
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 5; 10 - 15, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.25
Ethyl Benzene	0.09
Total Xylenes	0.51

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	13100

*Denotes "less than"

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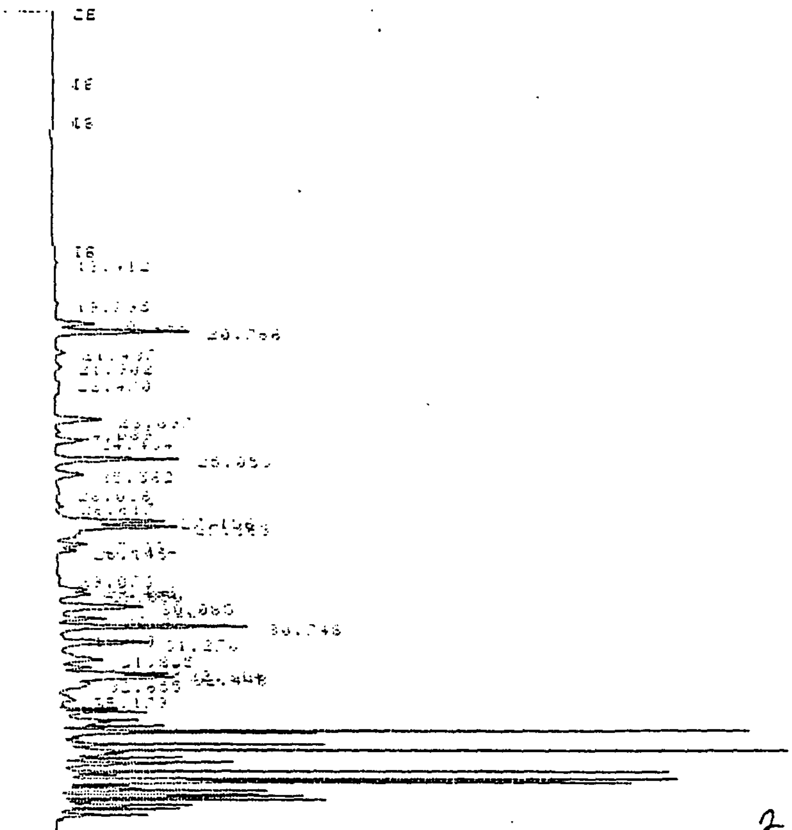
RUN # 15 APR 17 1992 00:26:09

START



TIMETABLE STOP

RUN # 15 APR 17 1992 00:26:09

77646-2
0.748

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
13.412	78535	PB	.122	.24451	Benzene
19.735	82196	PB	.146	.25493	
20.495	611367	PV	.148	1.85247	
20.766	2373786	VB	.129	8.24599	Surrogate
21.437	[illegible]	BP	.145	[illegible]	
21.702	[illegible]	PB	[illegible]	[illegible]	
22.470	74345	PB	[illegible]	.25772	
23.527	[illegible]	PP	.136	[illegible]	
24.069	123784	PV	.115	.44593	
24.414	641182	VP	.165	2.22236	
25.051	[illegible]	PV	.126	7.54051	Toluene
25.362	707400	VV	.163	2.45694	
[illegible]	[illegible]	VP	.263	[illegible]	
[illegible]	[illegible]	PP	.144	[illegible]	
27.176	[illegible]	PV	.124	8.48470	
27.363	[illegible]	VV	.125	7.5[illegible]	
27.932	467704	PV	.122	1.66924	
28.140	[illegible]	VB	[illegible]	.53101	
29.075	66126	BB	.114	.23386	
29.433	512507	PV	.165	1.81127	
29.670	[illegible]	VV	.147	[illegible]	
30.065	[illegible]	VV	.173	[illegible]	
30.477	661207	VP	.104	2.36149	E-Benzene
30.748	[illegible]	PB	.100	[illegible]	m,p-xylene
31.060	[illegible]	PV	.088	.26046	
31.270	[illegible]	VV	.131	5.62059	
31.523	[illegible]	VV	.135	3.81923	
32.045	489283	VV	.112	1.66136	
32.314	[illegible]	VV	.100	5.31742	o-xylene
32.440	[illegible]	VV	[illegible]	[illegible]	
32.655	340723	VP	.119	[illegible]	
33.173	301211	PH	.136	1.01657	

TOTAL AREA= [illegible]

MUL FACTOR= [illegible]

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-1
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 5; 48 - 50, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	4-16-92	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	4.83
Toluene	0.50
Ethyl Benzene	0.16
Total Xylenes	0.28

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	214

*Denotes "less than"

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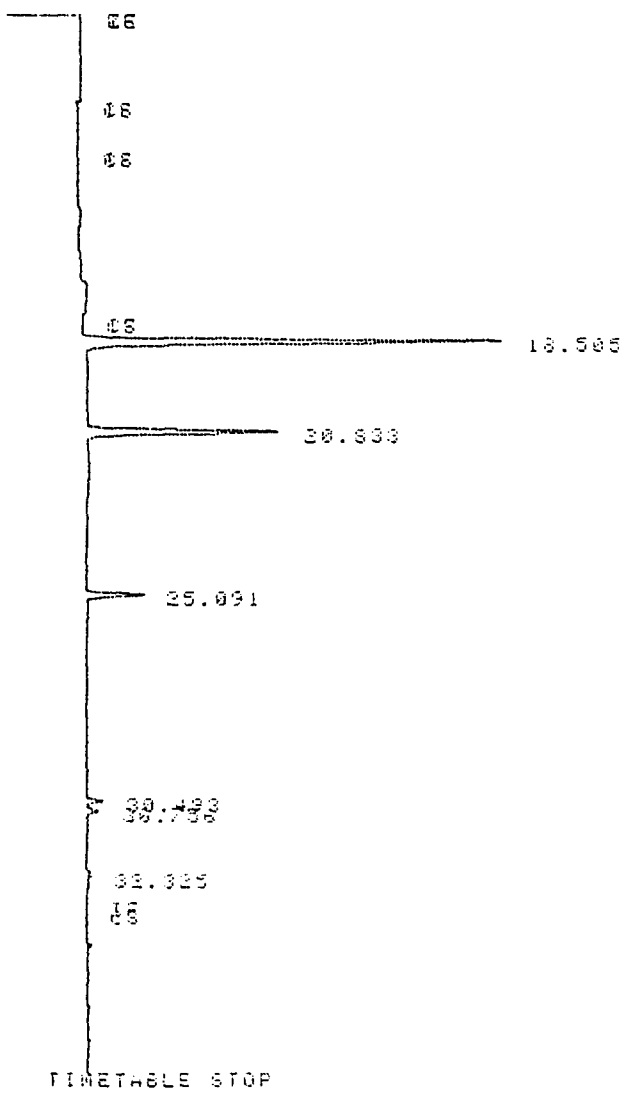
* RUN # 14 APR 16, 1992 23:31:26

START



77646-1
100µl Ext
5s: 5m/s
F = 1

RUN# 14 APR 16, 1992 23:31:26

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
18.505	5642547	BB	.127	60.16776	Benzene
30.833	2611878	BB	.133	27.85104	Surrogate
25.091	660499	PB	.106	7.04595	Toluene
30.493	162558	PF	.095	1.73339	E-Benzene
30.756	142377	FB	.105	1.51820	m,p-xylene
33.325	158148	BF	.273	1.68658	o-xylene

TOTAL AREA=9.3780E+06

MUL FACTOR=1.0000E+00

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Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services
1703 West Industrial Avenue • P.O. Box 2150 • Midland, Texas 79702

Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-3
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 6; 48 - 50,
Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.03
Ethyl Benzene	* 0.02
Total Xylenes	* 0.02

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	101

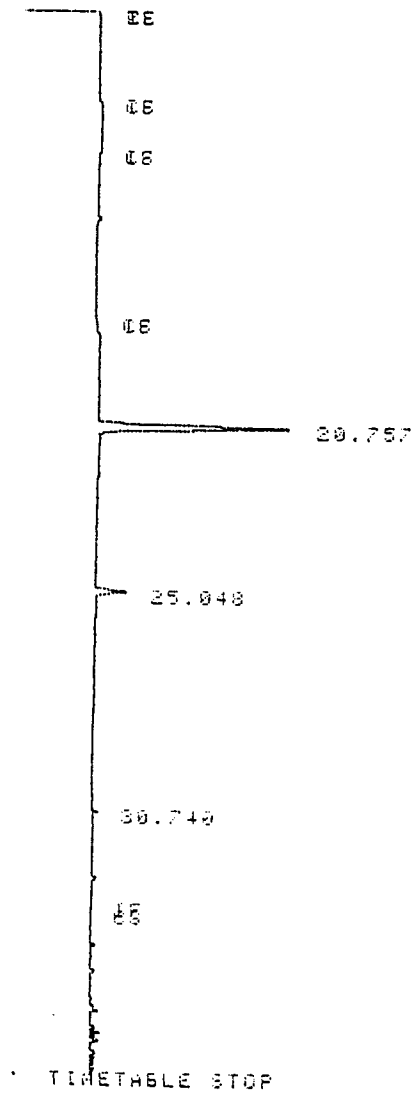
*Denotes "less than"

Copies: Texas-New Mexico Pipeline Co.

Reviewed by

SOUTHWESTERN LABORATORIES

* RUN # 16 APR 17, 1992 01:21:30
START



77646-3
0,97 g

* TIMETABLE STOP

RUN# 16 APR 17, 1992 01:21:30

AREA%

RT	AREA	TYPE	WIDTH	AREA%
20.757	2618250	PB	.127	85.60867
25.048	374099	PB	.105	12.23188
30.740	66044	PB	.102	2.15943

Surrogate
Toluene
m,p-Xylene

TOTAL AREA=3058394

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-5
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 7; 42 - 45, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-17-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.05
Ethyl Benzene	0.02
Total Xylenes	0.16

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	980

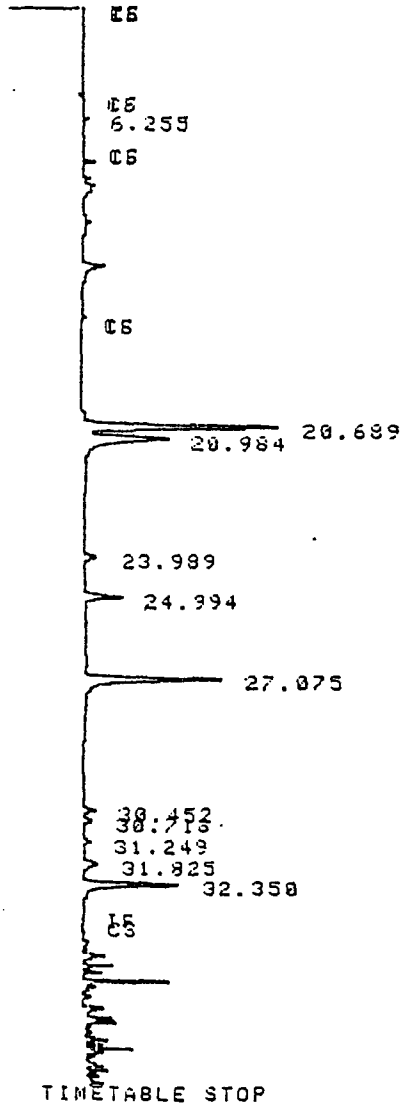
*Denotes "less than"

Copies: Texas-New Mexico Pipeline Co.

Reviewed by

SOUTHWESTERN LABORATORIES

* RUN # 43 APR 17, 1992 11:42:26
START



TIMETABLE STOP

7646-5
0.728

RUN# 43 APR 17, 1992 11:42:26

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
6.255	35570	PB	.056	.42588	Surrogate
20.689	2623010	BV	.127	31.40562	
20.984	1611336	VB	.181	19.29273	
23.989	175141	PB	.117	2.09699	
24.994	454772	PB	.114	5.44504	Toluene
27.075	1753038	BB	.120	20.98934	
30.452	112448	BV	.099	1.34635	E-Benzene
30.718	108406	VB	.104	1.29796	m,p-xylene
31.249	89298	PB	.114	1.06906	
31.825	256949	PP	.160	3.07648	
32.350	1132081	PB	.111	13.55454	O-xylene

TOTAL AREA=8352038

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-4
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, MW 7; 51 - 53, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.03
Ethyl Benzene	* 0.02
Total Xylenes	* 0.02

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418.
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	123

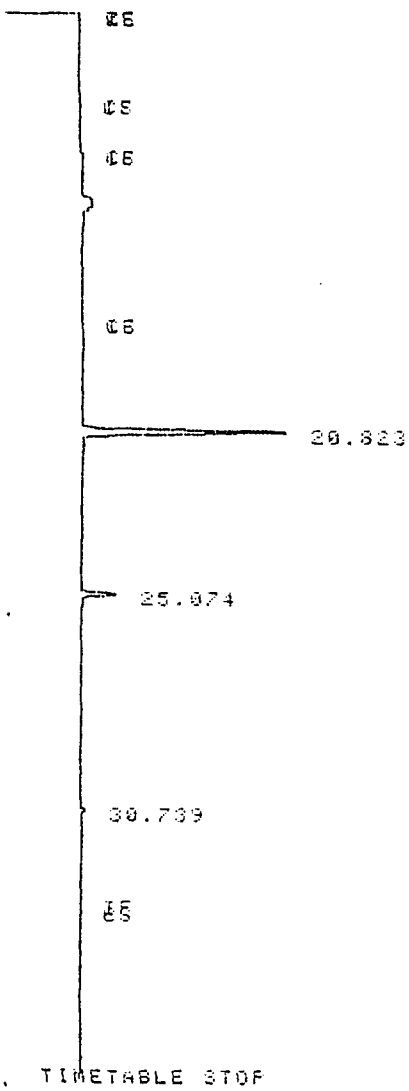
*Denotes "less than"

Copies: Texas-New Mexico Pipeline Co.

