1R - 289

REPORTS

DATE:

6/98-

SUBSURFACE ENVIRONMENTAL ASSESSMENT REPORT
COOPER-JAL UNIT SOUTH INJECTION STATION
LEA COUNTY, NEW MEXICO

Prepared for:

Texaco Exploration and Production, Inc.
205 East Bender
Hobbs, New Mexico

Prepared by:

Highlander Environmental Corp.
1910 North Big Spring Street
Midland, Texas

June 1998

Ike Tavarez
Senior Geologist\Project Manager

Mark J. Larson
Senior Project Manager

Table of Contents

Section			Page
LIST OF TABLES			ii
LIST OF FIGURES			iii
LIST OF APPENDICES			iv
1.0	INTRODUCTION		1
	1.1	Background	1
	1.2	Previous Investigations	1
		1.2.1 Environmental Spill Control, Inc. Investigations	1
		1.2.2 Highlander Environmental Corp. Investigation	3
	1.3	Regulatory Correspondence	4
2.0	SITE SETTING		4
	2.1	Topography	4
	2.2	Soils	5
	2.3	Geology	5
	2.4	Groundwater	6
3.0	SUBSURFACE ASSESSMENT ACTIVITIES		6
	3.1	Electromagnetic (EM-34) Terrain Conductivity Survey	6
	3.2	Monitor Well Drilling and Installation	8
	3.3	Groundwater Sampling and Analysis	10
	3.4	Water Well Survey	12
4.0	CONCLUSIONS		13
5.0	PROPOSED REMEDIATION PLAN		15

List of Tables

Table

1. **Summary of Monitor Well Drilling and Completion Details**
2. **Summary of Inorganic Analysis of Groundwater Samples From Monitor Wells**
3. **Summary of Water Wells Within 1-Mile**

List of Figures

Figure

1. Site Location and Topographic Map
2. Site Drawing
3. Structure Contour Map of Top of Triassic-age Chinle Formation
4. Depth-to-Groundwater, 5/18/98
5. Groundwater Potentiometric Surface (Shallow), 5/18/98
6. Groundwater Potentiometric Surface (Deep), 5/18/98
7. Ogallala Formation Saturated Thickness, 5/18/98
8. EM-34 - 40 Meter HD Conductivity Map
9. EM-34 - 40 Meter VD Conductivity Map
10. Isopleth Map of Chloride Concentration (Shallow)
11. Isopleth Map of Chloride Concentration (Deep)
12. Isopleth Map of TDS Concentration (Shallow)
13. Isopleth Map of TDS Concentration (Deep)
14. Water Wells Within 1-Mile
15. Proposed Recovery Well Location

List of Appendices

Appendix

A. Correspondence

B. EM-34 Field Sheets

C. Borehole Sample Logs

D. Monitoring Well Construction Diagrams

E. Trace Analysis, Inc. Laboratory Reports

F. Water Well Records

SUBSURFACE ENVIRONMENTAL ASSESSMENT REPORT
COOPER-JAL UNIT SOUTH INJECTION STATION
LEA COUNTY, NEW MEXICO

1.0 INTRODUCTION

Highlander Environmental Corp. (Highlander) has been requested by Texaco Exploration and Production, Inc. (Texaco) to perform a subsurface environmental assessment of the Cooper-Jal Unit South Injection Station (Site), located approximately 5.5 miles northwest of Jal, New Mexico. The Site is situated in the northwest quarter (NW/4), NW/4, SE/4, Section 24, Township 24 South, Range 36 East, Lea County, New Mexico. Figure 1 presents a Site location and topographic map. Figure 2 presents a Site drawing.

1.1 Background

The Site is used as an oil field tank battery and injection station. The Site includes numerous aboveground storage tanks, pumps, associated piping and equipment. Previously, an unlined emergency overflow pit was located at the Site. The pit was used for temporary storage of produced water. The pit was located near the west side of the Site and measured approximately 50' x 170' x 12'. The pit was operated until August 1996, when it was permanently closed. Figure 2 shows the approximate location of the pit.

1.2 Previous Investigations

1.2.1 Environmental Spill Control, Inc. Investigation

Environmental Spill Control, Inc. (ESCI), Hobbs, New Mexico, was contracted by Texaco to conduct a subsurface investigation of the pit prior to its closure. The purpose of the investigation was to determine if a release had occurred from the pit and if soil and groundwater

had been affected. The investigation consisted of drilling five (5) boreholes in and around the pit, and collection of soil samples for laboratory testing. The boreholes were drilled from 15 and 100 feet below ground surface (BGS). Soil samples were collected and analyzed for total petroleum hydrocarbons (TPH). The highest TPH concentration reported in the soil samples was 14,890 parts per million (PPM) from a location near the south end of the pit. The soil samples were also analyzed for benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX), which reported no levels of these constituents above the test method detection limits. A soil sample was also tested for RCRA metals by Toxicity Characteristic Leaching Procedure (TCLP), and reported no concentrations above the test method detection limits. The investigation was documented in a report submitted to Texaco on October 14, 1993. A copy of the report is presented in Appendix A.

On July 5, 1996, Texaco filed a notice of intent to close the pit with the OCD (Appendix A). Texaco contracted Western Environmental Consultants (WEC), Hobbs, New Mexico, to supervise closure of the pit. Globe Construction Co., Inc., Hobbs, New Mexico was contracted to excavate the pit. Closure of the pit began on August 1, 1996. Approximately 1,248 cubic yards of hydrocarbon affected soil was removed from the pit and disposed at Parabo, Inc., Eunice, New Mexico. Soil samples from the bottom of the excavation were analyzed for TPH and confirmed that all hydrocarbon-impacted soil had been removed. Approximately 1,091 cubic yards of clay was placed in the bottom of the excavation as a "buffer zone". The excavation was filled to grade with approximately 3,360 cubic yards of caliche, which was placed over the clay. The pit closure activities were documented in a report dated August 30, 1996, which was forwarded to Texaco (Appendix A). Texaco submitted the pit closure report to the OCD on December 13, 1996. On January 17, 1997 and July 10, 1997, the OCD requested Texaco to provide additional information before it could approve final closure of the pit. The request included information of the vertical extent of chloride in soil beneath the pit. On July 14, 1997, Texaco responded to the OCD's request for additional information, however, information concerning the vertical extent of chloride in soil was not available.

1.2.2 Highlander Environmental Corp. Investigation

On August 22, 1997, Highlander conducted an investigation to define the vertical extent of chloride in soil beneath the pit. The investigation consisted of installation of a rotary drilled borehole (BH-1) near the southeast corner of the pit. The borehole was drilled to approximately 100 feet BGS, and soil samples were collected from 15-17 feet BGS, and every ten (10) feet thereafter (i.e., 20'-22', 30-32', 40-42', etc.) to 100 feet. The soil samples were analyzed for chloride and reported concentrations from 580 milligrams per kilogram (mg/kg) from 15'-17' to 2,500 mg/kg from 80'-82'.

On September 9-10, 1997, following receipt of the initial sample results, the depth of the borehole was extended to approximately 173 feet BGS. The borehole was terminated in shale (clay) of the Triassic-age Chinle Formation. Soil samples were collected at 110'-112', 120'-122', 130'-132' and 140'-142' BGS. Groundwater was encountered at 142 feet BGS. The soil samples were analyzed for chloride, and reported levels from 500 mg/kg (110'-112' BGL) to 1,200 mg/kg (130'-132'). The chloride level decreased to 210 mg/kg when groundwater was encountered. The soil samples was visually examined for lithology, and a borehole sample log was prepared. The borehole sample log and laboratory reports were submitted to the OCD on October 10, 1997 (Appendix A).

Following review of the October 10, 1997 report, the OCD required Texaco to install a monitor well near borehole BH-1 to evaluate potential impacts from chloride. On September 10, 1997, Highlander supervised installation of monitor well MW-1 adjacent to borehole BH-1. Scarborough Drilling, Inc. drilled the well to a depth of approximately173 feet BGS. The well was constructed with 2-inch diameter schedule 40 PVC screen and casing. The well screen was placed from about 128 to 173 feet BGS. Following installation, the well was developed and groundwater samples were collected and analyzed for major cations and antions. Chloride was reported in the groundwater sample at 8,500 milligrams per liter (mg/L), and exceeded the New Mexico Water Quality control Commission (WQCC) domestic water supply standard of 250 mg/L

(20 NMAC 6.2, 3103 B). A total dissolved solids (TDS) concentration of 15,000 mg/L was also reported in the groundwater sample, and exceeded the WQCCC standard of 1,000 mg/L. Highlander reported the results to Texaco on October 10, 1997. The report, titled, "Preliminary Investigation Findings, Notification of Release and Proposed Additional Investigations, Emergency Overflow Pit (Closed), Texaco Exploration and Production, Inc., Cooper-Jal Unit South Injection Station and Tank Battery, NW/4, SE/4, Section 24, Township 24 South, Range 36 East, Lea County, New Mexico", was also submitted to the OCD (Appendix A).

1.3 Regulatory Correspondence

On December 16, 1997, the OCD approved the investigation plan submitted on October 10, 1997. The OCD required a report to be submitted by March 13, 1998. However, due to drilling contractor delays, and the need to install additional monitor wells, Highlander was required to request extensions for delivery of the report. Extensions were requested in writing on March 2, 1998 and April 16, 1998, and verbal approval was granted by Mr. William C. Olson with the Environmental Bureau of the OCD. A due date of June 13, 1998 was proposed for submittal of a final report.

2.0 SITE SETTING

2.1 Topography

The topography slopes gently from northwest to southeast toward Monument Draw located approximately 7.5 miles southeast of the Site. The Site is situated at an elevation of approximately 3,315 feet above mean sea level (AMSL). Storm water runoff generally follows the topography and flows to the southeast.

2.2 Soils

The Pyote and Maljamar fine sand (PU) underlies the Site. The Pyote and Maljamar fine sand consists of approximately 45% Pyote fine sand, 45% Maljamar fine sand and 10% inclusions of Palomas and Kermit soils. This soil is restricted to southern Lea County, New Mexico, and is used for range, wildlife habitat and recreational areas. The soil has a moderately rapid permeability and rapid water intake. The Pyote-Maljamar fine sand consists of a surface layer of light-brown fine sand, approximately 0 to 30 inches thick. A reddish-yellow fine sandy loam subsoil underlies the surface layer, approximately 10 inches thick. The subsoil is underlain by approximately 8 inches of light-brown fine sandy loam, followed by about 12 inches of pink fine sandy loam.

2.3 Geology

The Site is located within the Central Basin Platform of the Permian Basin, and is underlain by the Pliocene-age Ogallala Formation. The Ogallala Formation consists of unconsolidated deposits of reddish-brown fine-grained calcareous sand and minor deposits of clay, silt and gravel (Nicholson and Clebsch, 1961). Locally, the Ogallala Formation also contains thin beds of red to dark red, very hard to crystalline sandstone and is capped by a dense layer of caliche, commonly referred to as "caprock". Based on Site-specific data, the Ogallala Formation is about 164 to 173 feet thick.

The Ogallala Formation is underlain by the Triassic-age Chinle Formation. The Chinle Formation consists of red and green mudstone, minor fine-grained sandstone and siltstone. The Chinle Formation has a maximum thickness of about 1,270 feet. Beneath the Site, the surface of the Chinle Formation has been eroded. About 5.4 feet of topographic relief was observed on the pre-Ogallala surface beneath the Site. The elevation of the surface of the Chinle Formation ranges from about 3144.95 feet AMSL near well MW-8, to 3150.35 feet AMSL near well MW-7. Figure 3 presents a structure contour map of the surface of the Chinle Formation, and indicates a

topographically high area in the vicinity of well MW-7.

2.4 Groundwater

Groundwater occurs under unconfined conditions in the Ogallala Formation (commonly referred to as the Ogallala aquifer). On May 18, 1998, groundwater occurred at depths from 130.66 feet BGS (MW-3) to 135.42 feet BGS (MW-2). Figure 4 presents a depth-to-groundwater map for May 18, 1998. On May 18, 1998, the elevation of the upper (shallow) portion of the Ogallala aquifer ranged from 3184.59 feet AMSL at well MW-2A (up gradient) to 3179.91 feet AMSL at well MW-9A (down gradient). Groundwater flow in the shallow portion of the Ogallala aquifer was from northwest to southeast at a gradient of approximately 0.003 feet per foot. Figure 5 presents a groundwater potentiometric surface map for the shallow portion of the Ogallala aquifer. On May 18, 1998, the elevation of the lower (deeper) portion of the Ogallala aquifer ranged from 3185.56 feet AMSL at well MW-3 (up gradient) to 3179.90 feet AMSL at well MW-9 (down gradient). Groundwater flow in the deep portion of the Ogallala aquifer was also from northwest to southeast at a gradient of approximately 0.003 feet per foot. Figure 6 presents a groundwater potentiometric surface map for the deep portion of the Ogallala aquifer on May 18, 1998. The groundwater flow direction reported on May 18, 1998 was consistent with published information (Nicholson and Clebsch, 1961). Figure 7 presents a saturated thickness map for the Ogallala aquifer. Referring to Figure 7, the saturated thickness of the Ogallala aquifer ranged from 30.86 feet (MW-10) to 40.34 feet (MW-3). The saturated thickness decreases from west to east, which is likely due to eastward thinning of the Ogallala Formation. Recharge to the Ogallala aquifer occurs through infiltration of precipitation.

3.0 SUBSURFACE ASSESSMENT ACTIVITIES

3.1 Electromagnetic (EM-34) Terrain Conductivity Survey

An electromagnetic (EM-34) terrain conductivity survey was conducted at the Site on

January 13 - 14, 1998 and May 7, 1998. Highlander conducted the EM-34 survey to determine areas of elevated terrain conductivity, which typically correlates with areas of elevated chloride in soil and groundwater. The EM-34 instrument measures terrain conductivity by imparting an alternating electrical current to the instrument transmitter coil, which is positioned near the earth's surface. A magnetic field, produced as the current passes through the transmitter coil, induces small electrical currents into the subsurface soil. The electrical currents produce a secondary magnetic field, which is sensed, with the primary magnetic field by a receiver coil. The terrain conductivity, which is linearly proportional to the ratio of the secondary magnetic field to the primary magnetic field, is displayed in analog form representing millimhos per meter (mmhos/m). The EM-34 instrument detects changes in ground conductivity, and was selected for use at the Site since produced (brine) water may have been discharged from the Pit. The instrument's exploration capability is dependent on the spacing between the transmitter coil and receiver coil (intercoil spacing), which is measured in meters, and the orientation of the transmitter and receiver coils (horizontal or vertical). The depth of exploration for the EM-34 ranges from 24.6 to 196.8 feet BGS.

The EM-34 survey was performed in the horizontal dipole (HD) and vertical dipole (VD) modes, using a 40-meter intercoil separation, which yielded exploration depths of 0 to 98.4 feet (HD mode) and 0 to 196.9 feet (VD mode). Prior to conducting the EM-34 survey, grids measuring approximately 100 x 100 feet were established at the Site to allow accurate collection and plotting of data. Initially, the area measured approximately 800 x 800 feet. However, on May 7, 1998, the area was expanded to 1100 x 1400 feet. A background station, free of cultural interference (i.e., overhead and underground power lines, pipelines, fences, etc.), was selected northwest of the Site. The background station consisted of three (3) measurement points (A, B and C), at which HD and VD measurements were collected. The background measurements were compared to Site measurements to determine areas of elevated terrain conductivity. Cultural interference in the form of above ground and below ground pipe lines, as well as underground and overhead power lines were observed at the Site. Figure 2 presents a Site drawing showing the locations of the EM-34 measurement stations and observed cultural interference.

At each measurement station, terrain conductivity measurements were collected in the HD and VD modes. The measurements were recorded on field forms and later transferred to drawings. Figure 8 presents the EM-34 terrain conductivity map for the 40-meter HD survey and Figure 9 presents the EM-34 terrain conductivity map for the 40-meter VD survey. Referring to Figure 8, the EM-34 -40 meter HD survey recorded background readings from 14 to 15 mmhos/m. Measurements greater than two to nearly three times background were recorded near the former pit. The elevated EM-34 readings suggest that chloride impacts to unsaturated zone soils may have occurred. A broad area of slightly elevated terrain conductivity (i.e., 16 to 22 mmhos/m) readings trends from northwest to southeast across the Site, and generally corresponds with the groundwater flow direction. Several anomalies, possibly associated with below ground and above ground pipelines, were observed near stations South 300 and East 400, South 200 and East 1100, and from South 700 and East 400 to South 700 and East 800.

Referring to Figure 9, the 40 meter VD survey recorded measurements nearly 100 times background near the former pit. This area corresponds with elevated readings observed from the 40 meter HD survey. The EM-34 measurements suggest that chlorides have migrated vertically into the deeper portion of the Ogallala Formation. A broad area of elevated EM-34 readings, approximately two to three times background, trending northwest to southeast, was observed in the area observed in the HD mode, also suggesting that chlorides have migrated vertically and encountered groundwater. This area of elevated readings generally trends with the direction of groundwater flow. An area of elevated EM-34 readings (greater than 100 mmhos/m) was also observed in the vicinity of well MW-7, and corresponds to the erosional feature observed on the Chinle Formation. An area of west to east readings from stations South 800 and East 900 to East 1100 are likely associated with above ground or below ground pipelines. Appendix B presents the EM-34 field sheets.

3.2 Monitor Well Drilling and Installation

From February 9 - 13, and May 12 - 14, 1998, Highlander personnel supervised drilling and

installation of thirteen (13) monitor wells. Scarborough Drilling, Inc., Lamesa, Texas drilled the wells, using a truck-mounted water rotary drilling rig. Samples of cuttings were collected during drilling and visually examined for lithologic properties. Lithologic sample logs were prepared for each borehole, based on the visual examination. Appendix C presents the borehole sample logs.

Based on the EM-34 survey (January 13 - 14, 1998), Highlander selected locations for installation of five deep monitor wells (MW-2 through MW-5) and three shallow monitor wells (MW-2A, MW-4A and MW-5A). Well MW-3 was located hydraulically up gradient (northwest) of the Site, and was installed as a background well location. Well MW-2 was located east of the pit and in the central location of the Site, where elevated EM-34 terrain conductivity measurements were recorded. Wells MW-4, MW-5 and MW-6 were installed south, southeast and east of the Site, respectively, to evaluate down gradient groundwater quality. The monitoring wells were drilled to depths ranging from about 170 to 173 feet BGS, and completed using two (2) inch diameter schedule 40 PVC threaded casing and factory slotted screen. The well screen, approximately ten (10) feet in length, was positioned near the base of the Ogallala aquifer to determine the extent, if any, of density stratification from chloride. The well screen was surrounded by a filter pack consisting of 8-16 graded silica sand. The sand was placed to a depth approximately 3 to 5 feet above the screen. A layer of bentonite pellets, approximately 3 to 5 feet thick, was placed in the annulus above the sand. The remainder of the annulus was filled with Portland cement and bentonite grout.

The OCD, as a condition of its approval of the investigation plan, required that Texaco install a minimum of three shallow monitor wells to investigate the presence of phase-separated hydrocarbons on the groundwater and density stratification of chloride in groundwater. The shallow wells (MW-2A, MW-4A and MW-5A) were installed adjacent to the deep wells at each corresponding location. The wells were drilled to depths from 141 to 145 feet BGS, and the well screens, approximately 15 feet in length, were positioned in the boreholes, with approximately five feet of screen above the groundwater level observed in the adjacent deep monitor well. The well screens were surrounded with a filter pack, consisting of 8-16 graded silica sand, which was placed in the annulus of the borehole to a depth approximately 3 to 5 feet above the screen. The remainder of the borehole was completed as previously mentioned. The wells are secured with locking caps and

steel protectors that were placed around the PVC casing and cemented into a concrete pad measuring about 3 x 3 feet.

Following receipt of the laboratory report of groundwater samples collected from the monitor wells, it was determined that additional monitor wells were necessary to fully delineate the extent of chloride impact to groundwater. On May 7, 1998, Highlander expanded the area of the EM-34 survey. Locations were selected for four additional deep monitor wells (MW-7 through MW-10) and one additional shallow monitor well (MW-10), following an evaluation of the expanded EM-34 terrain conductivity survey results. The OCD permitted the monitor wells to be installed with fifteen feet of screen, rather than ten feet of screen, as previously required, which allowed for use of a submersible pump for purging, due to additional groundwater yields. Table 1 presents a summary of monitor well drilling and completion details. Appendix D presents construction diagrams for the monitor wells.

Scarborough Drilling, Inc., using the drilling rig and a retrievable bailer, developed the monitoring wells. Water removed from the wells was containerized in 55-gallon drums, and later disposed by Chaparral Services, Inc., Eunice, New Mexico, at an OCD approved disposal well. The bailer and drilling rig were thoroughly decontaminated between wells using high-pressure hot water. Soil displaced during drilling was piled next to the monitor wells. Piper Surveying, Inc., Gardendale, Texas, a New Mexico licensed professional land surveyor, surveyed the monitor wells for elevation.

3.3 Groundwater Sampling and Analysis

From February 25 - 27, 1998, Highlander personnel collected groundwater samples from wells MW-1 through MW-6, including shallow wells MW-2A, MW-4A and MW-5A. Prior to sample collection, the wells were purged of groundwater using dedicated disposable polyethylene bailers. Water purged from the wells was placed in 55-gallon drums and disposed by Chaparral Services, Inc., Eunice, New Mexico, at an OCD approved disposal well. The samples were placed

in laboratory prepared containers, and submitted under chain-of-custody control to Trace Analysis, Inc., Lubbock, Texas. The samples were analyzed for BTEX, polynuclear aromatic hydrocarbons (PAH), WQCC metals, TDS, major cations and anions. The samples for metals were field filtered at the time of sample collection. No concentrations of BTEX, PAH or metals were reported above the test method detection limits in the groundwater samples.

On May 12 and 13, 1998, groundwater samples were collected from wells MW-7 through MW-10, including MW-9A. Since samples from wells MW-1 through MW-6, including MW-2A, MW-4A and MW-5A, did not report detectable levels of BTEX, PAH or metals, samples from wells MW-7 through MW-10 and MW-9A were only analyzed for TDS, major cations and anions. The wells were purged of groundwater using electric submersible pump. The purged water was placed in 55-gallon drums and disposed by Chaparral Services, Inc., Eunice, New Mexico, at an OCD approved disposal well. Appendix E presents the laboratory report. The TDS and general chemistry analyses are summarized in Table 2.

The WQCC standards for chloride, TDS and sulfate are 250 mg/L (chloride), 1,000 mg/L (TDS) and 600 mg/L (sulfate), for domestic drinking water. Concentrations of chloride were reported in shallow well groundwater samples from 190 mg/L (MW-5A) to 1,600 mg/L (MW-4A). Figure 10 presents an isopleth map for chloride in shallow groundwater. The chloride levels reported in groundwater from shallow wells MW-2A (280 mg/L), MW-9A (600 mg/L) and MW-4A (1,600 mg/L), exceeded the WQCC standard. The chloride level reported in groundwater from well MW-5A (190 mg/L) was below the domestic water supply standard. The area of chloride impact in the shallow portion of the aquifer correlates with the EM-34 data, and indicates that limited lateral dispersion has occurred.

Referring to Figure 11, chloride in groundwater samples from the deep monitor wells ranged from 270 mg/L (MW-8) to12, 000 mg/L (MW-4). Wells MW-2 and MW-4 were re-sampled on April 9, 1998, and reported chloride at 8,200 mg/L (MW-2) and 13,000 mg/L (MW-4). Based on the laboratory tests, chloride levels in groundwater samples from all wells, including the up gradient

well, MW-3, exceeded the WQCC standard of 250 mg/L. The area of elevated chloride correlates with elevated EM-34 readings. Based on these data, the area of impacted groundwater was defined.

Figures 12 and 13 present isopleth maps of TDS concentrations in the shallow and deep portions of the Ogallala aquifer, respectively. Referring to Figure 12, the TDS concentrations in groundwater from the shallow wells ranged from 740 mg/L (MW-5A) to 2,200 mg/L (MW-9A). Groundwater samples from all wells, except well MW-5A, exceeded the WQCC domestic water supply standard of 1,000 mg/L. The distribution of TDS in the shallow portion of the aquifer correlates with the distribution of chloride. The distribution of TDS in the deep portion of the aquifer (Figure 13) also correlates with the distribution of chloride. Groundwater samples from all wells, including the background well (MW-3) exceeded the WQCC standard for TDS. On April 9, 1998, groundwater samples were collected from wells MW-2 and MW-4, and reported TDS concentrations of 15,000 mg/L (MW-2) and 23,000 mg/L (MW-5). Based on these data, the area of elevated TDS in the deep portion of the aquifer was defined.

Sulfate exceeded the WQCC standard of 600 mg/L in groundwater from deep wells MW-2 990 mg/L), MW-4 (1,500 mg/L), and MW-5 (910 mg/L). The only shallow well reporting sulfate above the WQCC standard was well MW-9A (770 mg/L).

3.4 Water Well Survey

Highlander conducted a review of the New Mexico State Engineer's files to locate water wells within 1-mile of the Site. A total of three (3) wells were identified. The wells are located northwest (up gradient) of the Site. Figure 14 presents a map showing the locations of the water wells. Table 3 presents a summary of the water well drilling and completion details. Appendix F presents the water well records.

Referring to Table 3, Humble Oil Company drilled two of the wells in about 1941. These wells were likely drilled during early development of the oil field and used as a source of water for

the drilling rigs. The third well was drilled on behalf of Mr. Fred Cooper, and appears to be a domestic water well. It is unlikely that impacts detected in groundwater at the Site will affect these wells. There were no down gradient receptors identified from the water well search.

4.0 CONCLUSIONS

1. On May 18, 1998, groundwater occurred at depths from 130.66 feet BGS (MW-3) to 135.42 feet BGS (MW-2). The elevation of the upper (shallow) portion of the Ogallala aquifer ranged from 3184.59 feet AMSL at well MW-2A (up gradient) to 3179.91 feet AMSL at well MW-9A (down gradient). The elevation of the lower (deeper) portion of the Ogallala aquifer ranged from 3185.56 feet AMSL at well MW-3 (up gradient) to 3179.90 feet AMSL at well MW-9 (down gradient). Groundwater flow in the shallow and deep portions of the Ogallala aquifer was from northwest to southeast at a gradient of approximately 0.003 feet per foot. The groundwater flow direction was consistent with published information.

2. The EM-34-40 meter HD survey recorded measurements at background stations A, B and C ranging from 14 to 15 mmhos/m. Measurements greater than two to nearly three times background were recorded in the vicinity of the former pit and central area of the Site, suggesting that that impacts to the unsaturated zone soils have occurred. A broad area of slightly elevated terrain conductivity (i.e., 16 to 22 mmhos/m) readings trends from northwest to southeast across the Site, and generally corresponds with the groundwater flow direction. Several anomalies observed near stations South 300 and East 400, South 200 and East 1100, and from South 700 and East 400 to South 700 and East 800, are possibly associated with below ground and above ground pipelines.

3. The 40 meter VD survey recorded measurements approximately 100 times background in the vicinity of the former pit and central area of the Site, suggesting

that the subsurface impact has migrated vertically into the deeper portion of the Ogallala Formation. A broad area of elevated EM-34 readings, approximately two to three times background, trending northwest to southeast, was observed in the general area of elevated readings observed in the HD mode, also suggesting that chloride may have migrated vertically and encountered groundwater. The area of elevated readings generally trends with the direction of groundwater flow. An area of elevated EM-34 readings (greater than 100 mmhos/m) was also observed in the vicinity of well MW-7, and may correspond to the erosional feature observed on the surface of the Triassic-age Chinle Formation. An area of west to east readings from stations South 800 and East 900 to East 1100 are likely associated with above ground or below ground pipelines. The EM-34 VD readings near the southern and eastern margins of the survey area, except anomalies previously mentioned, decrease to near background or less, indicating that that the area of soil and groundwater potentially impacted by chlorides was defined.

4. Laboratory results of groundwater sample analysis did not report any concentrations of BTEX, PAH or metals. Chloride, TDS and sulfate were reported in the groundwater above the WQCC domestic water supply standards of 250 mg/L (chloride), 1,000 mg/L (TDS) and 600 mg/L (sulfate). Concentrations of chloride reported in shallow well groundwater samples ranged from 190 mg/L (MW-5A) to 1,600 mg/L (MW-4A), and exceeded the WQCC standard at wells MW-2A (280 mg/L), MW-9A (600 mg/L) and MW-4A (1,600 mg/L). The chloride level reported in groundwater from well MW-5A (190 mg/L) was below the domestic water supply standard.

5. Chloride in groundwater samples from the deep monitor wells (MW-1 through MW-10) ranged from 270 mg/L (MW-8) to12, 000 mg/L (MW-4). The WQCC domestic water supply standard for chloride (250 mg/L) was also exceeded at the up gradient well (MW-3). Based on the EM-34 readings and laboratory analysis of groundwater

samples, the area of impacted groundwater in the deep portion of the aquifer was defined.

6. The TDS concentrations reported in groundwater samples from the shallow wells ranged from 740 mg/L (MW-5A) to 2,200 mg/L (MW-9A), and exceeded the WQCC domestic water supply standard of 1,000 mg/L in all wells, except well MW-5A. The distribution of TDS in the deep portion of the aquifer is generally consistent with the distribution of chloride in the deep portion of the aquifer. The TDS samples from all wells in the deep portion of the aquifer exceeded the WQCC standard for domestic water supplies. Background well MW-3 reported TDS at 1,500 mg/L.

7. A survey of records from the New Mexico State Engineer's file revealed records for three (3) water wells within 1-mile of the Site. The wells are located northwest (up gradient) of the Site and it is unlikely that impacts at the Site will affect the wells. There were no down gradient receptors identified from the water well search.

8. Sulfate exceeded the WQCC standard of 600 mg/L in groundwater from deep wells MW-2 990 mg/L), MW-4 (1,500 mg/L), and MW-5 (910 mg/L). Shallow well MW-9A (770 mg/L) also reported sulfate above the WQCC standard.

5.0 PROPOSED REMEDIATION PLAN

Based on the findings, concentrations of chloride, TDS and sulfate in groundwater exceed the WQCC standards of 250 mg/L, 1,000 mg/L and 600 mg/L, respectively. The impact is greatest approximately 100 feet south of the Site. The impact decreases in concentration to near the WQCC standards approximately 700 feet south to southeast (down gradient) of the Site. Based on a review of records from the New Mexico State Engineer's office, there are no identifiable groundwater receptors south and southeast of the Site. Texaco proposes to implement a groundwater recovery

program to reduce the levels of chloride, TDS and sulfate in the groundwater.

The groundwater recovery system will consist of approximately three (3) recovery wells. However, the final determination regarding the number of recovery wells will be based on a pumping test, which will be performed following installation of the initial well. The initial well will be installed in the area of greatest concentration, near wells MW-4 and MW-4A. The proposed recovery well location is shown on Figure 15. The recovery well will be installed in a borehole drilled to the top of the Triassic-age Chinle Formation. The well will be screened from the bottom of the borehole to approximately five (5) feet above groundwater. The well will be constructed with PVC casing and screen of sufficient diameter for installation of a pitless adapter and electric submersible pump. The well will be constructed in accordance with State of New Mexico water well construction standards. The electric submersible pump will be equipped with an amperage (Coyote) controller, which has an adjustable timer for establishing pumping and resting cycles. The timer will be adjusted to allow sufficient recharge to occur in the aquifer between pumping cycles.

Following installation of the initial recovery well, Highlander will perform a pumping test of sufficient duration (i.e., 12 to 24 hours) to obtain data to perform a computer model for purposes of establishing capture zones. Based on the computer model results, a final determination will be made as to the number and locations of recovery wells needed to obtain capture of the contaminant plume. The recovery wells will be constructed in accordance with the procedures presented above.

Recovered fluid will be conveyed from the well(s) to the Cooper-Jal Unit South Injection Station for placement into the injection stream. The fluids will be transferred through suitable diameter HDPE piping, which will be placed underground or aboveground. The piping will be pressure tested to 3 pounds per square inch (psi) prior to system start-up. A flow meter will be installed at each well to record the volume of fluid recovered.

The recovery well will be monitored weekly during operation and the volume of recovered groundwater will be recorded at the flow meter. Groundwater samples will be collected every six

(6) months (semi-annually) from all wells, and analyzed for chloride, TDS and sulfate. During each semi-annual monitoring event, depth-to-groundwater measurements will be obtained from the recovery well and monitor wells. These measurements will be used to prepare a groundwater potentiometric map to evaluate the performance of the groundwater recovery system, and determine if pumping from the recovery well has decreased the concentration of chloride in groundwater. An annual report will be prepared and submitted to the OCD during April of each calendar year. The report will summarize the groundwater volumes recovered, laboratory analysis and potentiometric maps. Based on the recovery system performance evaluation, recommendations will be made to modify the recovery system (i.e., installation of additional recovery wells), continue or discontinue the current recovery program.

References

Nicholson, Alexander, Jr. and Alfred Clebsch, Jr., 1961, Geology and Ground-water Conditions in Southern Lea County, New Mexico; New Mexico State Bureau of Mines and Mineral Resources, Ground-water Report 6, 123 p.

Turner, M.T., et. al., 1974, Soil Survey of Lea County, New Mexico; U.S. Department of Agriculture, Soil Conservation Service, 89 p.

Ronit Nativ, 1988, Hydrogeology and Hydrogeochemistry of the Ogallala Aquifer, Southern High Plains, Texas Panhandle and Eastern New Mexico; The University of Texas at Austin, Bureau of Economic Geology, Report of Investigation No. 177, 64 p.