Reviewed by

SOUTHWESTERN LABORATORIES

* RUN # 17 APR 17, 1992 02:16:49
START



77646-4
0.889

TIMETABLE STOP

RUN# 17 APR 17, 1992 02:16:49

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
20.823	2688702	BB	.133	85.24998	Surrogate
25.074	399244	BB	.103	12.65672	Toluene
30.709	65958	PB	.098	2.09131	m,p-Xylene

TOTAL AREA=3153904
MUL FACTOR=1.0000E+00

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-6
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, TB 8; 10 - 15, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	4-17-92	Matrix	Soil
Date of Analysis	4-17-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	2.27
Toluene	0.16
Ethyl Benzene	6.70
Total Xylenes	6.53

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	11800

*Denotes "less than"

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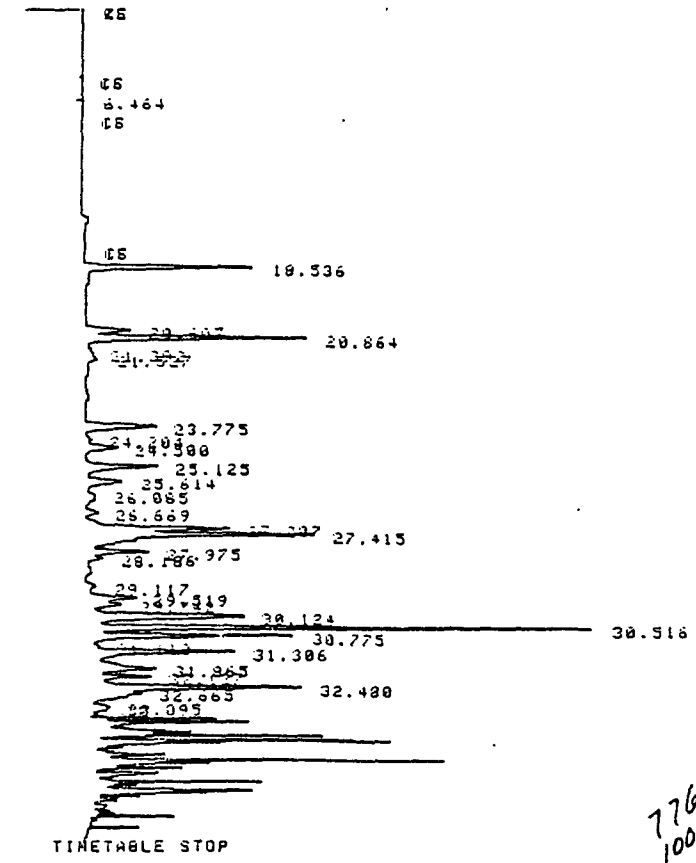
Reviewed by

* RUN # 4 APR 17, 1992 12:37:32
START



77646-6
100 µL Ext.
5 m/s
5?
F= 1

RUN# 4 APR 17, 1992 12:37:32

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
6.464	25100	BB	.036	.05239	
18.536	2704720	PB	.128	5.64530	Benzene
20.697	934675	BV	.149	1.95086	
20.864	3923030	VV	.130	8.18817	Surrogate
21.292	224922	VV	.208	.46946	
21.527	260516	VP	.163	.54375	
23.775	1573907	PV	.164	3.28506	
24.204	125335	VV	.159	.26160	
24.500	690651	VB	.163	1.44153	
25.125	1382639	BP	.145	2.88585	Toluene
25.614	831903	PP	.174	1.73635	
26.085	56420	PB	.088	.11776	
26.669	257243	PP	.157	.53692	
27.207	3182224	PV	.165	6.64195	
27.415	4018578	VV	.130	8.38759	
27.975	1055926	VV	.130	2.20393	
28.186	208298	VB	.109	.43476	
29.117	124700	BB	.110	.26027	
29.519	886757	BV	.146	1.85084	
29.742	676864	VV	.157	1.41275	
30.124	3887016	VV	.187	8.11299	
30.516	6832275	VV	.099	14.26035	E-Benzene
30.775	3050093	VV	.111	6.36617	m,p-Xylene
31.110	109403	VV	.102	.22835	
31.306	2878264	VV	.147	6.00752	
31.865	1874686	VV	.212	3.91268	
32.127	982327	VV	.120	2.05032	
32.480	3994789	VV	.140	8.33794	O-Xylene
32.665	863969	VV	.126	1.80328	
33.095	293883	VV	.114	.61339	

TOTAL AREA=4.7911E+07

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-7
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92
Identification	SPS 11, TB 8; 30 - 35, Sampled 4-10-92 by Client		

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.02
Ethyl Benzene	* 0.02
Total Xylenes	* 0.02

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	116

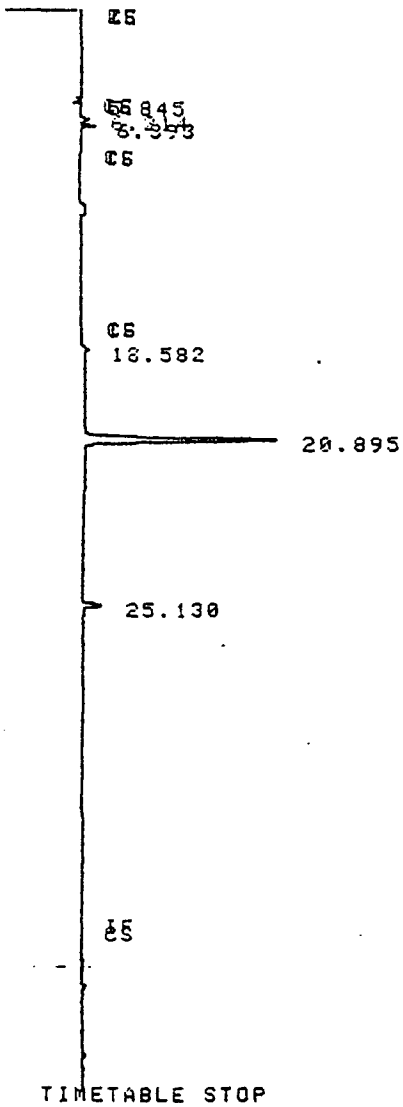
*Denotes "less than"

Copies: Texas-New Mexico Pipeline Co.

KKC
Reviewed by

SOUTHWESTERN LABORATORIES

* RUN # 45 APR 17, 1992 13:32:53
START



TIMETABLE STOP

77646-7
0.858

RUN# 45 APR 17, 1992 13:32:53

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
5.845	28177	BB	.037	.92947	
6.214	85080	PV	.093	2.80652	
6.393	79614	VB	.057	2.62622	
18.582	62234	PB	.117	2.05291	Benzene Surrogate
20.895	2557957	BB	.124	84.37904	Toluene
25.130	218446	PB	.103	7.20586	

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-8
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, TB 9; 44 - 50, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.55
Ethyl Benzene	2.41
Total Xylenes	3.86

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	34600

*Denotes "less than"

Copies: Texas-New Mexico Pipeline Co.

Reviewed by

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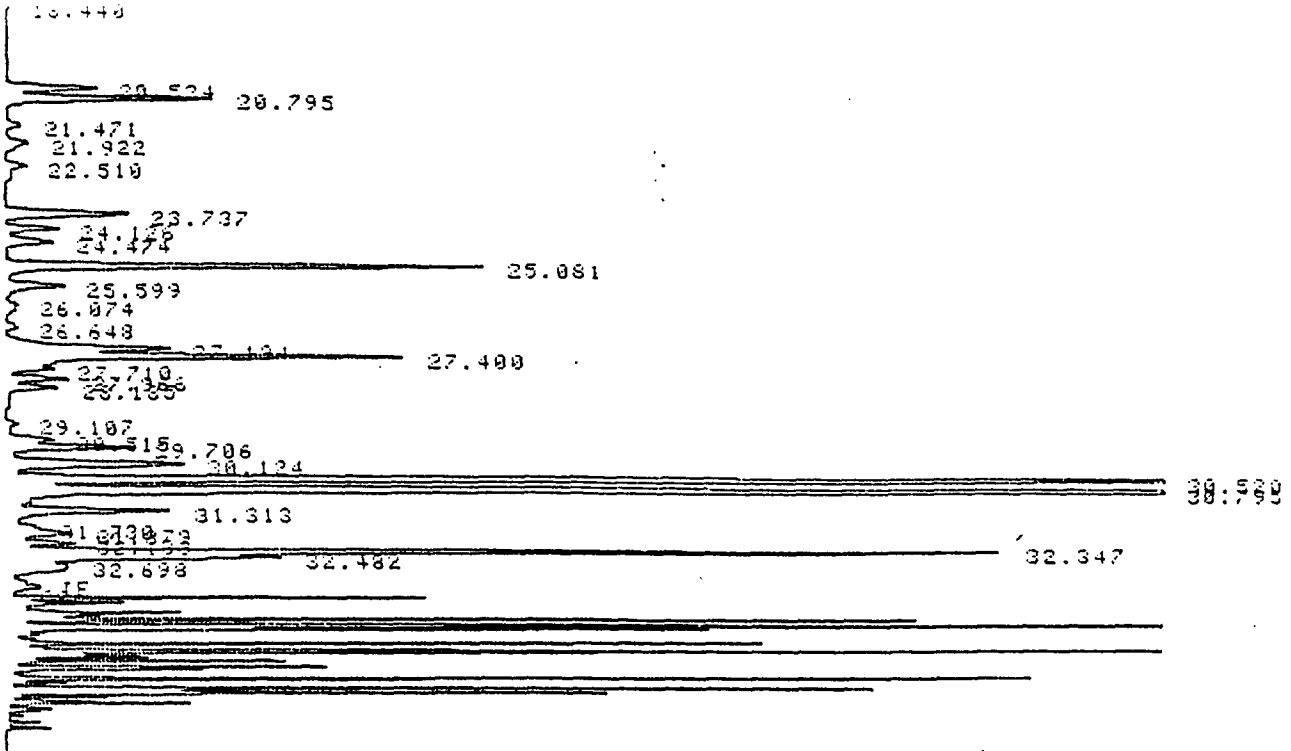

TIMETABLE STOP

77646-8
0.928

RUN# 66 APR 17, 1992 14:28:26

AREA%

RT	AREA	TYPE	WIDTH	AREA%	
18.440	71303	BB	.127	.06847	Benzene
20.534	1446840	PV	.149	1.38936	
20.795	2874293	VB	.131	2.76010	Surrogate
21.471	244017	BP	.145	.23432	
21.922	564335	PP	.210	.54191	
22.510	237946	PB	.126	.22849	
23.737	2210010	BV	.165	2.12221	
24.126	740408	VV	.127	.71099	
24.474	895576	VB	.171	.86000	
25.081	5842906	PB	.116	5.61077	Toluene
25.599	994397	BP	.162	.95489	
26.074	64351	PB	.097	.06179	
26.648	235886	PP	.170	.22651	
27.194	3003520	PV	.170	2.88419	
27.400	5393482	VV	.128	5.17921	
27.710	649306	VV	.125	.62351	
27.966	838759	VV	.126	.80544	
28.185	632166	VB	.116	.60705	
29.107	138343	BB	.120	.13285	
29.515	601857	PV	.132	.57795	
29.706	1703764	VV	.130	1.63608	
30.124	3110286	VP	.172	2.98672	
30.520	22623680	PV	.097	21.72486	E-Benzene
30.795	30090432	VB	.097	28.89498	M,p-Xylene
31.313	2059556	BP	.127	1.97773	
31.730	224548	PV	.096	.21563	
31.879	971054	VV	.158	.93248	
32.133	709375	VV	.111	.68119	
32.347	10403216	VV	.099	9.98991	O-Xylene
32.462	3146304	VV	.110	3.02131	
32.698	1415418	VP	.238	1.35919	

TOTAL AREA=1.0414E+08

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Report of tests on	Soil	File No.	6839101
Client	Texas-New Mexico Pipeline Co.	Report No.	77646-9
Delivered by	Client	Report Date	4-21-92
		Date Received	4-10-92

Identification: SPS 11, TB 9; 63 - 65, Sampled 4-10-92 by Client

REPORT OF ORGANICS ANALYSIS

Date of Extraction	N/A	Matrix	Soil
Date of Analysis	4-16-92	Method	SW846 5030/8020A
Analyst	L. Duty	MDL	0.01 mg/kg