TABLES

Table 1: Summary of Monitor Well Drilling and Completion Details, Texaco Exploration and Production Inc., Cooper Jal Unit South Injection Station, Lea County, New Mexico

Monitor Well	Date Drilled	Drilled Depth feet BGS	Ground Elevation feet AMSL	Top of Casing Elevation feet AMSL	Screen Interval feet BGS	Depth-to Groundwater feet BGS 5/18/98
MW-1	9/10/97	173	3320.17	3320.00	153-173	135-22
MW-2	2/12/98	173	3319.86	3319.40	163-173	135-46
*MW-2A	2/13/98	145	3319.86	3319.39	130-145	135-27
MW-3	2/9/98	171	3316.22	3318.21	161-171	130-66
MW-4	2/10/98	171	3317.64	3319.74	161-171	133-91
*MW-4A	2/11/98	143	3317.47	3319.58	128-143	133-57
MW-5	2/11/98	171	3318.95	3321.10	161-171	135-27
*MW-5A	2/12/98	141	3318.96	3321.07	126-141	135-09
MW-6	2/13/98	170	3319.13	3321.15	120-170	134-71
MW-7	5/14/98	166	3316.35	3318.39	151-166	134-15
MW-8	5/12/98	170	3314.95	3317.14	155-170	132-17
MW-9	5/12/98	164	3310.79	3312.79	149-164	130-89
*MW-9A	5/14/98	142	3310.44	3312.56	127-142	130-53
MW-10	5/13/98	166	3317.26	3319.30	151-166	135-14

Notes: All wells drilled by Scarborough Drilling Inc., Lamesa, Texas, and completed with 2" Schedule 40 PVC scree and casing (screw thread)

1. *: Denotes shallow well location
2. BGS: Denotes depth in feet below ground surface
3. AMSL: Denotes elevation in feet above mean sea level

Table 2: Summary of Inorganic Analysis of Groundwater Samples from Monitor Wells, Texaco Exploration and Production, Inc., Cooper-Jal Unit South Injection Station Lea County, New Mexico

Monitor Well	Sample Date	pH S.U.	TDS mg/L	Chloride mg/L	Sulfate mg/L	Alkalinity g/L as CaCo	Potassium mg/L	Magnesium mg/L	Calcium mg/L	Sodium mg/L	Hardness
MW-1	09/16/97	7.1	15,000	8,500	1,100	280	50	630	520	4,300	3,900
	02/25/98	7.4	9,300	5,600	570	280	116	520	285	2,900	2,850
MW-2	02/25/98	7.4	9,400	5,900	760	210	30	380	840	2,650	3,660
	04/09/98	7	15,000	8,200	990	290	29	490	1,100	3,430	4,800
MW-2A	02/26/98	7.9	1,200	280	330	190	6	36	144	215	508
MW-3	02/27/98	7.9	1,500	452	406	190	11	50	200	237	705
MW-4	02/27/98	7.1	22,000	12,000	1,300	230	48	880	1,700	5,300	7,870
	04/09/98	6.7	23,000	13,000	1,500	240	42	840	1,740	5,400	7,800
MW-4A	02/27/98	7.6	3,300	1,600	410	180	11	130	470	620	1,710
MW-5	02/26/98	7.2	12,000	6,600	910	180	31	470	1,400	2,400	5,430
MW-5A	02/26/98	7.9	740	190	180	170	3.5	23	107	117	362
MW-6	02/26/98	7.7	1,200	260	400	200	6.2	44	180	205	631
MW-7	05/14/98	7.5	1,200	430	340	230	13	66	214	165	810
MW-8	05/13/98	7.4	1,200	270	390	200	12	60	190	170	720
MW-9	05/14/98	7.6	1,300	350	470	190	12	61	207	200	770
MW-9A	05/14/98	7.3	2,200	600	770	280	12	96	338	334	1,240
MW-10	05/14/98	7.3	1,400	360	450	240	11	62	211	190	780

Notes: All analysis performed by Trace Analysis, Inc., Lubbock, Texas

1. S.U.: Denotes Standard Units
2. mg/L: Denotes concentration in milligrams per liter

Table 3: Summary of Water Well Drilling and Completion Details
Texaco Exploration and Production, Inc.,
Cooper-Jal Unit South Injection Station,
Lea County, New Mexico

Highlander Well Number	Owner	Date Drilled	Location	Drilled, Depth, feet BGS	Screen Interval feet BGS	Depth-to-Groundwater feet BGS
1	Humble Oil Co. E.E. Hunter Well #1	Sept. 1941	SE/4, NW/4, SW/4 Sec. 13, T-24-S, R-36-E	160	Unknown	Unknown
2	Humble Oil Co. E.E. Humble Well #2	Unknown	NZE/4, SW/4, SW/4 Sec. 13, T-24-S, R-36-E	160	Unknown	Unknown
3	Fred B. Cooper Jal, New Mexico	arch 7-10, 19	NE/4, NE/4 Sec. 23, T-24-S, R-36-E	180	159-175	Unknown

Note: Information obtained from New Mexico State Engineer, Roswell, New Mexico

1. BGS: Denotes depth in feet below ground surface

FIGURES

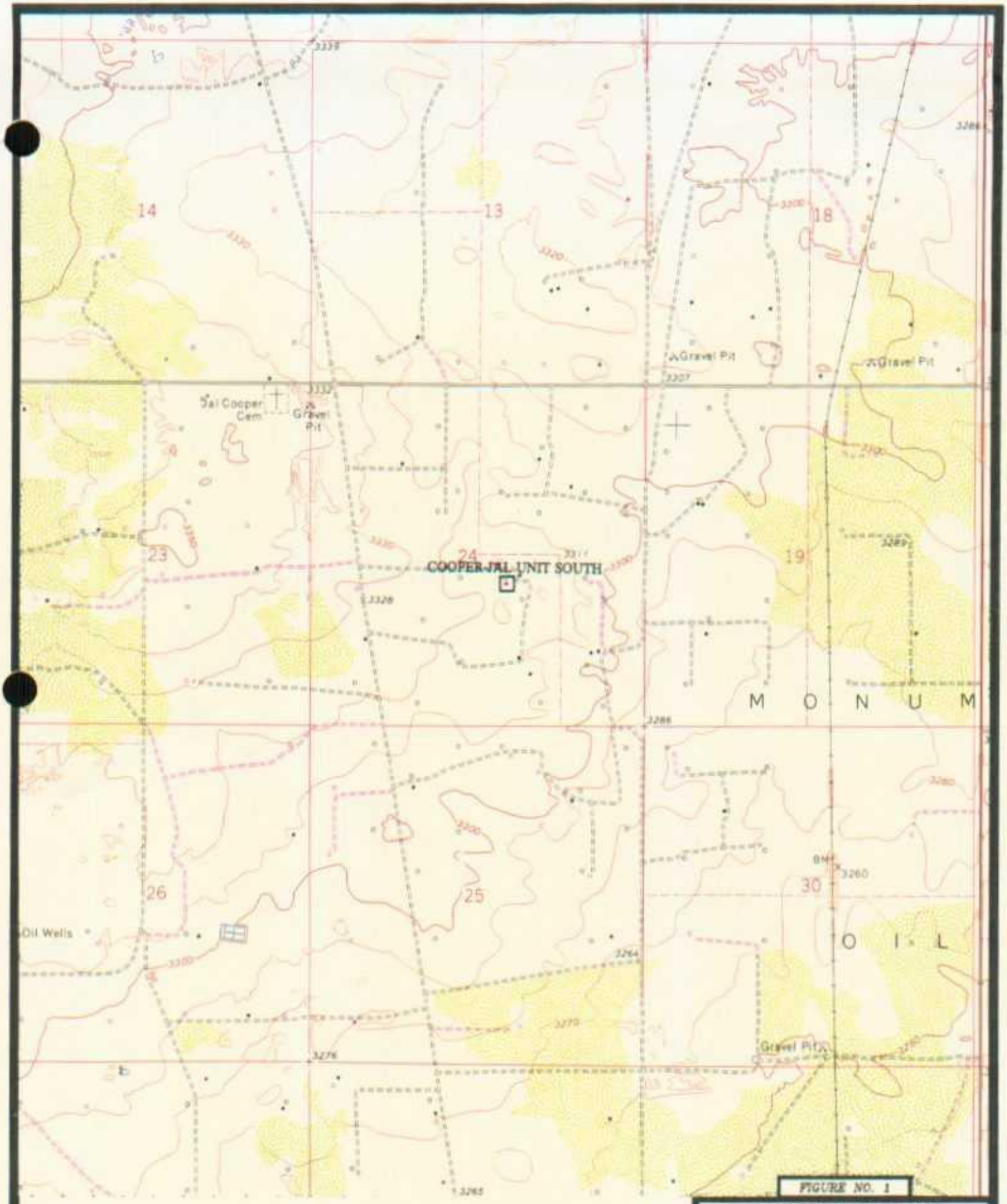


FIGURE NO. 1

LEA COUNTY, NEW MEXICO

TEXACO

EXPLORATION & PRODUCTIION INC.

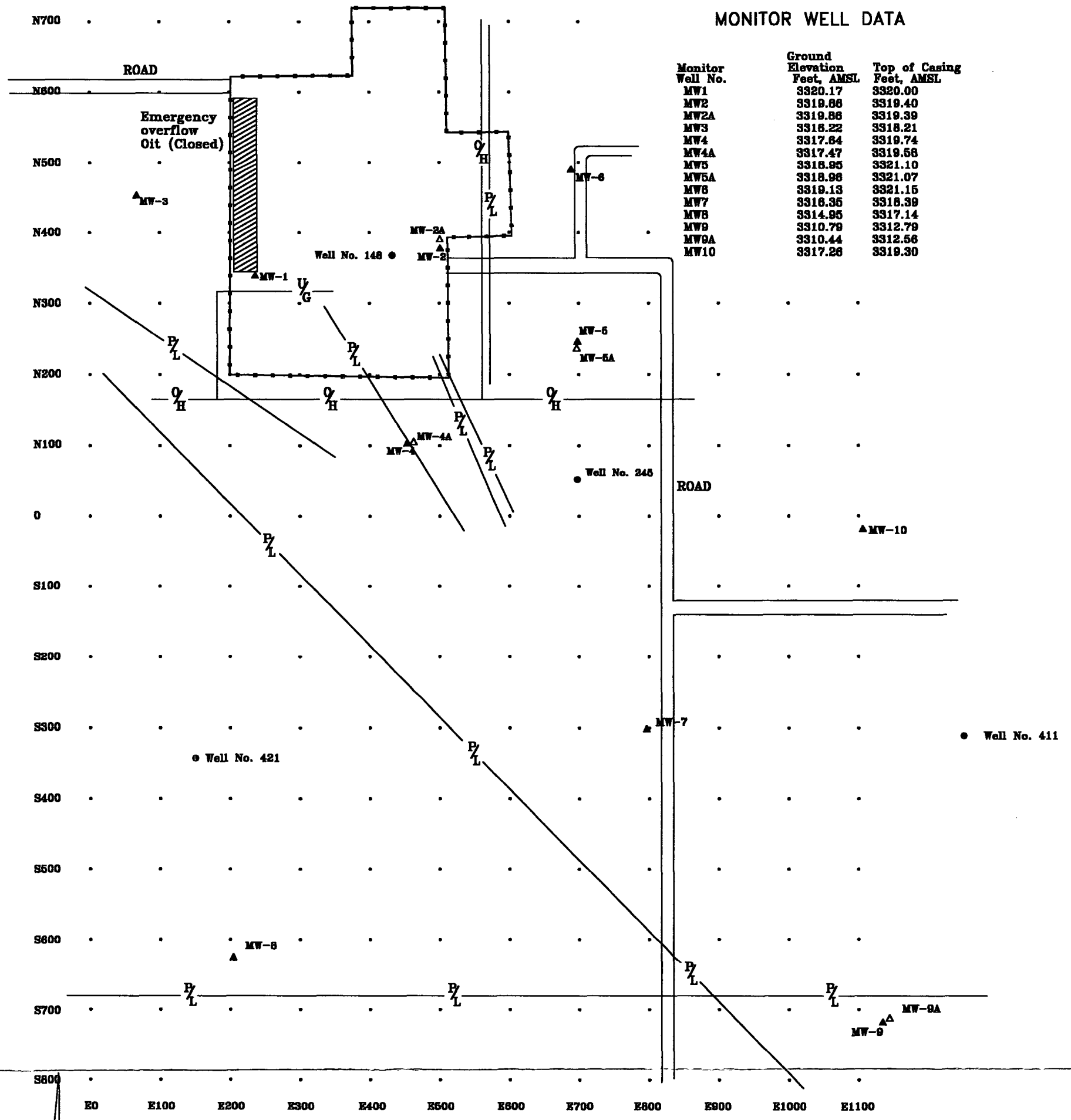
TOPOGRAPHIC MAP

HIGHLANDER ENVIRONMENTAL
MIDLAND, TEXAS

TAKEN FROM U.S.G.S.
JAL NW, NM
7.5' QUADRANGLE

SCALE: 1" = 2000'

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.66	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.56
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3316.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

9,400
MW-2 ▲ = Monitor Well (Deep)

MW-2A △ = Monitor Well (Shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

· = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

P/L = Pipeline

O/H = Overhead Electric

U/G = Underground Electric

N

SCALE
0 50 100

FIGURE 2

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

SITE MAP

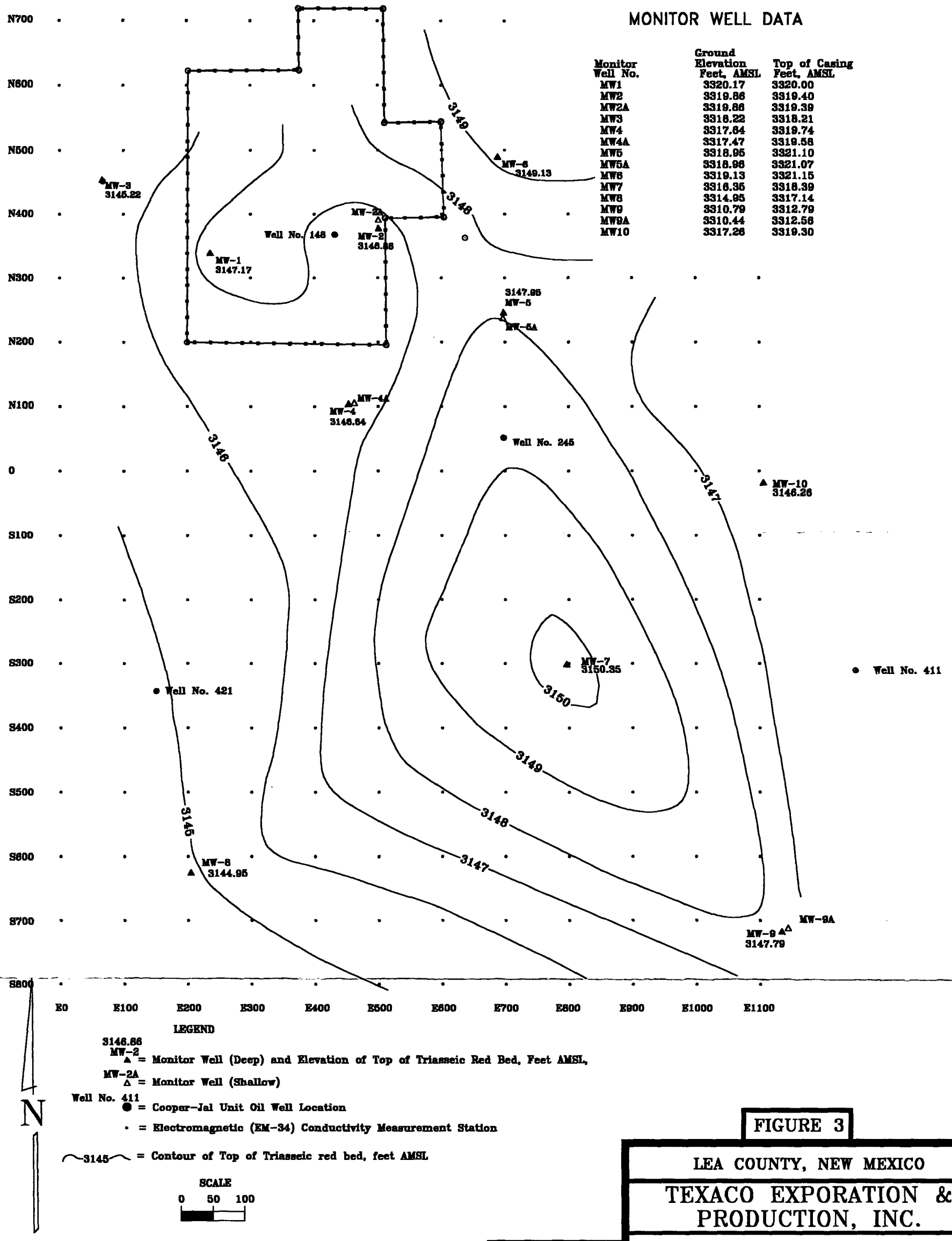
DATE: 6/9/98

DWN. BY: JDA

FILE: C:\TEXACO\996 SITE MAP

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3318.22	3318.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.56
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