Compound	mg/kg
Benzene	* 0.02
Toluene	0.02
Ethyl Benzene	* 0.02
Total Xylenes	* 0.02

Date of Analysis	4-14-92	Method	SW846 3550; EPA 418
Analyst	S. Stovall	MDL	5.0 mg/kg

Compound	mg/kg
Total Petroleum Hydrocarbons	101

*Denotes "less than"

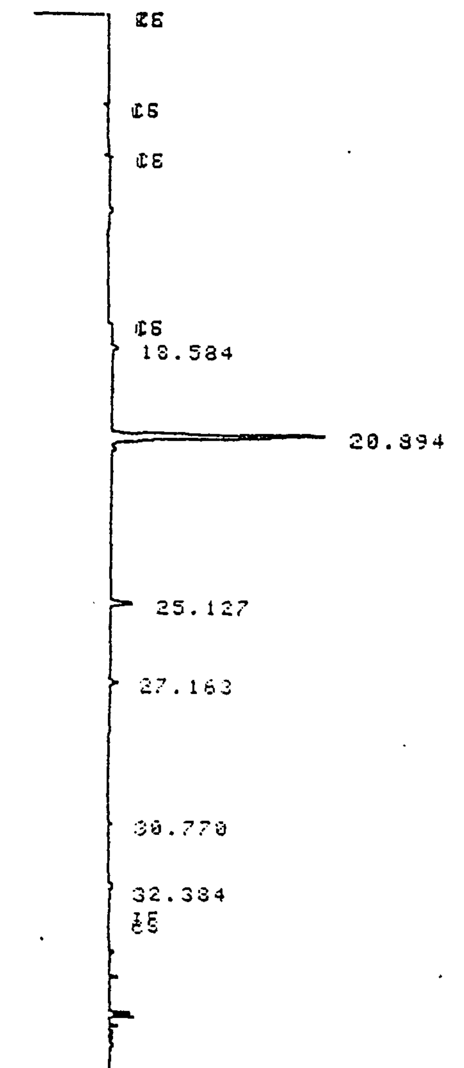
Copies: Texas-New Mexico Pipeline Co.

Reviewed by

SOUTHWESTERN LABORATORIES

* RUN # 07 APR 17, 1992 15:24:17

START



TIMETABLE STOP

RUN# 07 APR 17, 1992 15:24:17

AREA%

RT	AREA	TYPE	WIDTH	AREA%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27.163	80362	PB	.092	2.36155
30.770	58027	BB	.101	1.69466
32.384	99439	BB	.164	2.90408

TOTAL AREA=3424110

77646-9

1.428

889078

Page 1 of 3

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Analysis Request and Chain of Custody Record

Project no.	Client/Project	Sample Date
SPS 11	TNMPLCO	4-10-92

Field Sample No./ Identification	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LAB I.D. NO.
MW5; 48-50			BRASS TUBE	SOIL		TPH; ~~FE~~ BTEX	
MW5; 10-15			BOTTLE	SOIL		TPH BTEX	
MW6 48-50			BRASS TUBE	SOIL		TPH BTEX	
MW7 51-53			Brass tube	SOIL		TPH BTEX	
MW7 42-45			Bottle	SOIL		TPH BTEX	
TB8 10-15			Bottle	SOIL		" "	
TB8 30-35			"	"		" "	
TB9 44-50			"	"		" "	
TB9 63-65			Brass tube	"		" "	

Samplers: (Print)	Relinquished by: (Signature)	Date: 4/10/92 Time: 1253	Received by: (Signature)	Date: 4-10-92 Time: 5:53 p	COC Seal No.
J. HOLLY					
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
TEXACO R&D	Relinquished by: (Signature)	Date: Time:	Received by Laboratory: (Signature)	Date: Time:	Intact:
Results by	REMARKS:		Data Results To: 505 1. 397-0486		Laboratory No.
Rush Charges Authorized Yes ___ No X			2.		

SOUTHWESTERN LABORATORIES

1703 West Industrial Avenue ± P.O. Box 2150 ± Midland, Texas 79702

Report of tests on Petroleum
Client Texas New Mexico Pipeline
Delivered by M. Freight

File No. 6839101
Report No. 27647
Report Date
Date Received 4-10-92

Identification SP 511, MW 5

DISTILLATION, ASTM D-86

Date of Analysis
Analyst C. Brooks

Barometric Pressure 685 mm Hg

Percent Distilled	Observed Temperature °F
I.B.P.	258
5	296
10	320
20	400
30	434
40	608
50	660
60	692
70	
80	
90	
95	
End Point (Final Boiling Point)	700

Percent Recovery 79.0
Percent Residue 20.0
Percent Loss 1.0
Gravity 27.7 °API @ 60°F, ASTM D-287 28.4 @ 70
Total Sulfur 1.18 % by wt, ASTM D-4294

Copies: 7 NMPL
Attn:

6839101
J. Holly

54-56-607-092-1 @ $ 35.00
54-56-607-022-1 @ $ 40.00

Jim Holly 409 989-6824

SOUTHWESTERN LABORATORIES

1703 West Industrial Avenue ± P.O. Box 2150 ± Midland, Texas 79702

Report of tests on Petroleum
Client Texas New Mexico Pipeline
Delivered by M. Freight

File No. 6839101
Report No. 77648
Report Date
Date Received 4-10-92

Identification SPS II, Buckeye Sour Val. Sta.

DISTILLATION, ASTM D-86

Date of Analysis
Analyst C. Brooks

Barometric Pressure 685 mm Hg

Percent Distilled	Observed Temperature °F
I.B.P.	98
5	164
10	204
20	262
30	326
40	410
50	502
60	594
70	684
80	
90	
85	
End Point (Final Boiling Point)	700

Percent Recovery 76.0
Percent Residue 21.5
Percent Loss 2.5
Gravity ..... 38.0 °API @ 60°F, ASTM D-287 39.1@74
Total Sulfur ..... 0.82 % by wt, ASTM D-4294

Copies: TNMPL
Attn:

6839101
J. Holly

54-56-607-092-1 @ $ 35.00
54-56-607-022-1 @ $ 40.00

SOUTHWESTERN LABORATORIES

1703 West Industrial Avenue ± P.O. Box 2150 ± Midland, Texas 79702

Report of tests on Water
Client Texas-New Mexico Pipe Line Company
Delivered by Jim Holly

File No. 6839101
Report No. 17913
Report Date
Date Received 5-8-92

Identification Project No.: Project Location:
Project ID: PW-1
Date Sampled: 5-6/7-92 Time Sampled: By: Jim Holly

REPORT OF CHEMICAL ANALYSIS

Parameters	Results mg/L	Date Performed	Analyst	Standard Methods, 17th Edition
Calcium	59	5-19-92	L. Church	3500-Ca,D
Magnesium	14	↓	↓	3500-Mg,E
Sodium	30	5-18-92	G. Burch	3500-Na,D
Potassium	3	↓	↓	3500-K, D
Iron	* 0.10	↓	↓	3500-Fe, B
Manganese	* 0.05	↓	↓	3500-Mn, B
Carbonate	0	5-19-92	L. Church	2320-B
Bicarbonate	206	↓	↓	2320-B
Sulfate	33	5-20-92	↓	4500-SO_4,C
Chloride	43	↓	↓	4500-Cl,B
Nitrate			A. Johnston	4500-NO_3, F
Total Dissolved Solids, @ 180°C	290	5-19-92	L. Church	2540-C
Total Hardness as $CaCO_3$	204	↓	↓	2340-C
pH	7.18	↓	↓	4500-H
Fluoride		5-20-92	↓	4500-F, C
Total Suspended Solids @ 105°C	2	5-11-92	W. Jaycox	2540-D

* Denotes "less than"

Copies: Texas-New Mexico P/L
Attn: J.T. Janica

6839101
Jim Holly
PW-1
54-56-603-527-1 @ $ 119.00

SOUTHWESTERN LABORATORIES

1703 West Industrial Avenue ± P.O. Box 2150 ± Midland, Texas 79702

Report of tests on Water
Client Texas-New Mexico Pipe Line Company
Delivered by Jim Holly

File No. 6839101
Report No. 77914
Report Date
Date Received 5-8-92

Identification Project No.: Project Location:
Project ID: PW-2
Date Sampled: 5-6/7-92 Time Sampled: By: Jim Holly

REPORT OF CHEMICAL ANALYSIS

Parameters	Results mg/L	Date Performed	Analyst	Standard Methods, 17th Edition
Calcium	62	5-19-92	L. Church	3500-Ca, D
Magnesium	17	↓	↓	3500-Mg, E
Sodium	37	5-18-92	G. Bunch	3500-Na, D
Potassium	3	↓	↓	3500-K, D
Iron	* 0.10	↓	↓	3500-Fe, B
Manganese	* 0.050	↓	↓	3500-Mn, B
Carbonate	0	5-19-92	L. Church	2320-B
Bicarbonate	214	↓	↓	2320-B
Sulfate	26	5-20-92	↓	4500-SO_4, C
Chloride	71	↓	↓	4500-Cl, B
Nitrate			A. Johnston	4500-NO_3, F
Total Dissolved Solids, @ 180°C	324	5-19-92	L. Church	2540-C
Total Hardness as $CaCO_3$	228	↓	↓	2340-C
pH	7.33	↓	↓	4500-H
Fluoride		5-20-92	↓	4500-F, C

* Denotes "less than"

Copies: Texas-New Mexico P/L
Attn: J.T. Janica

6839101
Jim Holly
PW-2
54-56-603-527-1 @ $ 119.00

APPENDIX C

AQUIFER PERFOMANCE TEST DATA

Aquifer Performance Test for PW1

Monitor Well: MW9
Radius: 50 ft

DATE	TIME	ELAPSED TIME (min)	t/r^2 (min/ft^2)	WATER LEVEL (ft)	DRAWDOWN (ft)
05-Jun-92	13:35:00	0.0	--	54.73	0.00
	13:35:30	0.5	0.00020	54.74	0.01
	13:36:30	1.5	0.00060	54.81	0.08
	13:37:00	2.0	0.00080	54.86	0.13
	13:41:00	6.0	0.00240	55.13	0.40
	13:43:00	8.0	0.00320	55.21	0.48
	13:46:30	11.5	0.00460	55.28	0.55
	13:53:30	18.5	0.00740	55.36	0.63
	14:04:30	29.5	0.01180	55.42	0.69
	14:21:00	46.0	0.01840	55.48	0.75
	14:38:00	63.0	0.02520	55.52	0.79
	14:49:00	74.0	0.02960	55.56	0.83
	15:05:00	90.0	0.03600	55.59	0.86
	15:17:00	102.0	0.04080	55.61	0.88
	15:50:00	135.0	0.05400	55.67	0.94
	16:10:00	155.0	0.06200	55.69	0.96
	16:28:00	173.0	0.06920	55.73	1.00
	17:08:00	213.0	0.08520	55.78	1.05
	18:58:00	323.0	0.12920	55.92	1.19
	19:58:00	383.0	0.15320	55.98	1.25
	20:42:00	427.0	0.17080	56.03	1.30
05-Jul-92	03:03:00	808.0	0.32320	56.25	1.52
	07:08:00	1053.0	0.42120	56.34	1.61
	09:15:00	1180.0	0.47200	56.41	1.68
	10:38:00	1263.0	0.50520	56.43	1.70
	12:06:00	1351.0	0.54040	56.45	1.72
	12:24:00	1369.0	0.54760	56.46	1.73
	12:45:00	1390.0	0.55600	56.47	1.74

Aquifer Performance Test for PW1

Monitor Well: MW6
Radius: 200 ft

DATE	TIME	ELAPSED TIME (min)	t/r^2 (min/ft^2)	WATER LEVEL (ft)	DRAWDOWN (ft)
06-May-92	13:35:00	0.0	0.00000	55.84	0.00
	13:48:00	13.0	0.00033	55.93	0.09
	13:55:00	20.0	0.00050	55.97	0.13
	14:07:00	32.0	0.00080	56.01	0.17
	14:23:00	48.0	0.00120	56.03	0.19
	14:36:00	61.0	0.00153	56.02	0.18
	15:08:00	93.0	0.00233	56.06	0.22
	15:52:00	137.0	0.00343	56.05	0.21
	16:30:00	175.0	0.00438	56.07	0.23
	17:07:00	212.0	0.00530	56.09	0.25
	19:00:00	325.0	0.00813	56.12	0.28
	19:56:00	381.0	0.00953	56.15	0.31
	20:45:00	430.0	0.01075	56.19	0.35
07-May-92	03:03:00	808.0	0.02020	56.25	0.41
	07:06:00	1051.0	0.02628	56.26	0.42
	09:17:00	1182.0	0.02955	56.29	0.45
	10:40:00	1265.0	0.03163	56.29	0.45
	11:58:00	1343.0	0.03358	56.29	0.45

07-16-1992
10:06

SLUG TEST DATA

Project : TNMPLCO - SPS11
Well Number : PW1
Well Depth : 140.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 54.28 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Elapsed Time (minutes)	Depth To Water (feet)	Change In Head (feet)	H/H0
0.000	85.000	30.720	1.000
0.267	82.000	27.720	0.902
0.417	80.000	25.720	0.837
0.517	79.000	24.720	0.805
0.617	78.000	23.720	0.772
0.733	77.000	22.720	0.740
0.833	76.000	21.720	0.707
0.967	75.000	20.720	0.674
1.117	74.000	19.720	0.642
1.250	73.000	18.720	0.609
1.417	72.000	17.720	0.577
1.567	71.000	16.720	0.544
1.750	70.000	15.720	0.512
1.933	69.000	14.720	0.479
2.167	68.000	13.720	0.447
2.383	67.000	12.720	0.414
2.617	66.000	11.720	0.382
2.900	65.000	10.720	0.349
3.183	64.000	9.720	0.316
3.533	63.000	8.720	0.284
3.900	62.000	7.720	0.251
4.333	61.000	6.720	0.219
4.783	60.000	5.720	0.186
5.367	59.000	4.720	0.154
6.117	58.000	3.720	0.121
7.300	57.000	2.720	0.089
8.267	56.500	2.220	0.072
9.700	56.000	1.720	0.056
10.483	55.800	1.520	0.049
12.167	55.600	1.320	0.043

07-16-1992
10:12

SLUG TEST DATA

Project : TNMPLCO - SPS11
Well Number : pw2
Well Depth : 140.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 55.27 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Elapsed Time (minutes)	Depth To Water (feet)	Change In Head (feet)	H/H0
0.000	85.000	29.730	1.000
0.267	82.000	26.730	0.899
0.417	80.000	24.730	0.832
0.517	79.000	23.730	0.798
0.617	78.000	22.730	0.765
0.733	77.000	21.730	0.731
0.833	76.000	20.730	0.697
0.967	75.000	19.730	0.664
1.117	74.000	18.730	0.630
1.250	73.000	17.730	0.596
1.417	72.000	16.730	0.563
1.567	71.000	15.730	0.529
1.750	70.000	14.730	0.495
1.933	69.000	13.730	0.462
2.167	68.000	12.730	0.428
2.383	67.000	11.730	0.395
2.617	66.000	10.730	0.361
2.900	65.000	9.730	0.327
3.183	64.000	8.730	0.294
3.533	63.000	7.730	0.260
3.900	62.000	6.730	0.226
4.333	61.000	5.730	0.193
4.783	60.000	4.730	0.159
5.367	59.000	3.730	0.125
6.117	58.000	2.730	0.092
7.300	57.000	1.730	0.058
8.267	56.500	1.230	0.041
9.700	56.000	0.730	0.025
10.483	55.800	0.530	0.018
12.167	55.600	0.330	0.011

APPENDIX D

AQUIFER PERFORMANCE TEST ANALYSIS

AQUIFER PERFORMANCE TEST ANALYSIS

The aquifer performance test data from the observation wells (MW6 and MW9) were analyzed using the method described by Neuman (1975) for use with wells that partially penetrate an anisotropic water table aquifer. The aquifer thickness (h) was taken from the well log of SPS11 as being 150 feet. The pumping wells were constructed to a depth of 140 feet with 80 feet of screen and observation wells were screened from 50 to 70 feet (see Figure **). The water level is at about 55 feet below land surface.

A family of type curves were constructed using the program DELAY2[1] for the situation in which:

σ = storage/specific yield = 0.001
PD = (140-55)/150 = 0.567 (see Figure 1 for notation)
DD = 5/150 = 0.033
ZD1 = (200-70)/150 = 0.867
ZD2 = 150/150 = 1

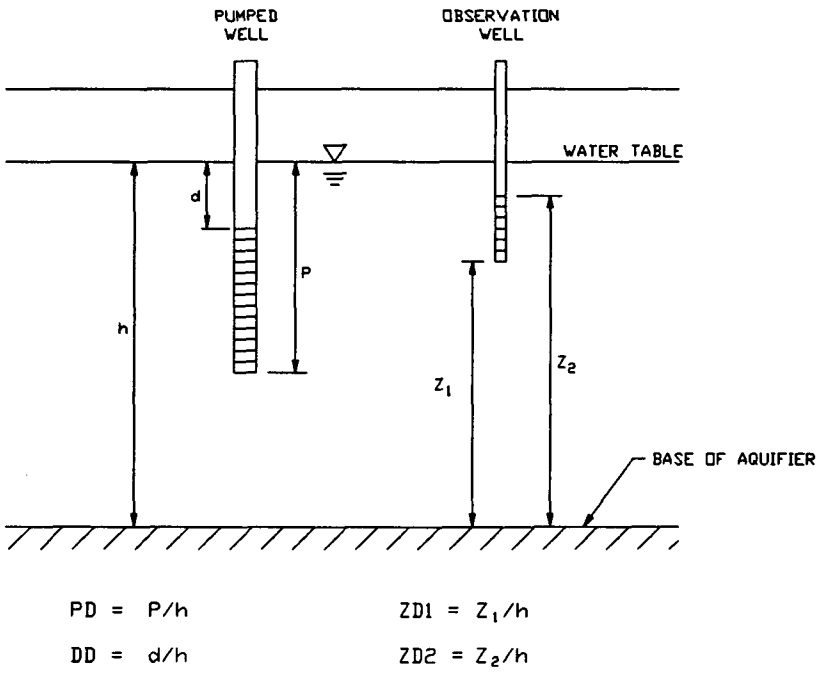


Figure 1. Terminology For Partially Wells in a Water Table Aquifer.

[1] The code for the program DELAY2 was obtained from the author and was modified for use on a IBM PC.

Each curve within the family of types curves corresponds to a value of ß:

$$ß = (K_v/K_h)/(h/r)^2$$

Where:

K_v = Vertical hydraulic conductivity (ft/day)
K_h = Horizontal hydraulic conductivity (ft/day)
h = initial aquifer thickness (ft)
r = Radial distance to the observation point (ft)

Curves were constructed for the cases in which ß = 10, 3, 1, 0.3, 0.1, 0.03, 0.01, 0.001, 0.0001, and 0.000001 (Figure 2).

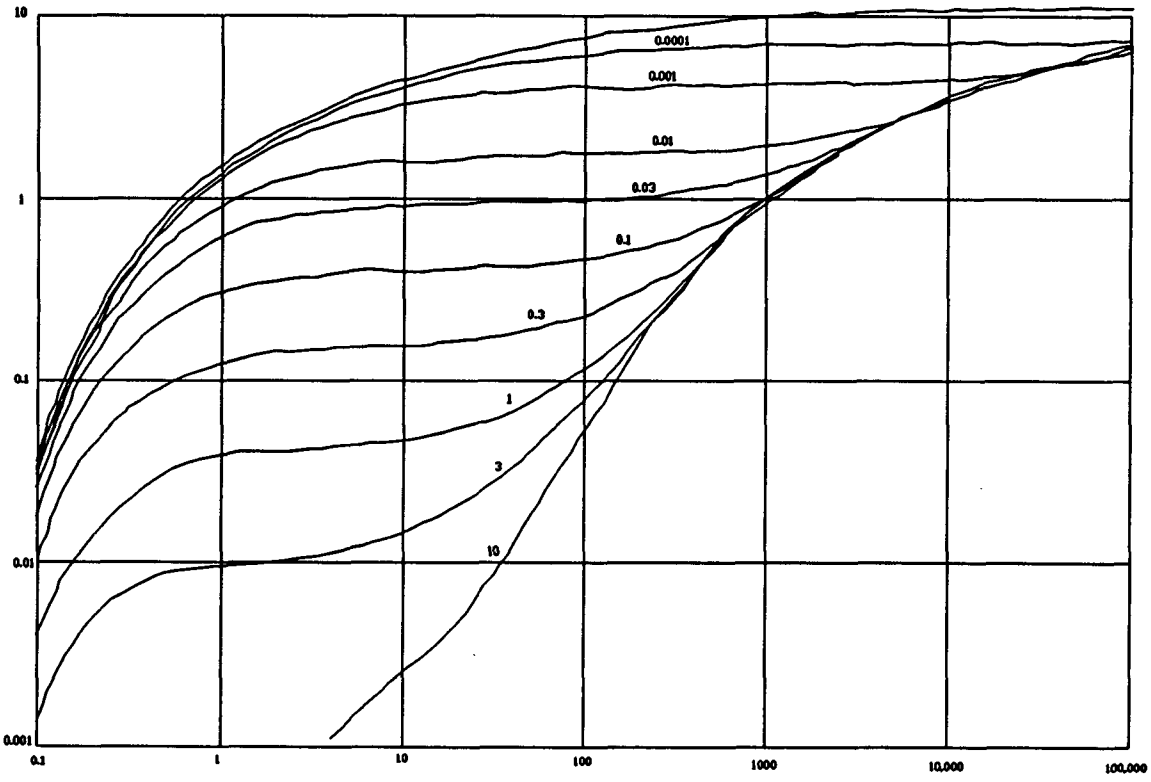


Figure 2. Type Curves for a Water-Table Aquifer with Partially Penetrating Wells.

Type curve calculations are filed at the TNMPLCO office in Hobbs, NM.

Dimensionless time with respect to storage and specific yield, t_S and t_Y respectively, and dimensionless drawdown, s_D, are represented by the equations:

$$t_S = Tt/S_s r^2$$

$$t_Y = Tt/S_y r^2$$

and

$$s_D = 4\pi Ts/Q$$

where:

T = Transmissivity (ft^2/day)
t = Time (days)
s = Drawdown (ft)
S_y = Specific Yield (dimensionless)
S_s = Storage (dimensionless)
r = Radius (ft)
Q = Discharge (ft^3/day)

No attempt was made to correct the early time data for the effects of well bore storage and no calculations were made for the aquifer storage. Aquifer parameters were calculated by rewriting the above equations as:

$$T = s_D Q/4\pi s$$

$$S_y = Tt/r^2 t_Y$$

and

$$K_v = ßK_h(h/r)^2$$

Drawdown data from observation wells MW6 and MW9 were plotted as drawdown, s, versus time divided by the radius squared, t/r2, on logarithmic paper (Figure 3). The data curves were then matched against the family of type curves. A unique match was obtained in which data from MW6 was matched against ß = 0.007 and data from MW9 was matched against ß = 0.08. A match point was chosen in which:

$t/r^2 = 0.00028$,
$s = 0.38$,
$s_D = 1$, and
$t_Y = 10$.

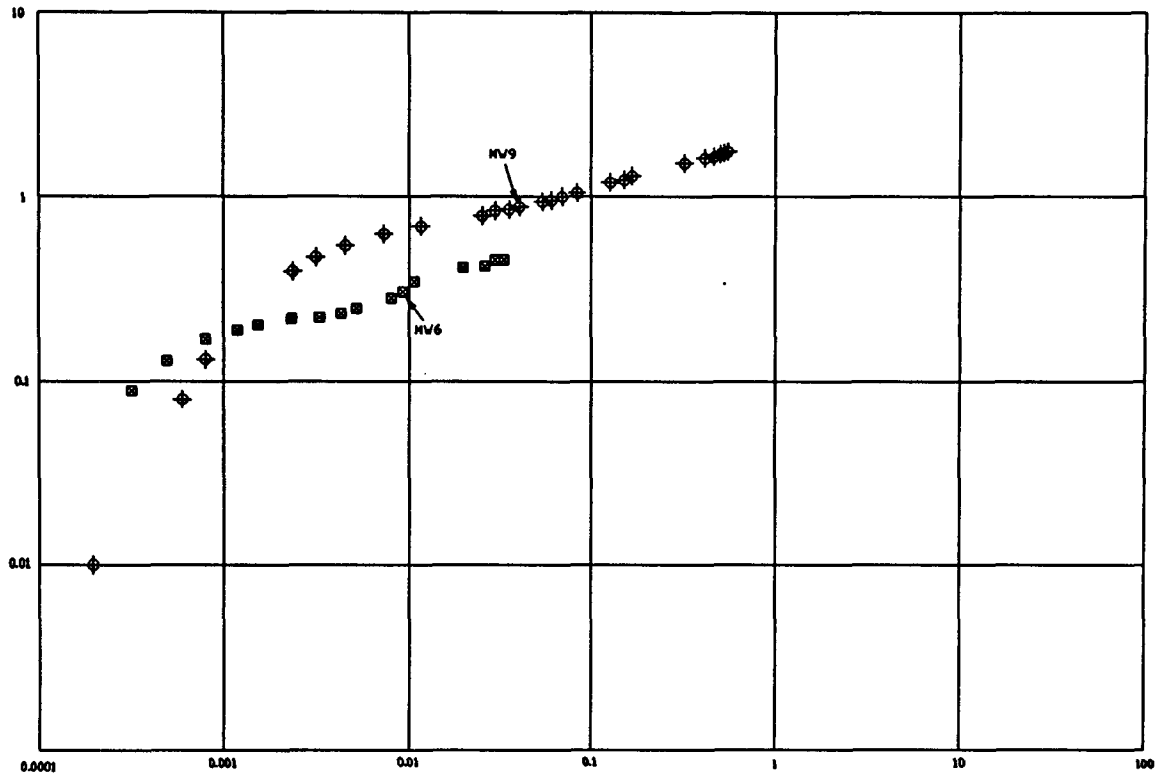


Figure 3. Pumping Test Data as Drawdown vs. t/r^2.