3146.66
MW-2 ▲ = Monitor Well (Deep) and Elevation of Top of Triasseic Red Bed, Feet AMSL,

MW-2A △ = Monitor Well (Shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

• = Electromagnetic (EM–34) Conductivity Measurement Station

~3145~ = Contour of Top of Triasseic red bed, feet AMSL

N

SCALE
0 50 100

FIGURE 3

LEA COUNTY, NEW MEXICO

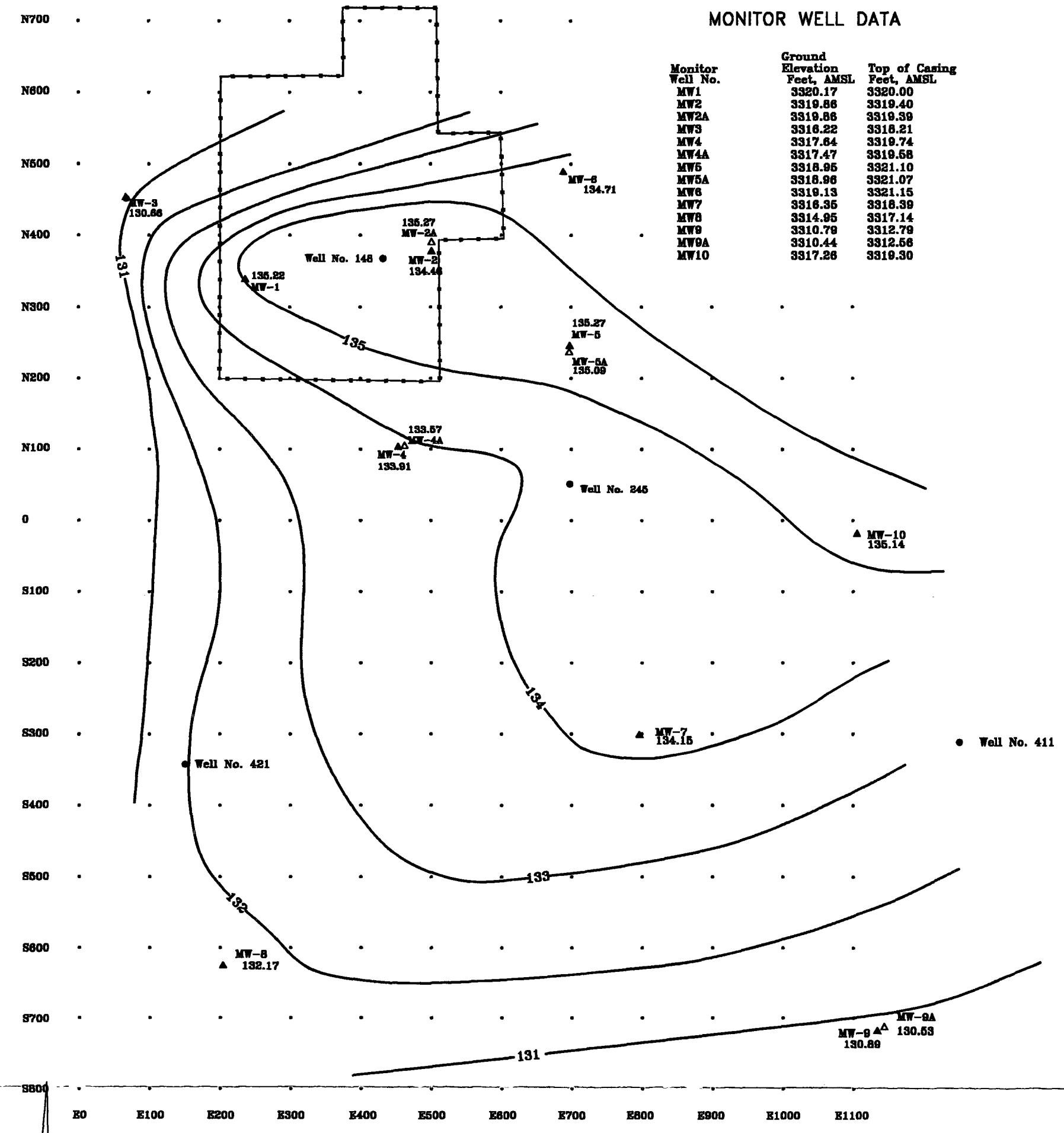
TEXACO EXPORATION & PRODUCTION, INC.

STRUCTURE CONTOUR MAP–
TOP OF TRIASSEIC REDBED

DATE: 6/4/98
DWN. BY: JDA
FILE: C:\TEXACO\996 TRIASSEIC

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3316.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

135.46
MW-2
▲ = Monitor Well (Deep) and Depth-to-Groundwater, Feet BGS, 5/18/98

135.27
MW-2A
△ = Monitor Well (shallow) and Depth-to-Groundwater, Feet BGS, 5/18/98

Well No. 411
● = Cooper-Jal Unit Oil Well Location

• = Electromagnetic (EM-34) Terrain Conductivity Measurement Station

~135~ = Contour of Depth-to-Groundwater, Feet BGS, 5/18/98

N

SCALE
0 50 100

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 DEPTH-GW

FIGURE 4

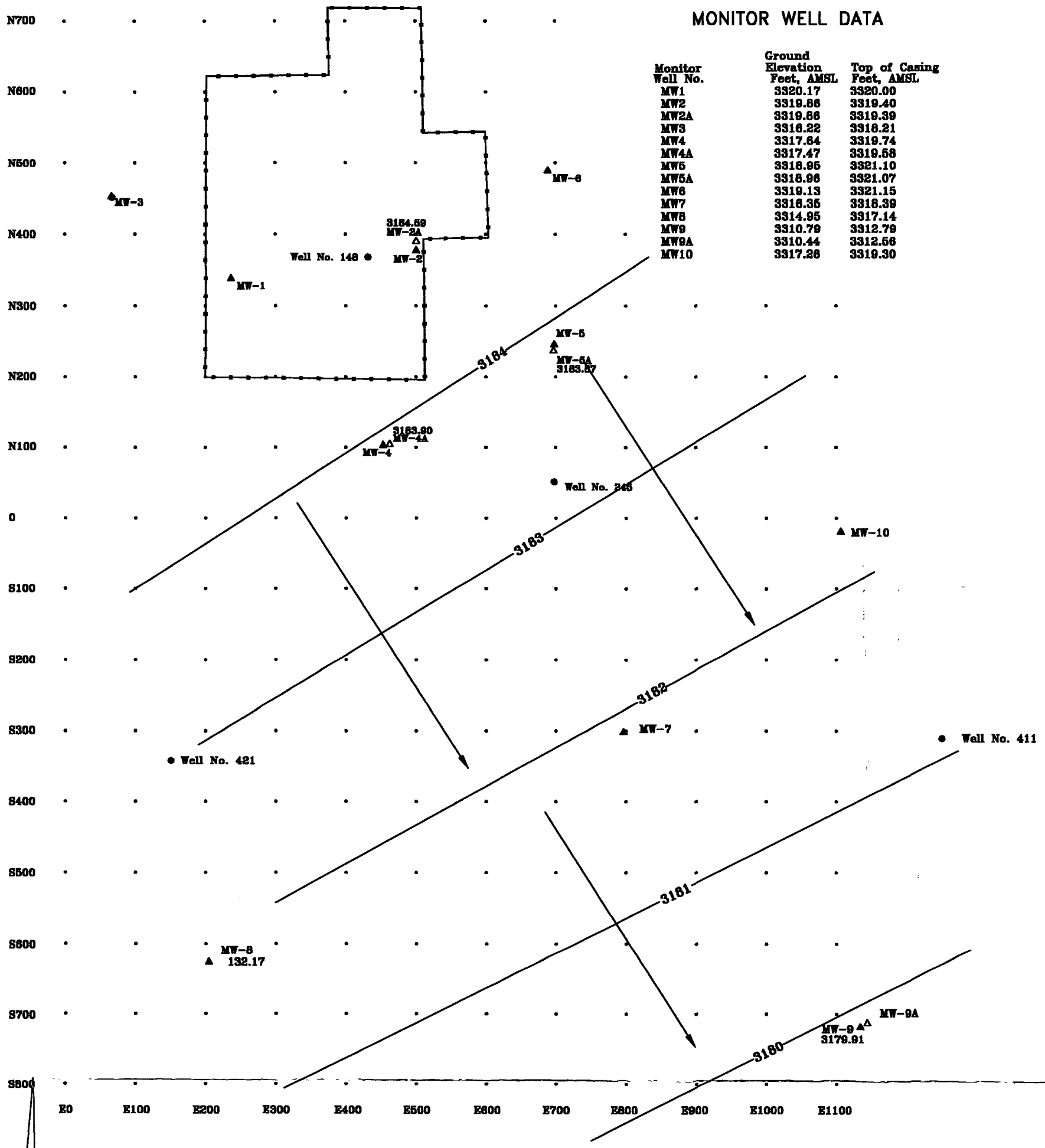
LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

DEPTH-TO-GROUNDWATER MAP
5/18/98

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3318.22	3318.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

MW-2 ▲ = Monitor Well (Deep)

3184.59 MW-2A △ = Monitor Well (shallow) and Groundwater Potentiometric Surface Elevation, Feet AMSL, 5/18/98

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

• = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

135 = Contour of Groundwater Potentiometric Surface Elevation (Shallow), feet AMSL, 5/18/98

→ = Groundwater Flow Direction

N

SCALE
0 50 100

FIGURE 5

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

GROUNDWATER POTENTIOMETRIC SURFACE MAP (SHALLOW) 5/18/98

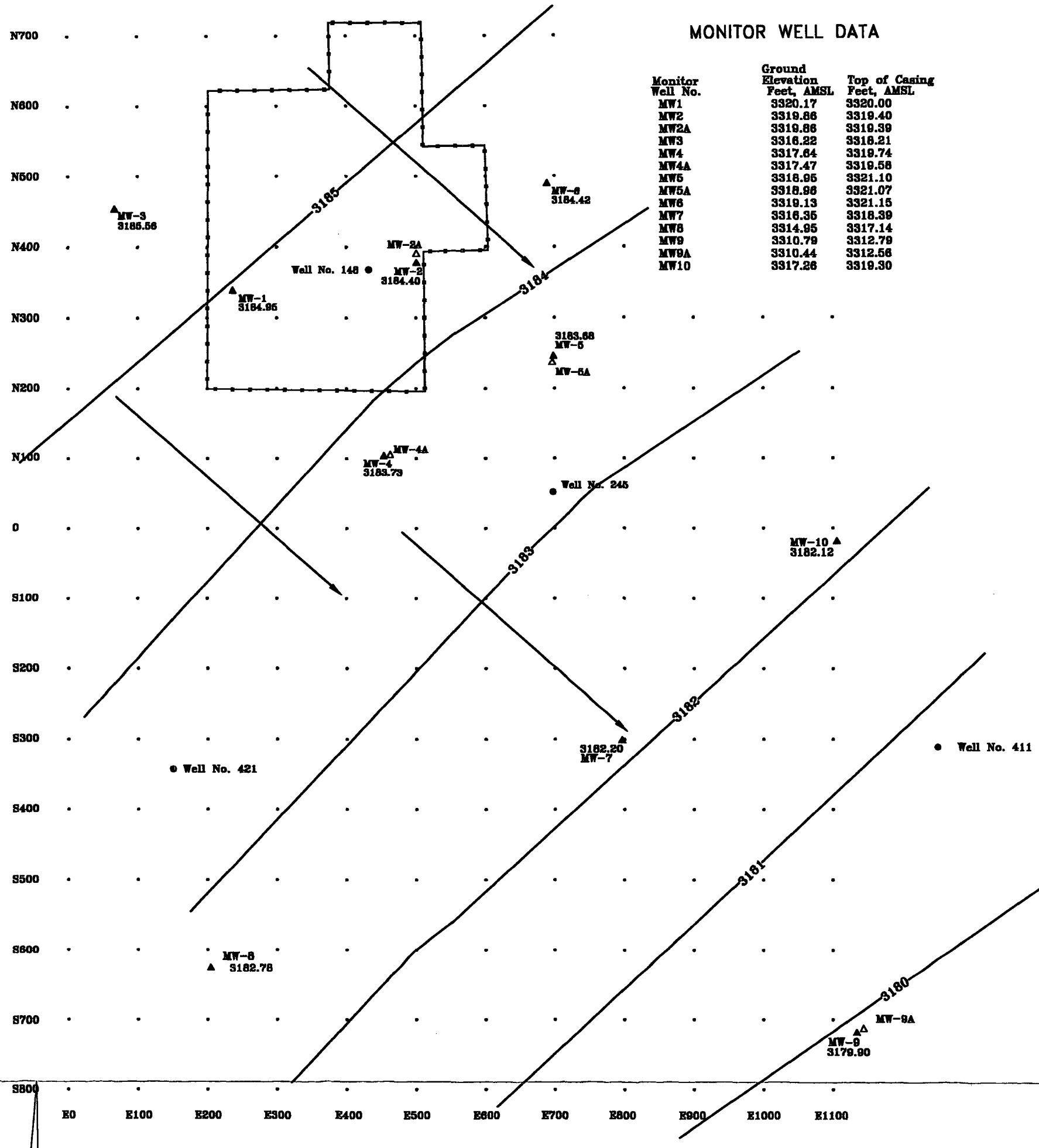
DATE: 6/9/98

DWN. BY: JDA

FILE: C:\TEXACO\996 SHALLOW

HIGHLANDER ENVIRONMENTAL CORP. MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3318.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

3184.40 MW-2 ▲ = Monitor Well (Deep) and Groundwater Potentiometric Surface Elevation, Feet AMSL, 5/18/98

MW-2A △ = Monitor Well (shallow)

Well No. 411 ● = *Cooper–Jal Unit Oil Well Location*

· = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

~3180~ = Contour of Groundwater Potentiometric Surface Elevation (Deep), feet AMSL, 5/18/98

→ = Groundwater Flow Direction

N

SCALE
0 50 100

FIGURE 6

LEA COUNTY, NEW MEXICO

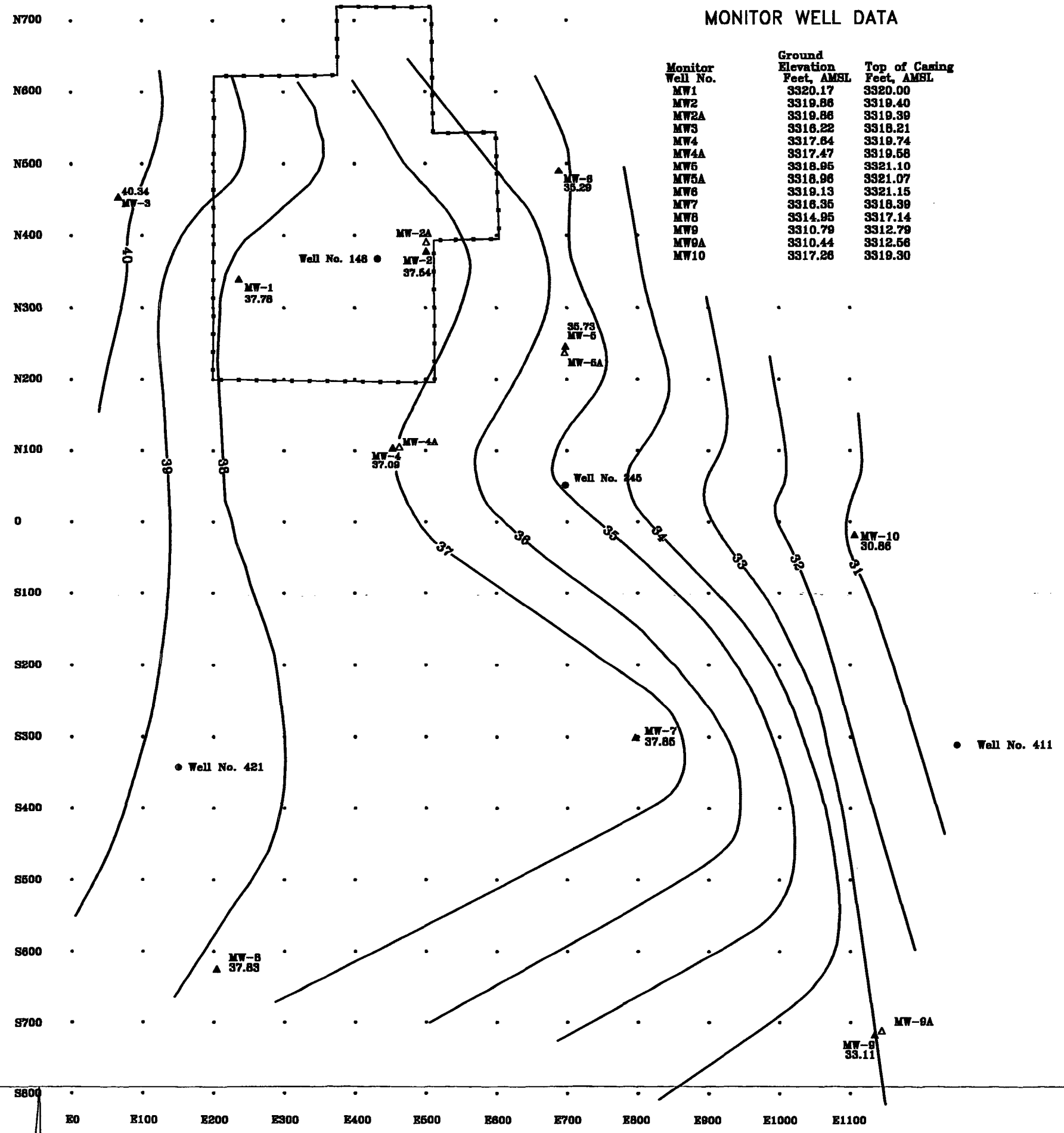
TEXACO EXPORATION & PRODUCTION, INC.

GROUNDWATER POTENTIOMETRIC SURFACE MAP (DEEP) 5/18/98

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 DEEP

HIGHLANDER ENVIRONMENTAL CORP. MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

37.54
MW-2 = Monitor Well (Deep) and Ogallala Formation Saturated Thickness, Feet, 5/18/98

MW-2A = Monitor Well (shallow)

Well No. 411 = Cooper–Jal Unit Oil Well Location

· = Electromagnetic (EM-34) Terrain Conductivity Measurement Station

~3180~ = Contour of Ogallala Formation Saturated Thickness, Feet, 5/18/98

N

SCALE
0 50 100

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 OGALLALA

FIGURE 7

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

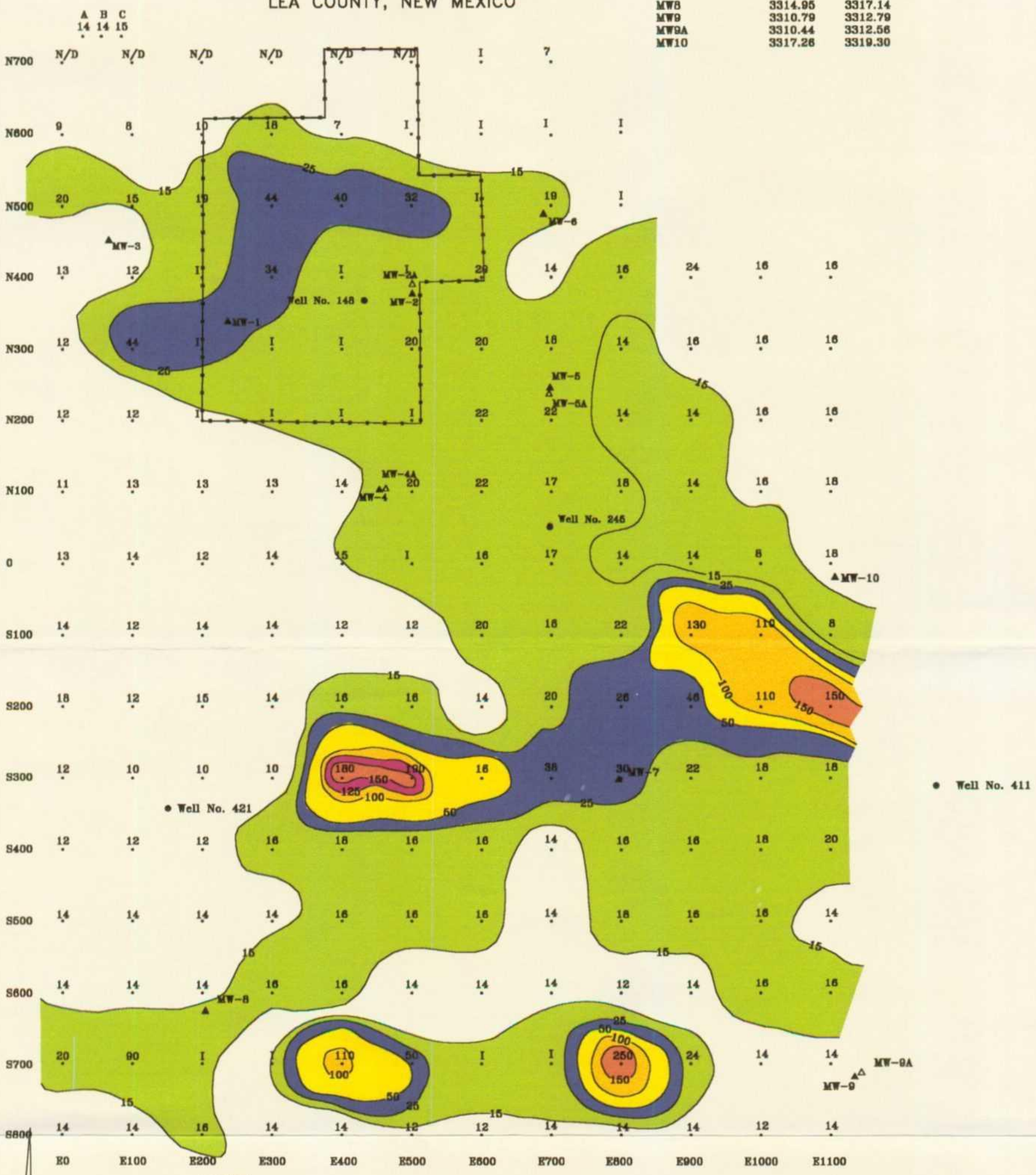
OGALLALA FORMATION
SATURATED THICKNESS FEET

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3318.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



LEGEND

MW-2 ▲ = Monitor Well (Deep)

MW-2A △ = Monitor Well (Shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

16 • = Electromagnetic (EM–34) Terrain Conductivity Measurement Station and Measured Value, MMHOS/M

~20~ Contour of Eqaul Electromagnetic Terrain Conductivity, MMHOS/M, 1/13–14/98 & 5/7/98

I • = Denotes interference

N/D = No Data Collected

- 15–25 MMHOS/M
- 25–50 MMHOS/M
- 50–100 MMHOS/M
- 100–150 MMHOS/M
- 125–150 MMHOS/M
- >150 MMHOS/M

N

SCALE 0 50 100

DATE: 6/10/98

DWN. BY: JDA

FILE: C:\TEXACO\996 EM–34_HD

FIGURE 8

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

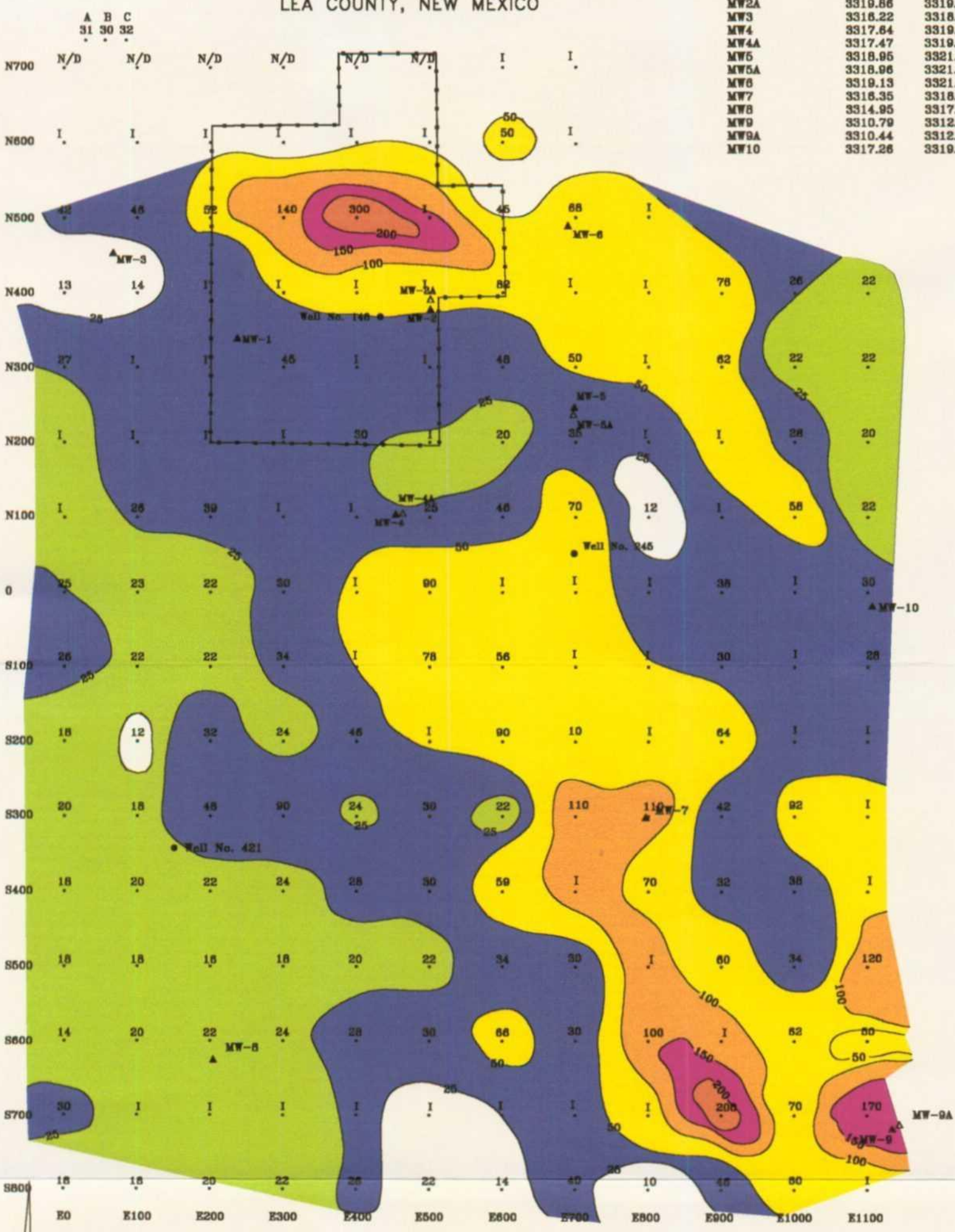
EM–34, 40 METER HD CONDUCTIVITY MAP

HIGHLANDER ENVIRONMENTAL CORP. MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO

MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3316.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30



LEGEND

MW-2 ▲ = Monitor Well (Deep)

MW-2A △ = Monitor Well (Shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

30 · = Electromagnetic (EM–34) Terrain Conductivity Measurement Station and Measured Value, MMHOS/M

~50~ Contour of Equal Terrain Conductivity, MMHOS/M, 01/13–14/98 & 5/7/98

I · = Denotes interference

N/D = No Data Collected

- 15–25 MMHOS/M
- 25–50 MMHOS/M
- 50–100 MMHOS/M
- 100–150 MMHOS/M
- 150–200 MMHOS/M
- >200 MMHOS/M

N

SCALE 0 50 100

FIGURE 9

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

EM–34, 40 METER
VD CONDUCTIVITY MAP

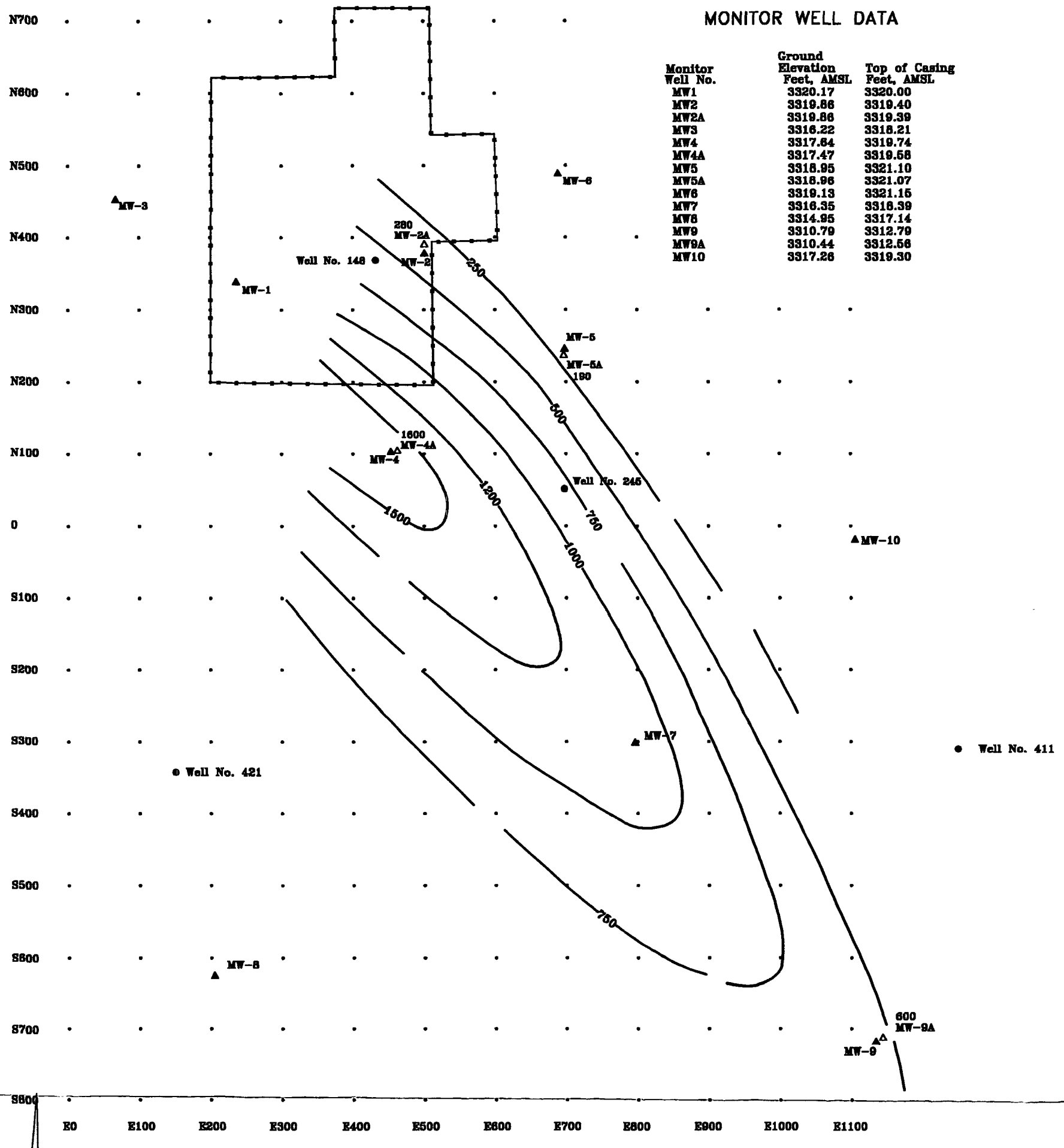
DATE: 6/10/98

DWN. BY: JDA

FILE: C:\TEXACO\996 EM–34_VD

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.56
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3316.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

MW-2 ▲ = Monitor Well (Deep)

280 MW-2A △ = Monitor Well (shallow) and Chloride Concentration in Groundwater Mg/L, 02/26-27/98 and 05/15/98

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

· = Electromagnetic (EM-34) Terrain Conductivity Measurement Station

~1000~ = Contour of Chloride Concentration in groundwater (Shallow), Mg/L, 02/26-27/98 and 05/15/98

N

SCALE
0 50 100

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 ISOPLETH–2

FIGURE 10

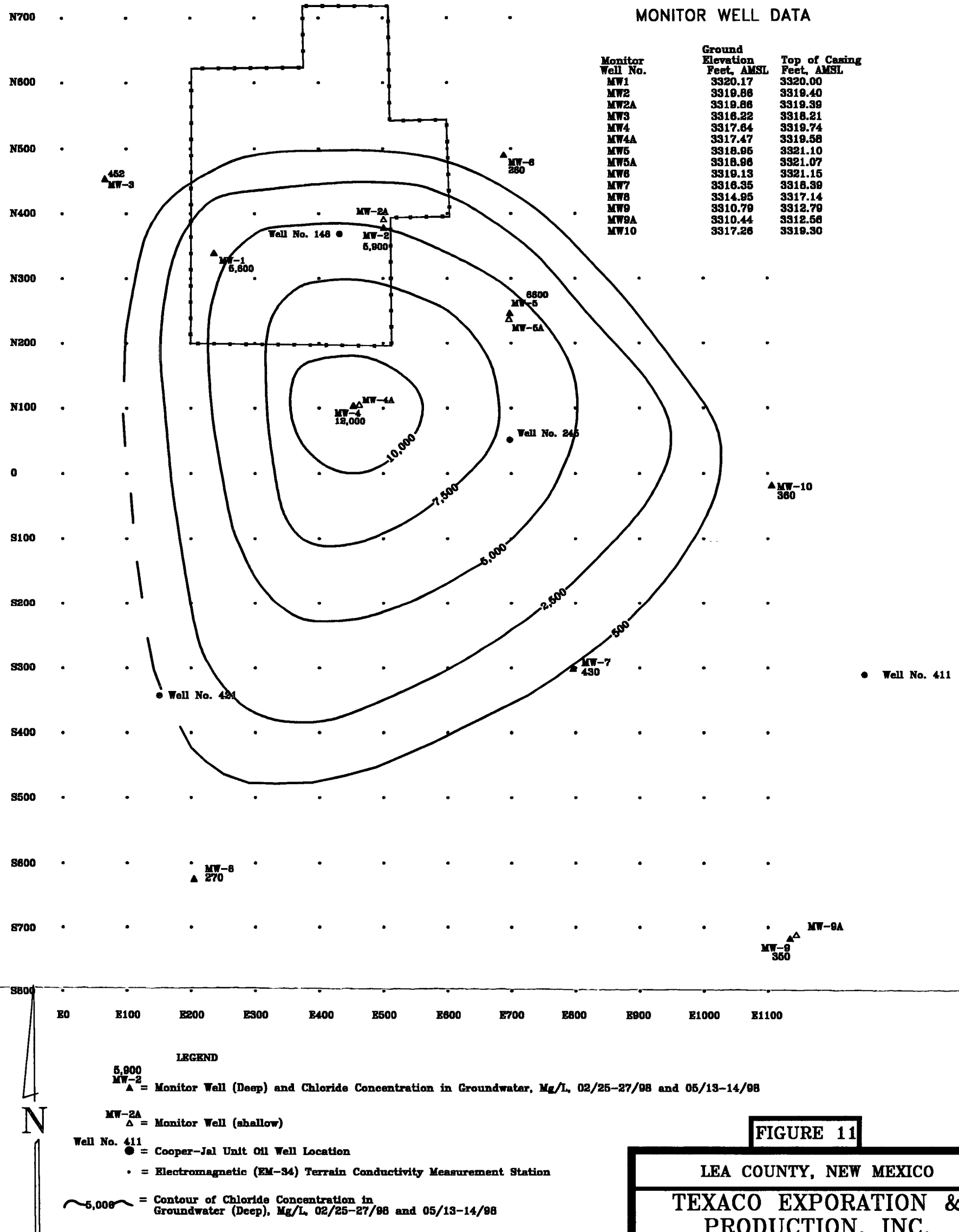
LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