Substituting values into the equations an aquifer transmissivity of:

$$T = 1(\text{dim}) \cdot 9626(ft^3/day)/4 \cdot \pi \cdot 0.38(ft)$$

$$= 2000 \ ft^2/day$$

a hydraulic conductivity of:

$$K_h = 2000(ft^2/day)/150(ft)$$

$$= 13(ft/day)$$

a specific yield of:

$$S_y = 2000(ft^2/day) \cdot 0.38(days/ft_2)/10$$

$$= 0.05$$

and a vertical permeability of:

$$K_v = 0.007(\text{dim}) \cdot [150(\text{ft})/50(\text{ft})]^2 \cdot 13.4(\text{ft/day})$$

$$= 0.85 \text{ ft/day}$$

and

$$K_v = 0.08(\text{dim}) \cdot [150(\text{ft})/200(\text{ft})]^2 \cdot 13.4(\text{ft/day})$$

$$= 0.60 \text{ ft/day}$$

averaging:

$$K_v = 0.7 \text{ ft/day}$$

are obtained.

Water level data were not analyzed by the more common Jacob-Theis (semi-log) method since this is inappropriate for use with a water table aquifer and does not account for the effects of partially penetrating wells.

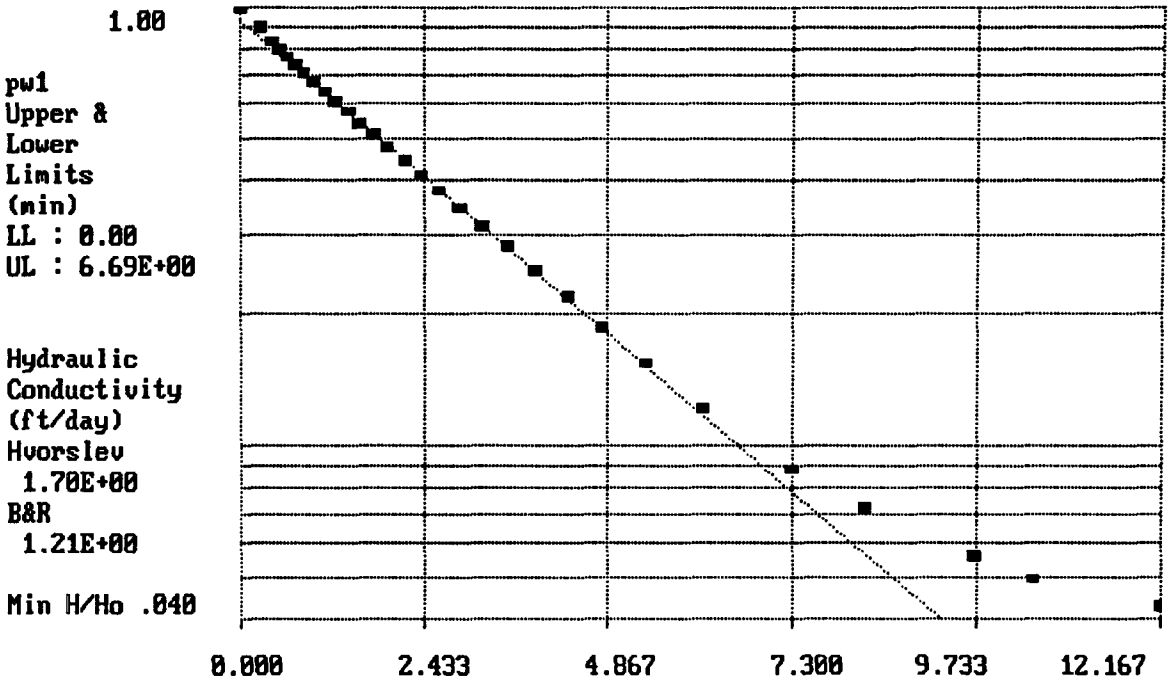
SLUG TESTS

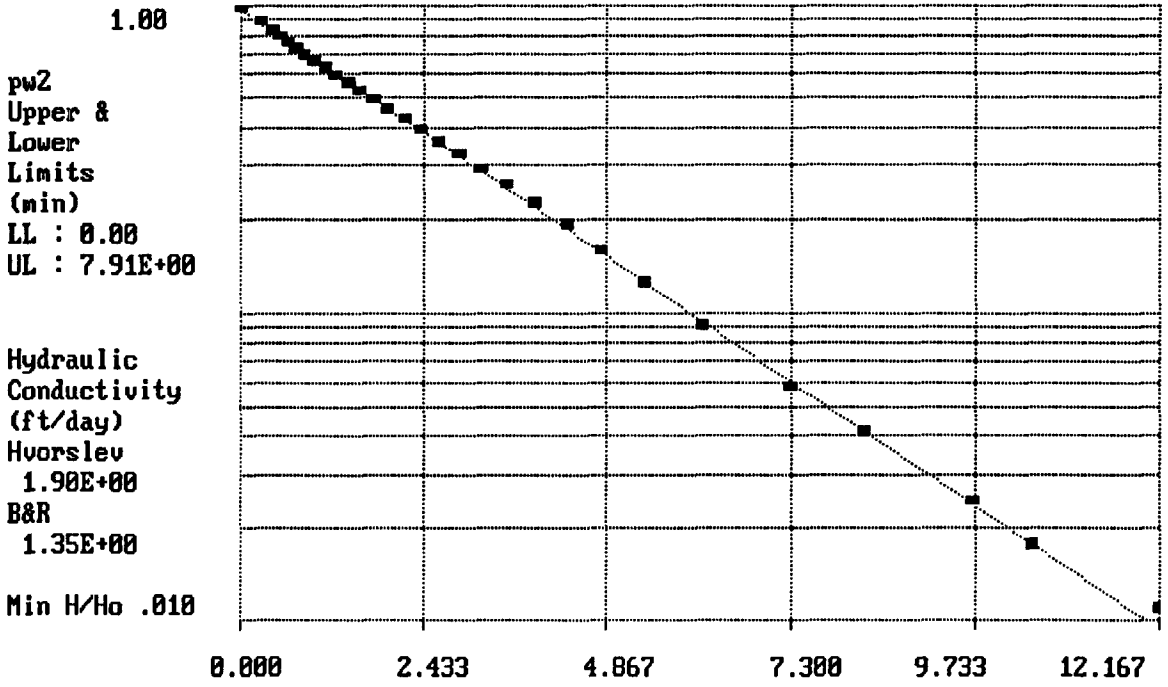
Slug tests were performed on PW1 and PW2 by pumping the water level down and allowing it to recover. Analysis of the slug test data was made using the methods described by Cooper, Bredehoeft, and Papadapulous (1967), Hvorslev (1951), Bouwer and Rice (1976), and by Ferris and Knowles (1954). The first of these is a curve-matching method, the second two are slope methods which analyze the early time data and the last is a slope method which analyzes the late time data. The results of the analyses, as output files from the program SLUGTEST, are attached and are summarized in Table 1. Data are included in Appendix C.

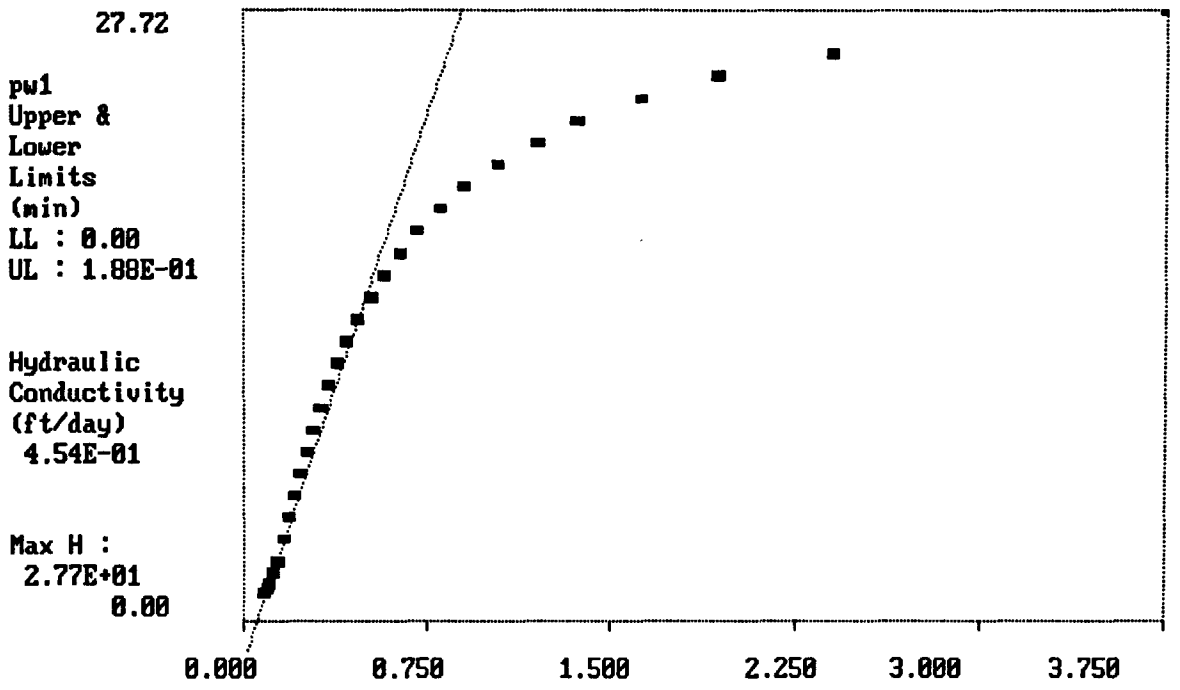
Table 1. Slug Test Results

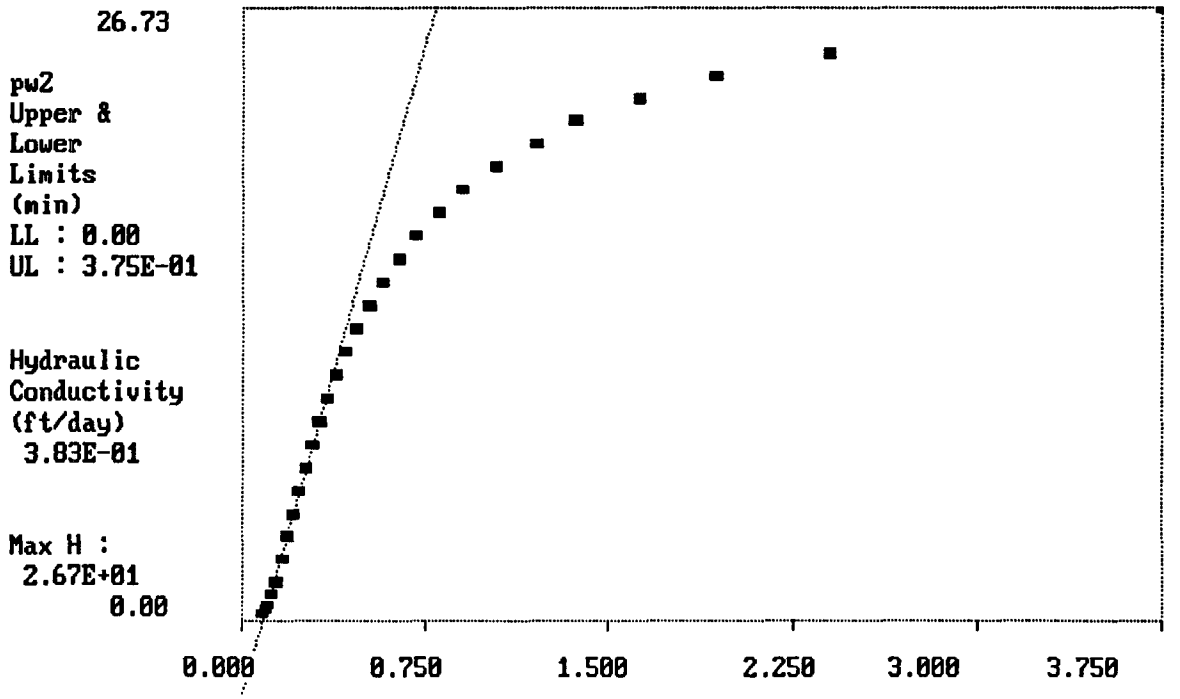
WELL NUMBER	HYDRAULIC CONDUCTIVITY (ft/day)			
	Hvorslev	Bouwer & Rice	Ferris & Knowles *	Cooper, Bredehoeft, & Papadopulous
PW1	1.7	1.2	0.5	2.0
PW2	1.9	1.3	0.4	2.2

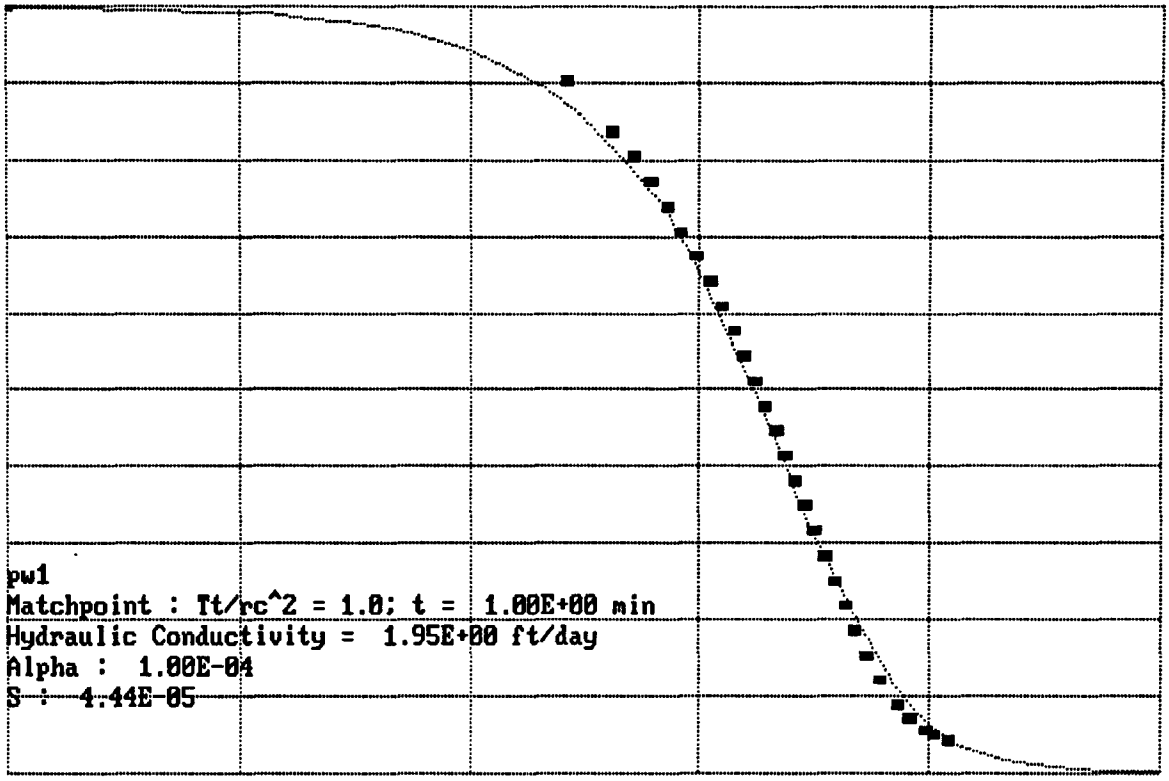
* Data are out of valid range for analysis.


1.00
pw1
Upper &
Lower
Limits
(min)
LL : 0.00
UL : 6.69E+00
Hydraulic
Conductivity
(ft/day)
Hvorslev
1.70E+00
B&R
1.21E+00
Min H/Ho .040
0.000
2.433
4.867
7.300
9.733
12.167


1.00
pw2
Upper &
Lower
Limits
(min)
LL : 0.00
UL : 7.91E+00
Hydraulic
Conductivity
(ft/day)
Hvorslev
1.90E+00
B&R
1.35E+00
Min H/Ho .010
0.000
2.433
4.867
7.300
9.733
12.167


27.72
pw1
Upper &
Lower
Limits
(min)
LL : 0.00
UL : 1.88E-01
Hydraulic
Conductivity
(ft/day)
4.54E-01
Max H :
2.77E+01
0.00
0.000
0.750
1.500
2.250
3.000
3.750


26.73
pw2
Upper &
Lower
Limits
(min)
LL : 0.00
UL : 3.75E-01
Hydraulic
Conductivity
(ft/day)
3.83E-01
Max H :
2.67E+01
0.00
0.000
0.750
1.500
2.250
3.000
3.750


pw1
Matchpoint : Tt/rc^2 = 1.0; t = 1.00E+00 min
Hydraulic Conductivity = 1.95E+00 ft/day
Alpha : 1.00E-04
S : 4.44E-05

07-16-1992
10:06

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw1
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 54.28 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Hvorslev (1951) Method G

$$K=((d^2*\ln(2*L/D)*\ln(H1/H2))/(8*L*(t2-t1)$$

Where:
K = Hydraulic Conductivity
d = Well Casing Diameter
W = Intake (filter pack) Diameter
L = Intake Length
t = Time
H = Head at Time t
M = Anisotropy Factor; SQR(KH/KV)
^ = Exponentiation

Hydraulic Conductivity = 1.70E+00 ft/day
1.27E+01 gpd/sq.ft
5.99E-04 cm/sec

Slope of Data Points : .3413288
Correlation Coefficient of Data : .9994291

Reference: Hvorslev, M. Juul, Time Lag and Soil Permeability in Ground-Water Observations, U.S. Army Corps of Engineers, Waterways Experiment Station Bulletin No. 36, 1951

07-16-1992
10:12

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw2
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 55.27 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Hvorslev (1951) Method G

$$K=((d^2*\ln(2*L/D)*\ln(H1/H2))/(8*L*(t2-t1)$$

Where:
K = Hydraulic Conductivity
d = Well Casing Diameter
W = Intake (filter pack) Diameter
L = Intake Length
t = Time
H = Head at Time t
M = Anisotropy Factor; SQR(KH/KV)
^ = Exponentiation

Hydraulic Conductivity = 1.90E+00 ft/day
1.42E+01 gpd/sq.ft
6.71E-04 cm/sec

Slope of Data Points : .3821618
Correlation Coefficient of Data : .9997237

Reference: Hvorslev, M. Juul, Time Lag and Soil Permeability in Ground-Water Observations, U.S. Army Corps of Engineers, Waterways Experiment Station Bulletin No. 36, 1951

07-16-1992
10:06

SLUG TEST ANALYSIS

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Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 54.28 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out
a : 5.438 b : 1.0272
Aquifer Thickness : 150 feet

Bouwer and Rice (1976)

$$K=(RC^2*LN(RE/RW)/2*L)*(1/T*LN(Y0/YT))$$

Where:
K = Hydraulic Conductivity
RC = Well Casing Radius
RW = Filter Pack Radius
RE = Effective Radius
L = Intake Length
T = Time
Y0 = Water Level at Time 0
YT = Water Level Displacement at Time T
^ = Exponentiation

Hydraulic Conductivity = 1.21E+00 ft/day
9.02E+00 gpd/sq.ft
4.25E-04 cm/sec
Slope of Data Points : .3413288
Correlation Coefficient of Data : .9994291

Reference: Bouwer, Herman 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, 1976

07-16-1992
10:12

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw2
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 55.27 feet
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a : 5.438 b : 1.0272
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Bouwer and Rice (1976)

K=(RC^2*LN(RE/RW)/2*L)*(1/T*LN(Y0/YT))

Where:

K = Hydraulic Conductivity
RC = Well Casing Radius
RW = Filter Pack Radius
RE = Effective Radius
L = Intake Length
T = Time
Y0 = Water Level at Time 0
YT = Water Level Displacement at Time T
^ = Exponentiation

Hydraulic Conductivity = 1.35E+00 ft/day
1.01E+01 gpd/sq.ft
4.75E-04 cm/sec
Slope of Data Points : .3821618
Correlation Coefficient of Data : .9997237

Reference: Bouwer, Herman 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, 1976

07-16-1992
10:06

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw1
Well Depth : 160.00 feet
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Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 54.28 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Ferris and Knowles (1954)

$T = (114.6*Q*(1/t)/s$

Where:

T = Transmissivity (gpd/ft)
Q = Volume of the Slug (gal)
t = Time
s = Residual Head

Transmissivity : 3.72E+01 ft^2/day
2.79E+02 gpd/ft
3.00E-03 M^2/sec
Hydraulic Conductivity : 4.54E-01 ft/day
3.40E+00 gpd/sq.ft
1.60E-04 cm/sec
Slope of Data : 32.99493
Correlation of Data Points : .9920176

Reference: Ferris, J. G., and D. B. Knowles, 1954, Slug Test for Estimating Transmissiblity: U.S. Geological Survey Ground Water Note 26, Vol. 3, No. 1 (From USGS Water Supply Paper 1536-1).

07-16-1992
10:12

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw2
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 55.27 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out

Ferris and Knowles (1954)

$T = (114.6*Q*(1/t)/s$

Where:

T = Transmissivity (gpd/ft)
Q = Volume of the Slug (gal)
t = Time
s = Residual Head

Transmissivity : 3.14E+01 ft^2/day
2.35E+02 gpd/ft
2.53E-03 M^2/sec
Hydraulic Conductivity : 3.83E-01 ft/day
2.87E+00 gpd/sq.ft
1.35E-04 cm/sec
Slope of Data : 37.85245
Correlation of Data Points : .998071

Reference: Ferris, J. G., and D. B. Knowles, 1954, Slug Test for Estimating Transmissiblity: U.S. Geological Survey Ground Water Note 26, Vol. 3, No. 1 (From USGS Water Supply Paper 1536-1).

07-16-1992
10:06

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw1
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 54.28 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out
Matchpoint : Tt/rc^2 = 1.0; t = 1 min
Alpha : 0.00010

Cooper, Bredehoeft, and Papadopulous (1967)

T = (BETA*r^2)/t
Where:
T = Transmissivity
r = Well Casing Radius
W = Intake (filter pack) Diameter
L = Intake Length
t = Time
BETA = T*t/r^2
^ = Exponentiation

Transmissivity : 1.60E+02 ft^2/day
1.20E+03 gpd/ft
1.72E-04 M^2/sec
Hydraulic Conductivity : 1.95E+00 ft/day
1.46E+01 gpd/sq.ft
6.89E-04 cm/sec
Storage Coefficient ; 0.0000444

Reference: Cooper, H.H., J.D. Bredehoeft. and I.S. Papadopulous, Response of a Finite Diameter Well to an Instantaneous Charge of Water, Water Resources Research Vol. 3, No. 1, 1967

07-16-1992
10:12

SLUG TEST ANALYSIS

Project : TNMPLCO - SPS11
Well Number : pw2
Well Depth : 160.00 feet
Casing Diameter : 8.00 inches
Screen Length : 80.00 feet
Casing Stickup : 2.00 Feet
Filter Pack Diameter : 12.00 inches
Filter Pack Length : 82.00 feet
Intake Length : 82.00 feet
Depth to Water (Static) : 55.27 feet
Starting Date : 5/7/92
Starting Time : 15:57:00
Slug Out
Matchpoint : Tt/rc^2 = 1.0; t = .891251 min
Alpha : 0.00010

Cooper, Bredehoeft, and Papadopulous (1967)

T = (BETA*r^2)/t
Where:
T = Transmissivity
r = Well Casing Radius
W = Intake (filter pack) Diameter
L = Intake Length
t = Time
BETA = T*t/r^2
^ = Exponentiation

Transmissivity : 1.80E+02 ft^2/day
1.34E+03 gpd/ft
1.93E-04 M^2/sec
Hydraulic Conductivity : 2.19E+00 ft/day
1.64E+01 gpd/sq.ft
7.73E-04 cm/sec
Storage Coefficient ; 0.0000444

Reference: Cooper, H.H., J.D. Bredehoeft. and I.S. Papadopulous, Response of a Finite Diameter Well to an Instantaneous Charge of Water, Water Resources Research Vol. 3, No. 1, 1967

APPENDIX E

CAPTURE ZONE CALCULATION

CAPTURE ZONE CALCULATION

In situations where wells are pumping from aquifers with a hydraulic gradient it is desirable to define the capture zone. This is achieved by superimposing the water-level drawdown on the gradient in the aquifer (Figure 1). This principle has been presented by various authors including Chow (1964) and Todd (1980). Keely and Tsang (1983) have described the usefulness of this method for determining the capture zone in groundwater contamination situations.

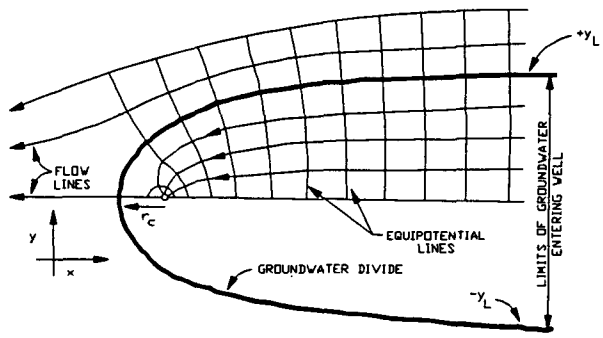


Figure 10. Groundwater flow to a pumping well in a water-level gradient.