ISOPLETH MAP OF CHLORIDE CONCENTRATION IN GROUNDWATER (SHALLOW) 02/26–27/98 AND 05/15/98

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3316.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

5,900
MW-2 ▲ = Monitor Well (Deep) and Chloride Concentration in Groundwater, Mg/L, 02/25–27/98 and 05/13–14/98

MW-2A △ = Monitor Well (shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

• = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

~5,000~ = Contour of Chloride Concentration in Groundwater (Deep), Mg/L, 02/25–27/98 and 05/13–14/98

FIGURE 11

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

ISOPLETH MAP OF CHLORIDE CONCENTRATION IN GROUNDWATER (DEEP) 02/25–27/98 AND 05/13–14/98

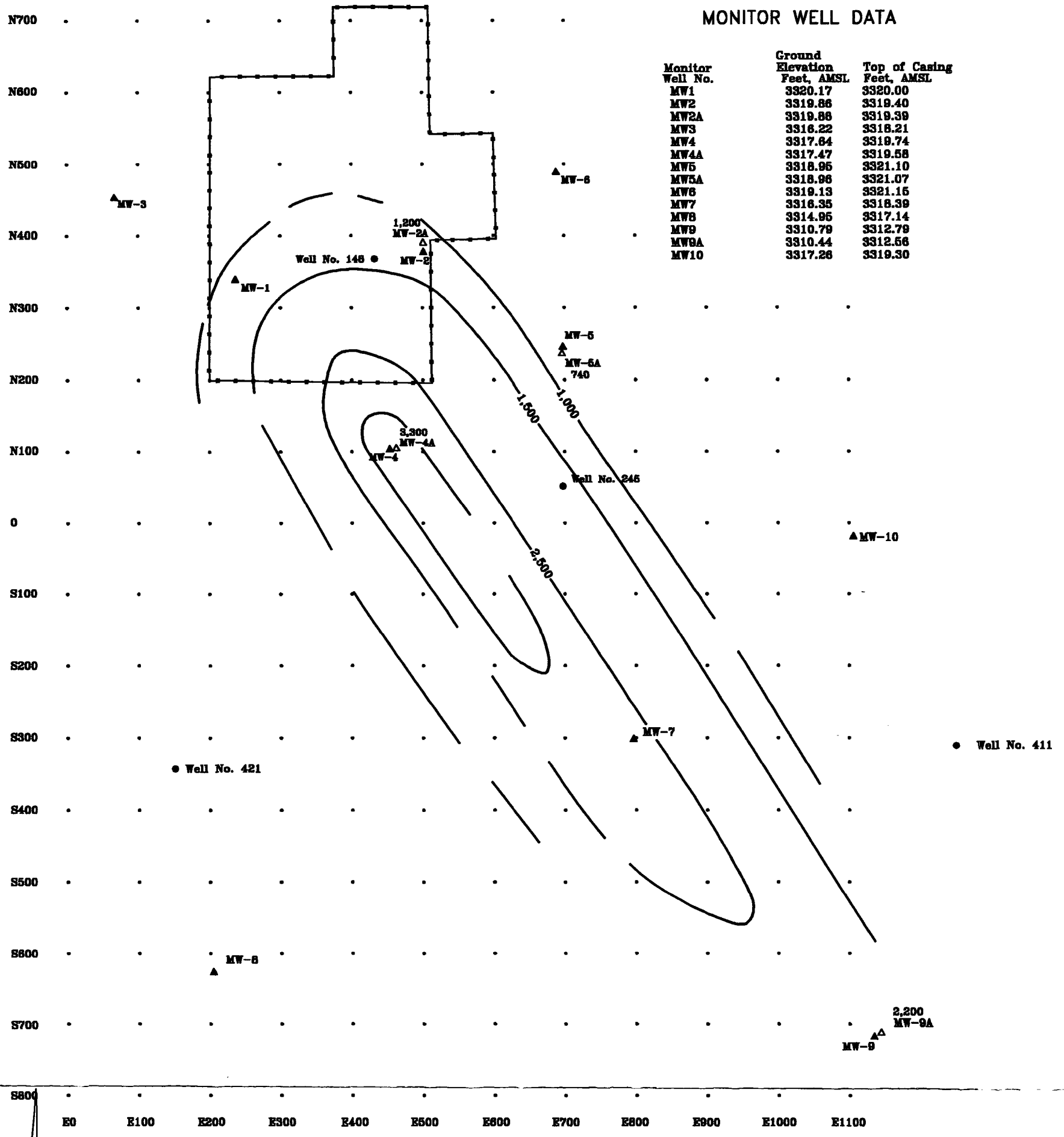
DATE: 6/9/98

DWN. BY: JDA

FILE: C:\TEXACO\996 ISOPLETH

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

COOPER-JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3318.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

MW-2 ▲ = Monitor Well (Deep)

280 MW-2A △ = Monitor Well (shallow) and TDS Concentration, Mg/L, 02/26-27/98 and 05/15/98

Well No. 411 ● = Cooper-Jal Unit Oil Well Location

· = Electromagnetic (EM-34) Terrain Conductivity Measurement Station

~1000~ = Contour of TDS Concentration in Groundwater (Shallow), Mg/L, 02/26-27/98 and 05/15/98

N

SCALE
0 50 100

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 TDS-1

FIGURE 12

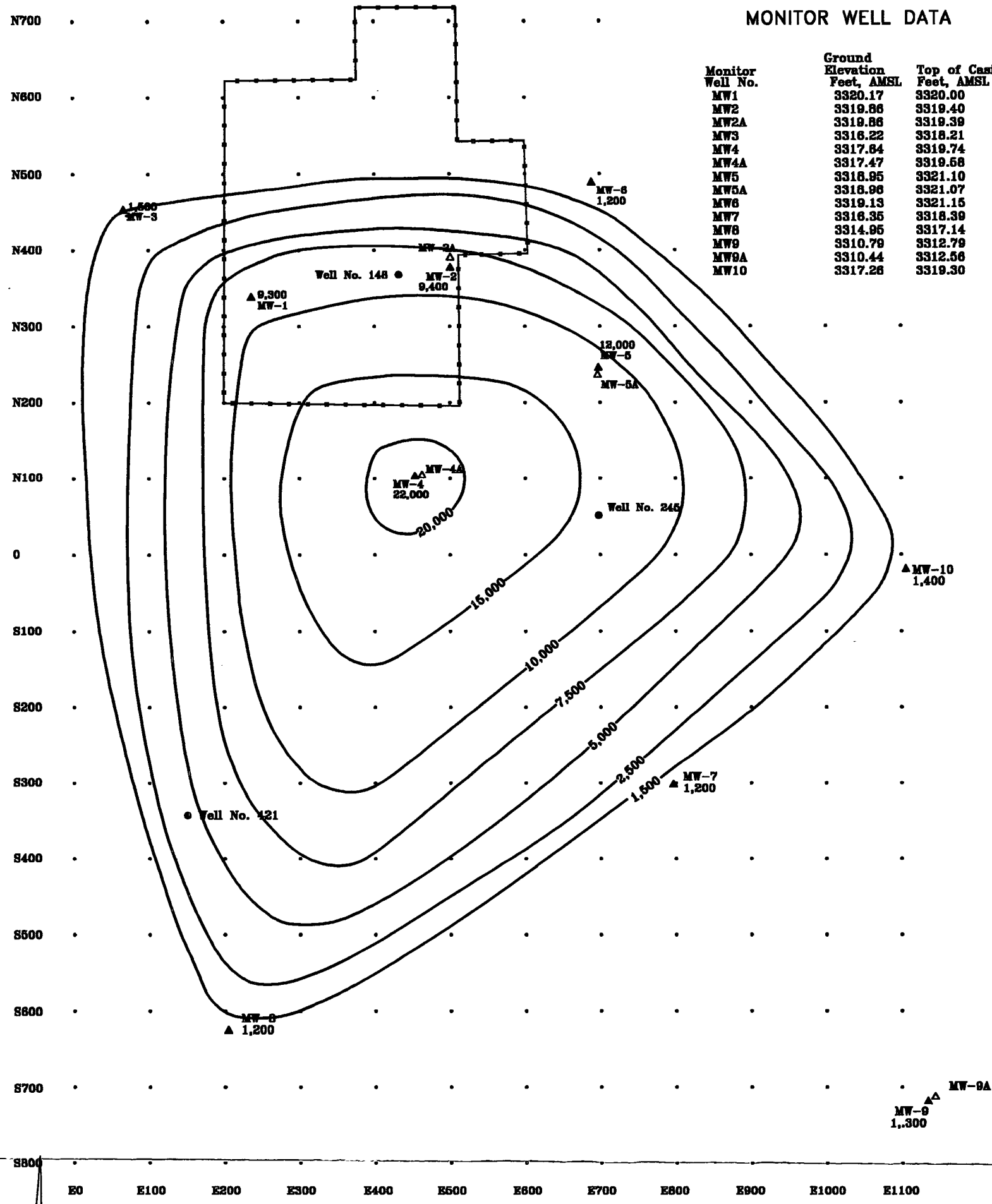
LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

ISOPLETH MAP OF TDS CONCENTRATIN IN GROUNDWATER (SHALLOW) 02/26-27/98 AND 05/15/98

HIGHLANDER ENVIRONMENTAL CORP. MIDLAND, TEXAS

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3316.95	3321.10
MW5A	3316.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3316.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

LEGEND

9,400
MW-2
▲ = Monitor Well (Deep) and TDS Concentration in Groundwater, Mg/L, 02/25–27/98 and 05/13–14/98

MW-2A
△ = Monitor Well (Shallow)

Well No. 411
● = Cooper–Jal Unit Oil Well Location

• = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

5000 = Contour of TDS Concentration in Groundwater (Deep), Mg/L, 02/25–27/98 and 05/13–14/98

N

SCALE
0 50 100

FIGURE 13

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

ISOPLETH MAP OF TDS CONCENTRATIN IN GROUNDWATER (DEEP) 02/25–27/98 AND 05/13–14/98

DATE: 6/9/98
DWN. BY: JDA
FILE: C:\TEXACO\996 TDS–2

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

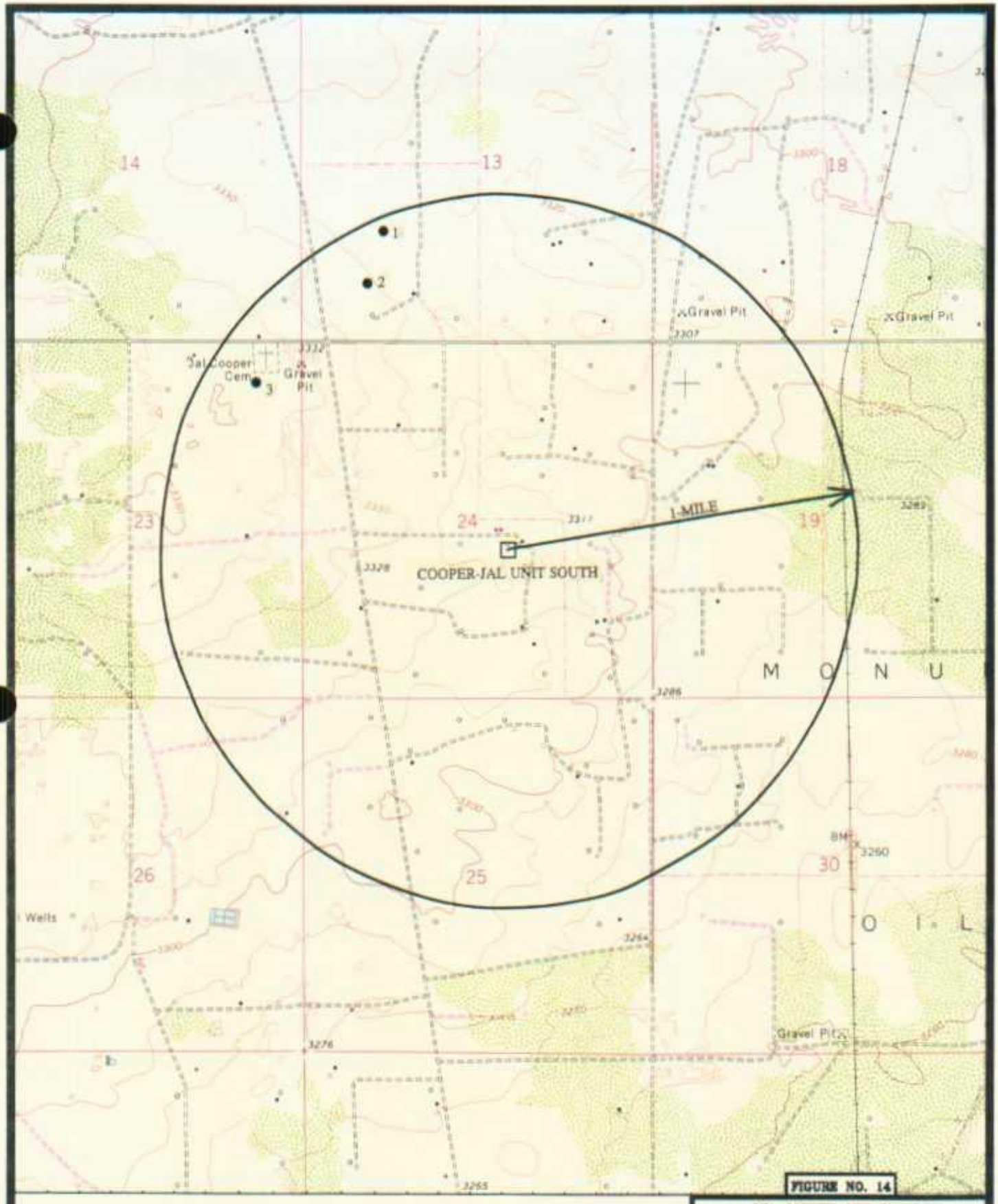


FIGURE NO. 14

LEA COUNTY, NEW MEXICO

TEXACO EXPLORATION & PRODUCTION , INC.