The stagnation point (velocity divide), or the distance from the well to the downgradient extent of its capture (r_c) is defined by the equation:

$$r_c = Q/(2\pi h\Theta V_n)$$

or

$$r_c = Q/(2\pi hKi)$$

where:

- Q = Discharge (ft^3/day)
- h = Aquifer thickness (ft)
- K = Hydraulic conductivity (ft/day)
- i = Hydraulic gradient (ft/ft)
- Θ = Effective porosity (dimensionless)
- V_n = Ki/Θ; Velocity of the groundwater under natural gradient (ft/day)

The width of the capture zone approaches the asymptotic limit (y_L):

$$y_L = \pm Q/(2Khi)$$

or

$$y_L = \pm (2\pi r_c)/2$$

Data from the site investigation indicate that:

$T = 2000$ ft^2/day
$K = 13$ ft/day

$$i = 0.0033 \text{ ft/ft}$$

Using these values in the equations described above and assuming a pumping rate of 50 gpm (9600 ft^3/day) we determine the following:

$$r_c = 9600(ft^3/day)/\{2 \cdot \pi \cdot 150(ft) \cdot 13(ft/day) \cdot 0.0033(ft/ft)\}$$

$$= 240 \text{ ft}$$

and

$$y_L = \pm 9600(ft^3/day)/\{2 \cdot 13(ft/day) \cdot 150(ft) \cdot 0.0033(ft/ft)\}$$

$$= \pm 750 \text{ ft}$$

The resulting configuration is given in Figure 2.

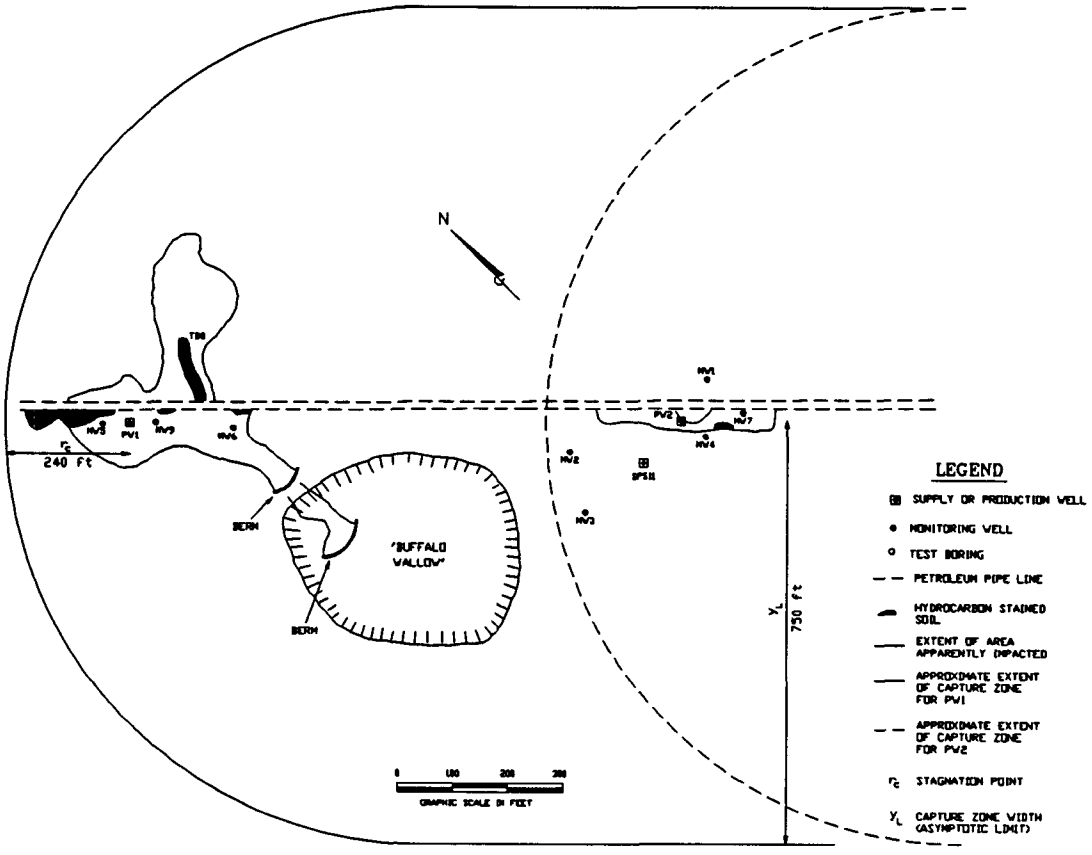


Figure 11. Capture Zone.

APPENDIX F

TREATMENT OF DISCHARGE WATER

TREATMENT OF DISCHARGE WATER

Groundwater from the aquifer performance test was treated by air sparging prior to discharge. The sparge tank (Figure 1) consisted of a 500 barrel frac tank with a perforated pipe along the bottom. Influent water was pumped into the tank at the northwest end and water was discharged from the southeast end of the tank under gravity flow. Compressed air was supplied by a trailer-mounted 180 cfm (cubic feet per minute) compressor. The tank was allowed to fill to about half of its capacity before water was discharged. Residence time in the tank was about 5 hours.

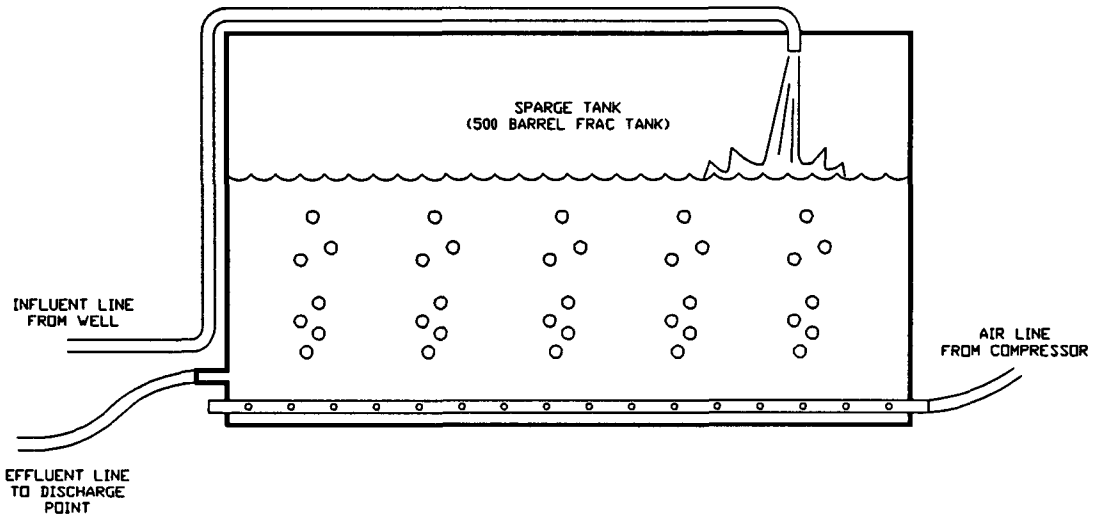


Figure 12. Sparge Tank.

Groundwater was discharged to a "buffalo wallow" about 550 feet southeast of the pumping well.

Samples of influent and effluent water were collected and submitted for laboratory analysis for BTEX. One sample was collected near the beginning of the test and a second near the end. Analyses (Appendix B) indicate that the influent as well as the effluent water did not contain BTEX above the laboratory detection limit.

APPENDIX G

SPECIFICATIONS FOR TNMPLCO-HOBBS GROUNDWATER RECOVERY AND TREATMENT SYSTEM

SPECIFICATIONS FOR TNMPLCO-HOBBS GROUNDWATER RECOVERY AND TREATMENT SYSTEM

I. DESCRIPTION

The pumping and treatment system shall include two submersible pumps which will feed groundwater into an air stripper. The air stripper effluent will be pumped through an optional cartridge filter and then into an activated carbon vessel. The treated water will be discharged to an existing pressurized water distribution system. With the exception of the submersible pumps, all equipment will be mounted on a skid.

II. SUBMERSIBLE PUMPS

A submersible pump will be installed in each well, PW1 and PW2, details in Figures 1 and 3. Preliminary calculations indicate that each of these pumps should be capable of producing approximately 50 gpm against 150 feet of head (TDH); however, actual pump sizing should be verified by the supplier. Refer to Figure 1 for estimated pipe sizes. The production wells are constructed with nominal 8 inch diameter PVC casing and screen. The pumps will be suspended 130 feet below ground level (static water level is about 55 to 60 feet below ground level).

The surface completions of the production wells will be modified before the pumps are installed. The surface configuration will consist either of a flush-mounted vault enclosing the open end of the casing, or the well casing will be fitted with a pitless adapter. The pitless adapter is the preferred configuration. As such, each pump will be protected from running dry (excessive drawdown) by a motor protection device, such as "Coyote" or "Motor Saver". As an alternative, a water level probe connected to the main control panel, may be used in the well. This arrangement is more suited to the vault completion at the surface. The supplier may design the control system based on the use of the pitless adapter/motor protection device, provide optional designs for each configuration, or justify the use of the vault/water level probe configuration.

III. AIR STRIPPER / TRANSFER PUMP

The packed tower air stripper shall be designed to treat a nominal groundwater flow of 100 gpm. Actual pump test water analyses (inorganics) are included in Table I. The design concentrations are 100 ug/L benzene in the influent and 0.5 ug/L benzene in the effluent with an air to water volumetric ratio of at least 30. The base of the tower will serve as a sump for the transfer pump. The transfer pump will be controlled primarily by high-level and low-level switches in the stripper sump. To allow the transfer pump to operate continuously (or nearly so), a small-diameter bypass line from the pump discharge to the sump will be installed. Inside the sump, the recycle flow will be controlled by a float valve. Details are shown in Figure 2. The pump will provide sufficient pressure and flow to transfer the nominal 100 gpm flow (not including the maximum 10 gpm recycle) through the downstream equipment and into the pressurized distribution line.

A third level switch in the sump will shut down the pumps and blower upstream of the stripper if downstream flow is interrupted or restricted. Other flow or pressure sensors shall be installed to monitor the blower air flow and the water flow from the wells. System shutdown should be initiated if any of these components fail.

The treatment system will be expected to operate continuously under all weather extremes. Therefore, the supplier will provide weatherproofing options to protect the equipment during dust storms and freezing conditions. The anticipated modifications needed to resist the effects of dust include: 1) a replaceable-element intake filter (should not be oil-wetted type) on the blower, 2) a dome enclosing the top of the air stripper, which exhausts the air sideways or downward through a smaller discharge pipe, and 3) a grit strainer upstream of the transfer pump. Freeze-protection is expected to consist of heat tracing, line insulation, or a small building to protect the skid-mounted equipment. The supplier should evaluate these options as well as any others that may be suitable and propose those that are most economical and practical.

IV. CARTRIDGE FILTER / ACTIVATED CARBON

To insure that no dissolved organics are discharged from the treatment system, the stripped water will be pumped through a bed of activated carbon. An appropriately-sized cartridge filter may be included upstream of the carbon if the supplier anticipates a high concentration of suspended solids. The elements in this filter should provide at least two weeks of service before changing is necessary. The activated carbon bed shall be designed to provide a minimum of 6 months of service. The source and method for replacing the carbon shall be recommended by the supplier in the proposal. The carbon vessel shall be pressure rated for 35 psig. This is the maximum anticipated pressure of the downstream distribution piping system. If the supplier can justify the modification as a cost-saving measure, a non-pressure-rated carbon vessel followed by a holding tank and additional transfer pump may be specified. Appropriate failsafe controls must be included with this modification.

V. MISCELLANEOUS REQUIREMENTS

The control system shall be wired to a single control panel containing motor switches, status lights, and control circuits. The control panel shall be protected from direct sunlight and rain by a small canopy (unless the system is to be enclosed by a building). All piping on the skid will be schedule 40, galvanized steel. Piping will be terminated with flanged fittings. All electrical components will be rated for NEMA 4 service.

TABLE I.