TOPOGRAPHIC MAP

HIGHLANDER ENVIRONMENTAL MIDLAND, TEXAS

LEGEND

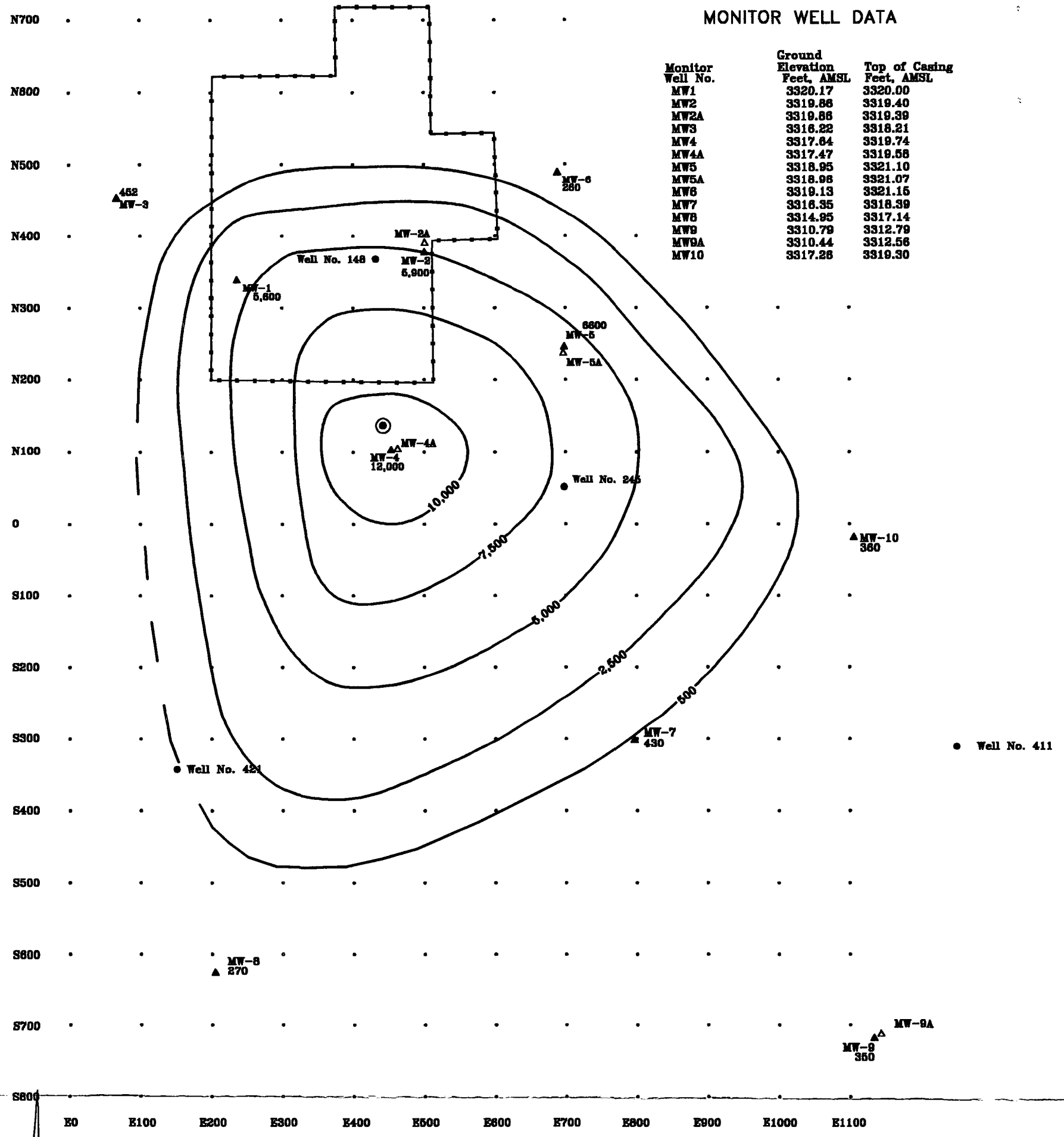
• WATER WELL LOCATION & HIGHLANDER IDENTIFICATION NUMBER

TAKEN FROM U.S.G.S. JAL NW, NEW MEXICO 7.5' QUADRANGLES

NOTE – REFER TO TABLE FOR WELL INFORMATION

SCALE: 1"=2,000'

COOPER–JAL TANK BATTERY
SEC. 24, T. 24S., R. 36E.
LEA COUNTY, NEW MEXICO



MONITOR WELL DATA

Monitor Well No.	Ground Elevation Feet, AMSL	Top of Casing Feet, AMSL
MW1	3320.17	3320.00
MW2	3319.86	3319.40
MW2A	3319.86	3319.39
MW3	3316.22	3316.21
MW4	3317.64	3319.74
MW4A	3317.47	3319.58
MW5	3318.95	3321.10
MW5A	3318.96	3321.07
MW6	3319.13	3321.15
MW7	3316.35	3318.39
MW8	3314.95	3317.14
MW9	3310.79	3312.79
MW9A	3310.44	3312.56
MW10	3317.26	3319.30

N

LEGEND

5,900 MW-2 ▲ = Monitor Well (Deep) and Chloride Concentration in Groundwater, Mg/L, 02/25–27/98 and 05/13–14/98

MW-2A △ = Monitor Well (shallow)

Well No. 411 ● = Cooper–Jal Unit Oil Well Location

· = Electromagnetic (EM–34) Terrain Conductivity Measurement Station

~5,000~ = Contour of Chloride Concentration in Groundwater (Deep), Mg/L, 02/25–27/98 and 05/13–14/98

◉ = Proposed Recovery Well Location

SCALE
0 50 100

FIGURE 15

LEA COUNTY, NEW MEXICO

TEXACO EXPORATION & PRODUCTION, INC.

PROPOSED RECOVERY WELL LOCATION

DATE: 6/9/98

DWN. BY: JDA

FILE: C:\TEXACO\996 RECOVERY

HIGHLANDER ENVIRONMENTAL CORP.
MIDLAND, TEXAS

APPENDICES

APPENDIX A

Correspondence

DATE: October 14, 1993

TO: Texaco, USA
P.O. Box 730
Hobbs, New Mexico 88241-0730

FROM: Eddie Slavens and Allen Hodge
ENVIRONMENTAL SPILL CONTROL, INC.

ATTN: Mr. Larry Lehman

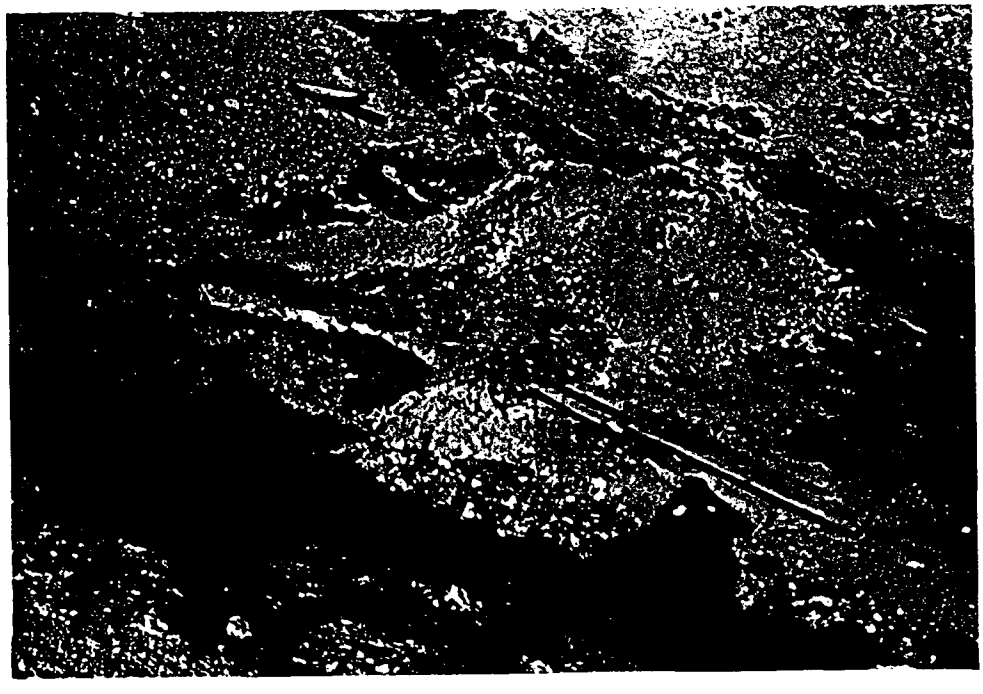
RE: Site Assessment on Jal Cooper Unit South Pit

The pit is an inground, unlined earthen pit that is basically dry that has the approximate dimensions of 50 feet by 170 feet. There is approximately 8,500 square feet of surface area in the pit and it is 12 feet from grade to the surface of the pit.

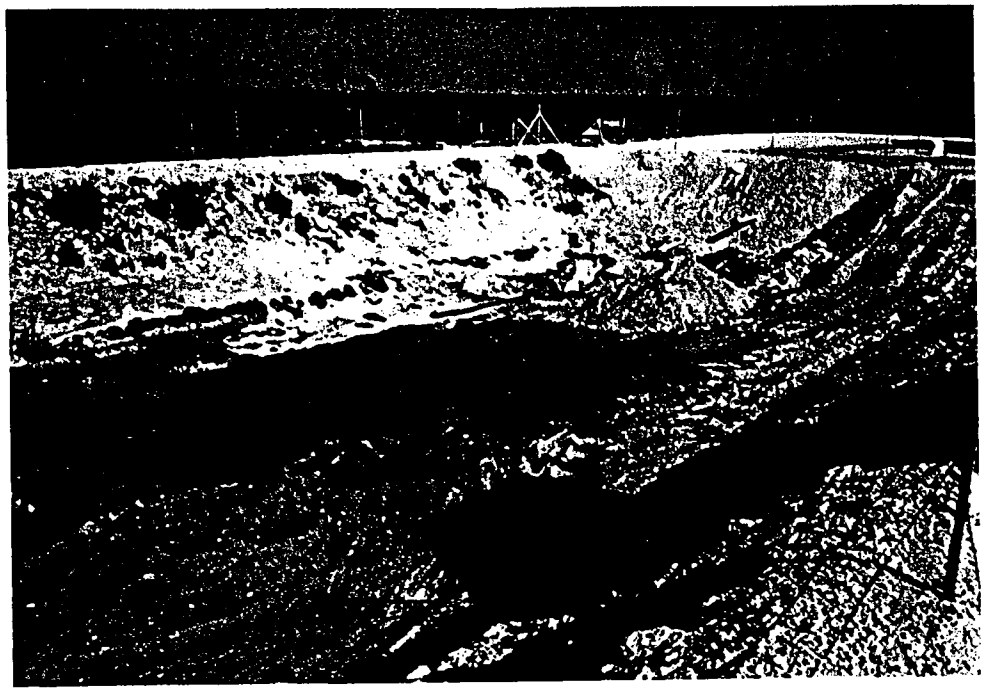
The monitor hole (number 1) was drilled approximately 20 feet out from the southeast corner of the main pit to a depth of 100 feet to check for contamination and the presence of groundwater. At the surface, analyses indicated 61 parts per million (ppm) of Total Petroleum Hydrocarbons (TPH) with 11 ppm of TPH at 100 feet. The next hole (number 2) was drilled in the southwest corner of the pit to a depth of 30 feet to check for contamination. At the surface, analyses indicated 64 ppm of TPH and 46 ppm of TPH at 10 feet. We further observed 20 ppm of TPH at 20 feet and 16 ppm of TPH at 30 feet. The next hole (number 3) was drilled in the south-eastern half of the pit to a depth of 15 feet. At the surface analyses indicated 14,890 ppm of TPH with 1,970 ppm at 10 feet and 86 ppm at 15 feet.

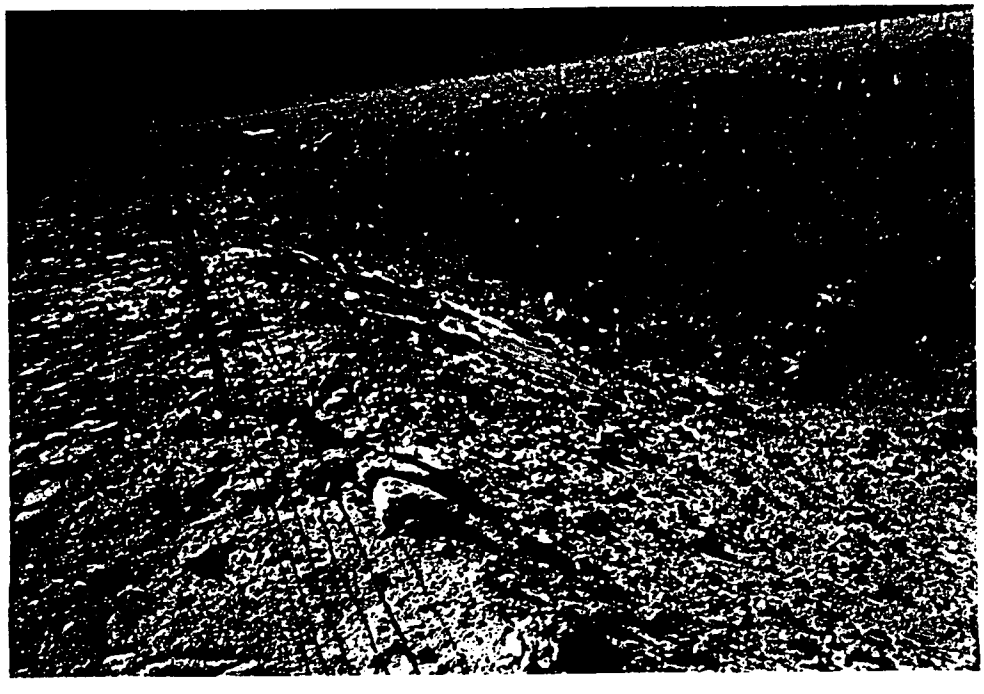
The next hole (number 4) was drilled in the center of the pit to a depth of 15 feet. At the surface, we observed 10,780 ppm of TPH and 1,740 ppm at 10 feet with 83 ppm of TPH at 15 feet. The last hole (number 5) was drilled in the northwest corner to a depth of 15 feet. At the surface, analyses indicated 9,380 ppm of TPH and 1,510 ppm at 10 feet with 79 ppm of TPH at 15 feet. Excavating the pit to 10 feet to remove the hydrocarbon contamination within Oil Conservation Division (OCD) guidelines, there is approximately 6,296 cubic yards of total material that would have to be excavated due to the degree of slope required for safety purposes. The Benzene, Toluene, Ethylbenzene, Xylene (BTEX) samples taken on the pit were all within closure guidelines for the OCD.

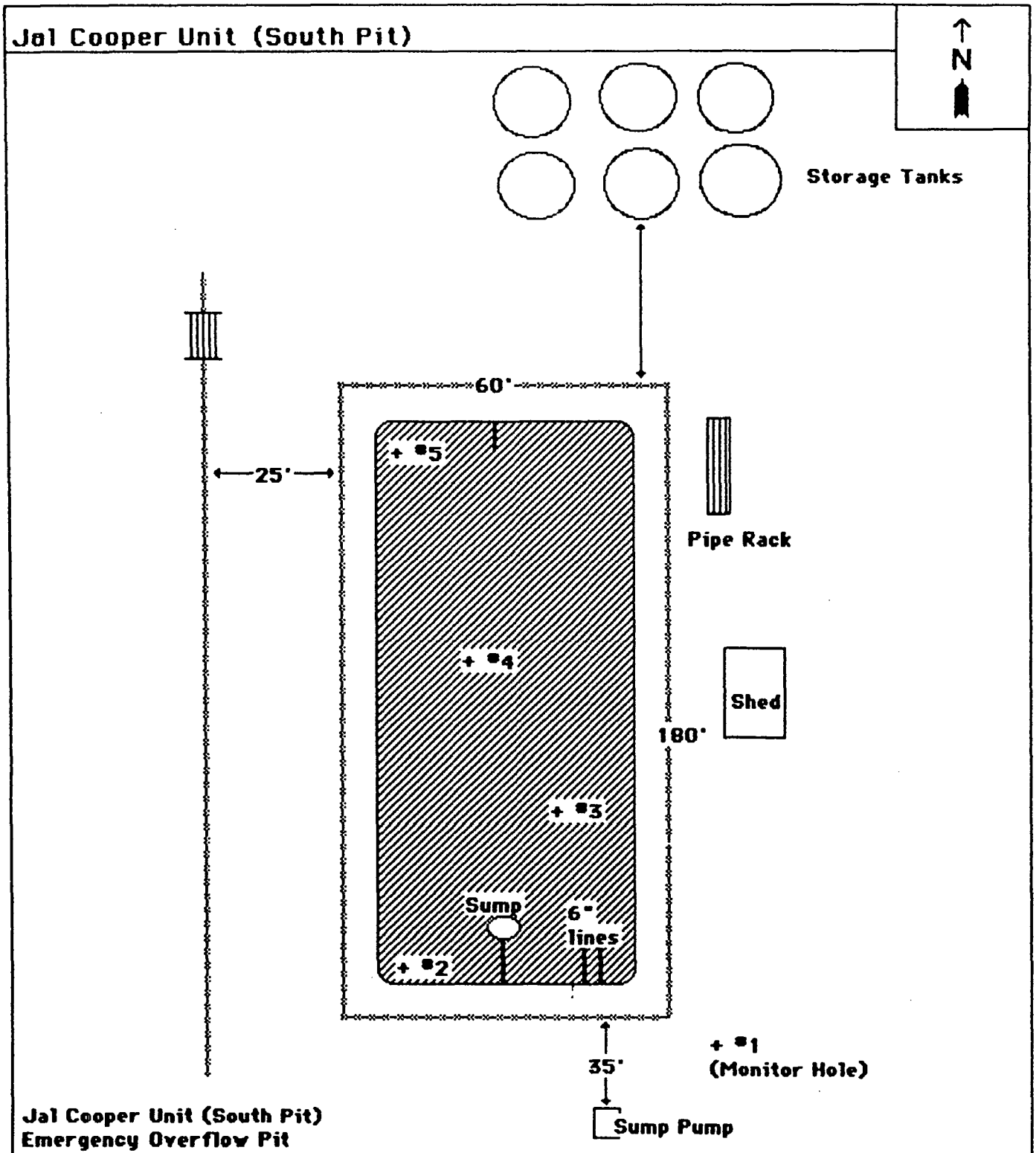
Jal Cooper South
NW4 of SE4, Section 24, T24S, R37E
Lea County, New Mexico



Jal Cooper South
NW4 of SE4, Section 24, T24S, R37E
Lea County, New Mexico







Jal Cooper Unit (South Pit)
Emergency Overflow Pit
NW4 of SE4, Section 24, Township 24 South, Range 37 East
Lea County, New Mexico

ENVIRONMENTAL SPILL CONTROL, INC.
6210 Lovington Highway
P.O. Box 5890
Hobbs, NM 88240
(505) 392-6167 (800) 390-6167

SOIL ANALYSIS REPORT

DATE: 10/01/93 FACILITY: JAL COOPER
CLIENT: TEXACO
SUPERVISOR: A. HODGE

	TPH		DEPTH	LOCATION
SAMPLE NO. 1:	64	PPM	SURFACE	SOUTHWEST END #2
SAMPLE NO. 2:	46	PPM	10"	SOUTHWEST END #2
SAMPLE NO. 3:	20	PPM	20'	SOUTHWEST END #2
SAMPLE NO. 4:	16	PPM	30'	SOUTHWEST END #2
SAMPLE NO. 5:	10,780	PPM	SURFACE	CENTER #4
SAMPLE NO. 6:	1,740	PPM	10'	CENTER #4
SAMPLE NO. 7:	83	PPM	15'	CENTER #4
SAMPLE NO. 8:	9,380	PPM	SURFACE	NORTHWEST CORNER #5
SAMPLE NO. 9:	1,510	PPM	10'	NORTHWEST CORNER #5
SAMPLE NO. 10:	79	PPM	15'	NORTHWEST CORNER #5
SAMPLE NO. 11:		PPM		
SAMPLE NO. 12:		PPM		
SAMPLE NO. 13:		PPM		

COMMENTS: Drilled one hole at South end of pit. Soil was clean from surface to bottom. The rig could not get down into the pit, so we took the backhoe and dug as far as the backhoe could reach. The ground was very soft at the bottom of the pit. Soil tested clean at a depth of 15'.