AIR STRIPPER DESIGN SPECIFICATIONS / INORGANIC WATER ANALYSES

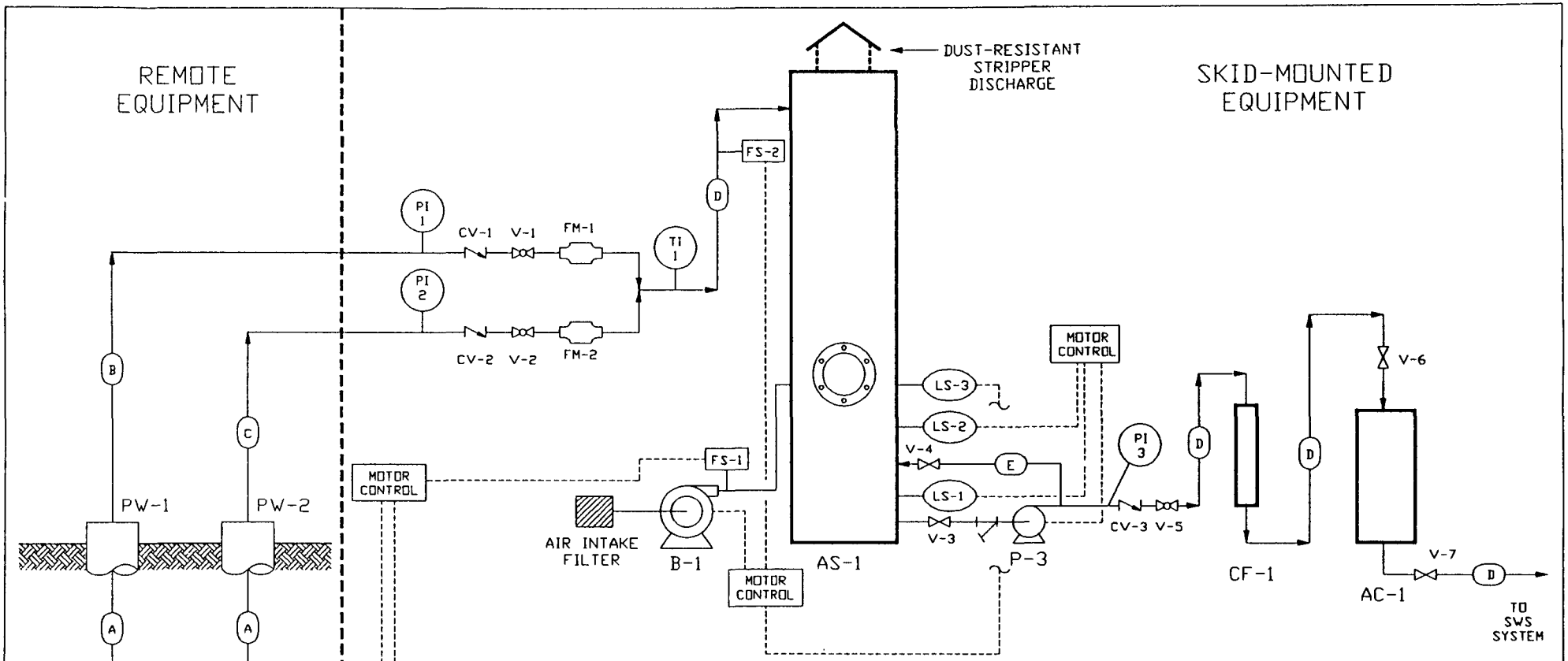
INFLUENT

Nominal flow:	100 gpm
Assumed water temperature:	60 F
Maximum BTEX concentration:	150 ug/L
Maximum benzene concentration:	100 ug/L
Calcium:	60 mg/L
Magnesium:	16 mg/L
Sodium:	35 mg/L
Potassium:	3 mg/L
Iron:	< 0.1 mg/L
Bicarbonate:	210 mg/L
Chloride:	50 mg/L
Total dissolved solids:	300 mg/L
Total hardness as $CaCO_3$:	210 mg/L
pH:	7.3
Total suspended solids:	2 mg/L

EFFLUENT

Estimated stripper effluent benzene concentration:	0.5 ug/L

Treated water must be discharged into a distribution system with a maximum pressure of 35 psig.



LEGEND

AS-1	AIR STRIPPER, 3' ø, APPROX. 20' PACKING HEIGHT, APPROX. 25' OVERALL HEIGHT.
AC-1	ACTIVATED CARBON VESSEL,
CF-1	CARTRIDGE FILTER, OPTIONAL.
B-1	AIR STRIPPER BLOWER, APPROX. 500 cfm
P-1, P-2	SUBMERSIBLE PUMPS, NOMINAL FLOW-50 gpm ea., SET AT ABOUT 130' BELOW GRADE. 3 HP, 230 VAC, THREE PHASE
P-3	CENTRIFUGAL TRANSFER PUMP, NOMINAL FLOW 110 gpm @ 150 ft. OF HEAD
FM-1, FM-2	MECHANICAL, DIAL-TYPE FLOW METERS, 10-100 gpm RANGE
PW-1, PW-2	GROUNDWATER PRODUCTION WELLS

PI-1	PRESSURE INDICATOR
TI-1	TEMPERATURE INDICATOR
FS-1	FLOW SWITCH
LS-1	LEVEL SWITCH

A	B	C	D	E
2" SCH 40 GALVANIZED STEEL	3" SCH 40 PVC	2" SCH 40 PVC	3" SCH 40 GALVANIZED STEEL	1" SCH 40 GALVANIZED STEEL

REVISIONS				APPROVED	
BY	DATE	DESCRIPTION		BY	DATE

FIGURE 1

TEXACO
PORT ARTHUR RESEARCH LABORATORIES
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TNMPLCo. - HOBBS GROUNDWATER TREATMENT SYSTEM

INITIALS	DATE	D M	SCALE NONE
DRAWN BY DLH	6/18/92	CHG.	SECT.
CHK'D. BY DLC	6/18/92		REVISION

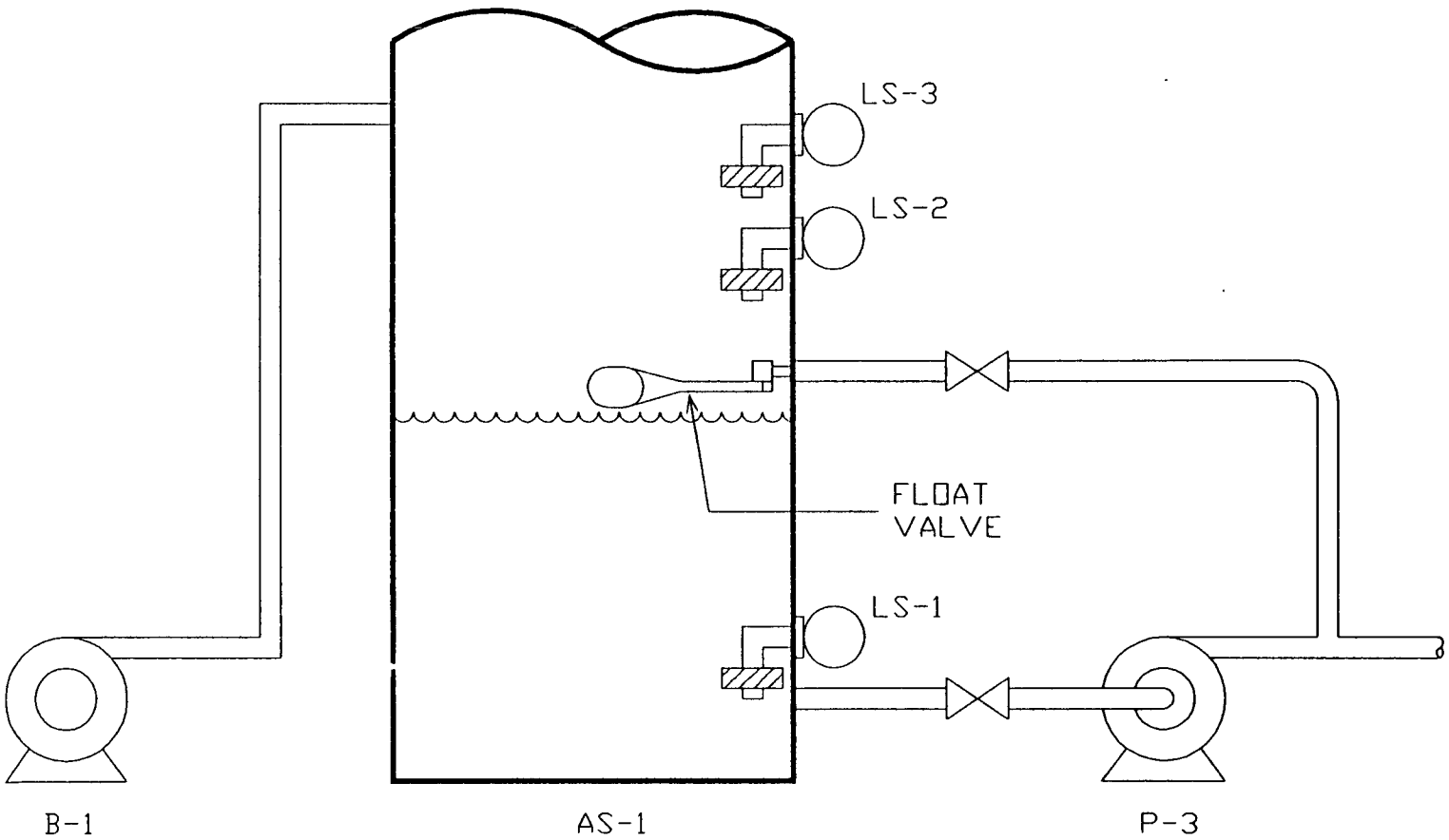

FIGURE 2

NOTICE

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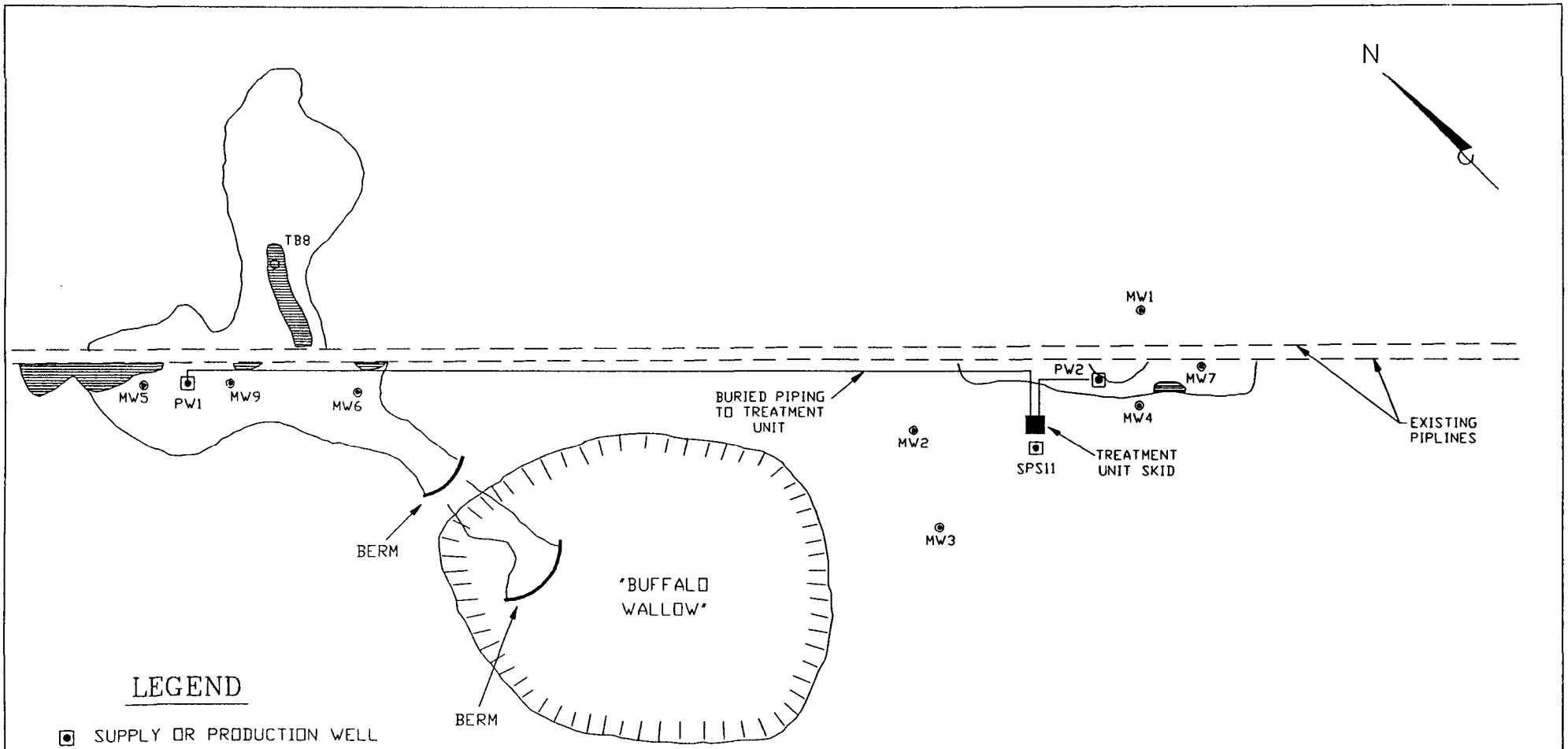
PORT ARTHUR, TEXAS

AIR STRIPPER
SUMP LEVEL CONTROLS

	INITIALS	DATE	B M	SCALE NONE
DRAWN BY	DLH	7/15/92	CHG	SECT.
CHK'D BY	DLC	7/15/92		REVISION



LEGEND

- SUPPLY OR PRODUCTION WELL
- MONITORING WELL
- TEST BORING
- PETROLEUM PIPE LINE
- HYDROCARBON STAINED SOIL
- EXTENT OF AREA APPARENTLY IMPACTED

0 100 200 300

GRAPHIC SCALE IN FEET

REVISIONS				APPROVED	
BY	DATE	DESCRIPTION		BY	DATE

FIGURE 3

TEXACO
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PORT ARTHUR, TEXAS

SITE MAP

	INITIALS	DATE	B M	SCALE GRAPHIC
DRAWN BY	DLH	7/15/92	CHG	SECT.
CHK'D BY	DLC	7/15/92		REVISION