ENVIRONMENTAL SPILL CONTROL, INC.
6210 Lovington Highway
P.O. Box 5890
Hobbs, NM 88240
(505) 392-6167 (800) 390-6167

SOIL ANALYSIS REPORT

DATE: 10/01/93 FACILITY: JAL COOPER
CLIENT: TEXACO
SUPERVISOR: A. HODGE

	TPH		DEPTH	LOCATION
SAMPLE NO. 1:	61	PPM	SURFACE	SOUTHEAST CORNER #1
SAMPLE NO. 2:	11	PPM	100"	SOUTHEAST CORNER #1
SAMPLE NO. 3:	14,890	PPM	SURFACE	SOUTHEAST HALF #3
SAMPLE NO. 4:	1970	PPM	10'	SOUTHEAST HALF #3
SAMPLE NO. 5:	86	PPM	15'	SOUTHEAST HALF #3
SAMPLE NO. 6:		PPM		
SAMPLE NO. 7:		PPM		
SAMPLE NO. 8:		PPM		
SAMPLE NO. 9:		PPM		
SAMPLE NO. 10:		PPM		
SAMPLE NO. 11:		PPM		
SAMPLE NO. 12:		PPM		
SAMPLE NO. 13:		PPM		

COMMENTS: Drilled monitor hole to a depth of 100' and no water was found in drilling.

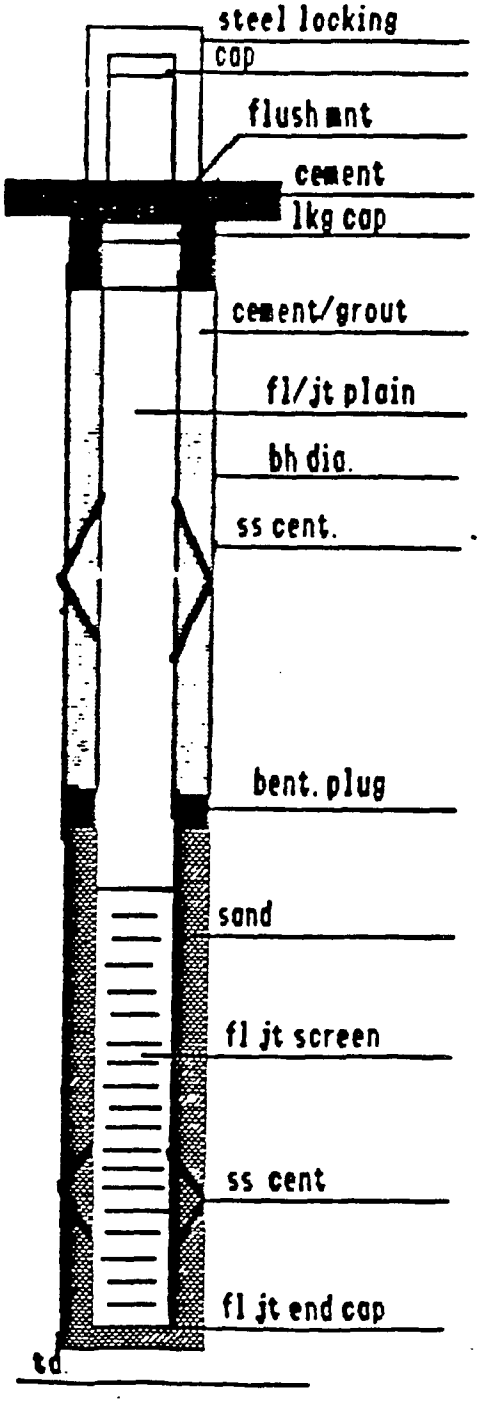
PHONE (505) 392-6167
FAX (505) 392-8788

ENVIRONMENTAL
SPILL CONTROL, INC.

P.O. BOX 5890 ★ HOBBS, NM 88241

Customer Cooper Jal South Date 10/1/93
Location Well

Description	Ft.	Ft.	Start	Stop	SB	SB	OVM Ft.	PPM
100' hole			9:00					
Fill/Cal	0	2						
TS	2	4						
Cal	4	11						
Cal & Sand	11	35						
Sand	35	100		11:00				
SB-1	30	TD	11:55	1:00				



ENVIRONMENTAL
LAB OF TEXAS, INC.
"Don't Treat Your Soil Like Dirt!"

October 11, 1993

Environmental Spill Control
Mr. Allen Hodge
P.O. Box 5890
Hobbs, NM 88241

Sample Matrix: Soil

Project: Jal Cooper South
Submitted By: Allen Hodge

Date Received: 9/30/93
Date Reported: 10/11/93

CHEMICAL ANALYSIS REPORT

Parameter	Value	Units	Test Method
Sample ID: Surface Water			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	
Sample ID: Bottom Water 100'			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	

Parameter	Value	Units	Test Method
Sample ID: Surface Center			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	
Sample ID: Bottom Center 15'			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	
Sample ID: South Surface			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	
Sample ID: South Bottom 15'			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	

Parameter	Value	Units	Test Method
Sample ID: North Surface			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	
Sample ID: North Bottom 15'			
Benzene	<0.1	mg/kg	8020/5030
Toluene	<0.1	mg/kg	
Ethylbenzene	<0.1	mg/kg	
Xylene (omp)	<0.1	mg/kg	

Total QC (Quality Control)

Tot. BTEX QC:Blank spiked with 24 ug/l BTE and 48 ug/l (m,p)Xylene, 24 ug/l (o) Xylene
Detection Limits 0.1 mg/kg

	Result (ug/l)	% Accuracy
Benzene	25.7	107
Toluene	23.8	99
Ethylbenzene	23.5	98
Xylene (mp)	47.3	99
Xylene (o)	23.8	99

Parameter	Value (ppm)	EPA Limit (ppm)	QC	% Accuracy	Detection Limit
Sample ID: Jal Cooper South 1' TCLP					
Arsenic (As)	<0.1	5.0	5.0	100	0.1
Selenium (Se)	<0.2	1.0	1.0	100	0.2
Chromium (Cr)	<0.1	5.0	5.1	102	0.1
Cadmium (Cd)	<0.1	1.0	1.0	100	0.1
Lead (Pb)	<0.1	5.0	4.9	98	0.1
Barium (Ba)	<0.1	100	100	100	1.0
Mercury (Hg)	<0.001	0.20	0.020	100	0.001
Silver (Ag)	<0.01	5.0	5.0	100	0.01

Methods: EPA SW 846-1311, 6010, 7471
TCLP Metals QC: Blank spiked with 5.0 ppm As, Cr, Pb and Ag; 1.0 ppm Se and Cd; 100 ppm Ba; and 0.020 ppm Hg.

Kirk Robinson

NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

POST OFFICE BOX 1980
HOBBS, NEW MEXICO 88241-1980
(505) 393-6161

Paula S. Ives
Engineering Assistant
Texaco E&P Inc.
205 E. Bender
Hobbs, NM 88240

Re: C-103 Pit Closure

Attention: Paula S. Ives,

Please find enclosed the **"OCD Approval Conditions"** and **"Pit Closure Form"** attached to the recent C-103 submitted by you for a pit closure in unit j section 24-Ts 24s-R 36e Cooper Jal Unit South Injection Station. These conditions are hereby incorporated into your approval process.

If you require any further assistance concerning this matter please do not hesitate to call (505-393-6161) or write.

Sincerely yours,

Wayne Price-Environmental Engineer

cc: Jerry Sexton-NMOCD District I Supervisor
Bill Olson-NMOCD Hydrogeologist-Environmental Bureau
Paul Kautz-Geologist

attachments-1 approval conditions
1 Pit Closure form.

State of New Mexico
Ener erals and Natural Resources Department

Form C-103
Revised 1-1-89

OIL CONSERVATION DIVISION

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

.c
.CT I
J. Box 1980, Hobbs, NM 88240
STRICT II
O. B awer DD, Artesia, NM 88210
STR II
000 Rio Brazos Rd., Aztec, NM 87410

WELL API NO.

5. Indicate Type of Lease STATE ☐ FEE ☒

6. State Oil / Gas Lease No.

7. Lease Name or Unit Agreement Name
COOPER JAL UNIT SOUTH INJECTION STATION

8. Well No.

9. Pool Name or Wildcat

SUNDRY NOTICES AND REPORTS ON WELL

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT (FORM C-101) FOR SUCH PROPOSALS.)

Type of Well: OIL WELL ☐ GAS WELL ☐ OTHER Emerg. Overflow Pit

Name of Operator: TEXACO EXPLORATION & PRODUCTION INC.

Address of Operator: 205 E. Bender, HOBBS, NM 88240

Well Location
Unit Letter J : ____ Feet From The ____ Line and ____ Feet From The ____ Line
Section 24 Township 24S Range 36E NMPM ____ Lea COUNTY

10. Elevation (Show whether DF, RKB, RT,GR, etc.)

Check Appropriate Box to Indicate Nature of Notice, Report, or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	☒	PLUG AND ABANDON	☐	REMEDIAL WORK	☐	ALTERING CASING	☐
TEMPORARILY ABANDON	☐	CHANGE PLANS	☐	COMMENCE DRILLING OPERATION	☐	PLUG AND ABANDONMENT	☐
PULL OR ALTER CASING	☐			CASING TEST AND CEMENT JOB	☐		
OTHER:			☐	OTHER:			☐

2. Describe Proposed or Completed Operations (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting ar posed work) SEE RULE 1103.

It is our intent to remediate the emergency overflow pit which is associated with the Cooper Jal Unit, South Injection Station. The pit is an unlined earthen pit, approximately 50 feet X 170 feet. We intent to excavate 10 feet deep, approximatley 200 cubic yards of contaminated soil out of the pit and use vertical mixing and dilution to lower the TPH under the OCD guidelines of 5, 000 ppm. It is well in excess of 100 feet to ground water.

JUL 23 1996
OCD HOBBS OFFICE

By LWP From B.P

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE [signature] TITLE Engineering Assistant DATE 7/1/96

TYPE OR PRINT NAME Paula S. Ives Telephone No. 397-0432

(This s State Use)

APPROVED BY Orig. Signed by Paul Kautz Geologist TITLE ____ DATE JUL 5 1996

CONDITIONS OF APPROVAL, IF ANY:

OCD APPROVAL CONDITIONS FOR RCRA EXEMPT UNLINED PIT CLOSURES — AP

DeSoto/Nichols 12-93 ver 1.0

OCD APPROVAL CONDITIONS
FOR
RCRA EXEMPT
UNLINED PIT CLOSURES

1. The following closure actions will be performed in accordance with OCD's February 1993 "SURFACE IMPOUNDMENT CLOSURE GUIDELINES":

   a. Vertical and horizontal extent of contamination will be determined either prior to, during or upon completion of remedial actions.

   b. Contaminated soils will be remediated to the OCD's recommended levels or a risk assessment will be provided which shows that an alternate cleanup level is protective of surface water, ground water, human health and the environment.

   c. Final soil contaminant concentrations will be determined upon completion of remedial actions.

   d. Soil samples for verification of completion of remedial actions will be sampled and analyzed for benzene, toluene, ethylbenzene, xylene and total petroleum hydrocarbons.

2. All wastes removed from a specific site will be disposed of at an OCD approved facility.

3. The OCD Santa Fe Office's Environmental Bureau Chief and the OCD Hobbs District Office will be notified within 24 hours of the discovery of ground water contamination related to a pit closure.

4. Upon completion of all closure activities, a completed OCD "Pit Remediation and Closure Report" form containing the results of all pit closure and soil remediation activities will be submitted to the OCD for approval. The report will include the concentrations and application rates of any materials or additives used to enhance bioremediation of the contaminants and the final concentrations of any soils landfarmed onsite or the final disposition of soils removed from the site . To simplify the approval process, the OCD requests that the final pit closure reports be submitted only upon completion of all closure activities including onsite remediation or landfarming of contaminated soils.

5. All original documents will be submitted to the OCD Hobbs Office for approval with copies provided to the OCD Santa Fe Office.

6. OCD approval does not relieve you of liability should closure activities determine that contamination exists which is beyond the scope of the work plan or if the closure activities fail to adequately remediate contamination related to your activities. In addition, OCD approval does not relieve you of responsibility for compliance with other federal, state or local laws and regulations.

District I
P.O. Box 1980, Hobbs, NM
District II
Drawer DD, Artesia, NM 88211
District III
1000 Rio Brazos Rd., Aztec, NM 87410

State of New Mexico
Energy, Minerals and Natural Resources Department

OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NM 87505

SUBMIT 1 COPY TO APPROPRIATE DISTRICT OFFICE AND 1 COPY TO SANTA FE OFFICE

(Revised 3/9/94)

PIT REMEDIATION AND CLOSURE REPORT

Operator: Texaco E & P Inc. Telephone: 505/394/2565

Address: P.O. Box 1060, 301 Texas Ave., Eunice N.M. 88231

Facility Or: Cooper Jal Unit South Injection Plant overflow Pit
Well Name

Location: Unit or Qtr/Qtr Sec J Sec 24 T 24S R 36E County Lea

Pit Type: Separator ___ Dehydrator ___ Other Emergency overflow

Land Type: BLM ___, State ___, Fee ___, Other Private

Pit Location: (Attach diagram)
Pit dimensions: length 50', width 170', depth 10'
Reference: wellhead ___, other See Attachment
Footage from reference: _____
Direction from reference: _____ Degrees ___ East ___ North of ___ West ___ South

Depth To Ground Water: (Vertical distance from contaminants to seasonal high water elevation of ground water)	Less than 50 feet (20 points) 50 feet to 99 feet (10 points) Greater than 100 feet (0 Points)	0
Wellhead Protection Area: (Less than 200 feet from a private domestic water source, or; less than 1000 feet from all other water sources)	Yes (20 points) No (0 points)	0
Distance To Surface Water: (Horizontal distance to perennial lakes, ponds, rivers, streams, creeks, irrigation canals and ditches)	Less than 200 feet (20 points) 200 feet to 1000 feet (10 points) Greater than 1000 feet (0 points)	0
	RANKING SCORE (TOTAL POINTS):	0

Date Remediation Started: 8-1-96 Date Completed: 8-8-96

Remediation Method: (Check all appropriate sections) Excavation X Approx. cubic yards 1248

Landfarmed X Insitu Bioremediation ___

Other Dilution

Remediation Location: (ie. landfarmed onsite, name and location of offsite facility) Onsite ___ Offsite Sundance Services Inc. Parabo Disposal Facility

General Description Of Remedial Action: West fence was removed and ramp was cut into west wall to allow access to pit bottom. Bulldozer was used to push impacted soil for a front end loader to load on to dump trucks & haul to Parabo. TPH Test were run on impacted soil being hauled and in pit bottom to confirm all soils had been addressed. When bottom was clean we lined it with clay to form a buffer zone & filled to the top with caliche.

Ground Water Encountered: No X Yes ___ Depth ___

Final Pit: Closure Sampling: (if multiple samples, attach sample results and diagram of sample locations and depths)

Sample location Composite sample of pit bottom.

Sample depth 24'

Sample date 8-5-96 Sample time 4:30pm.

Sample Results

Benzene(ppm) <1.0

Total BTEX(ppm) <1.0

Field headspace(ppm) <1.0

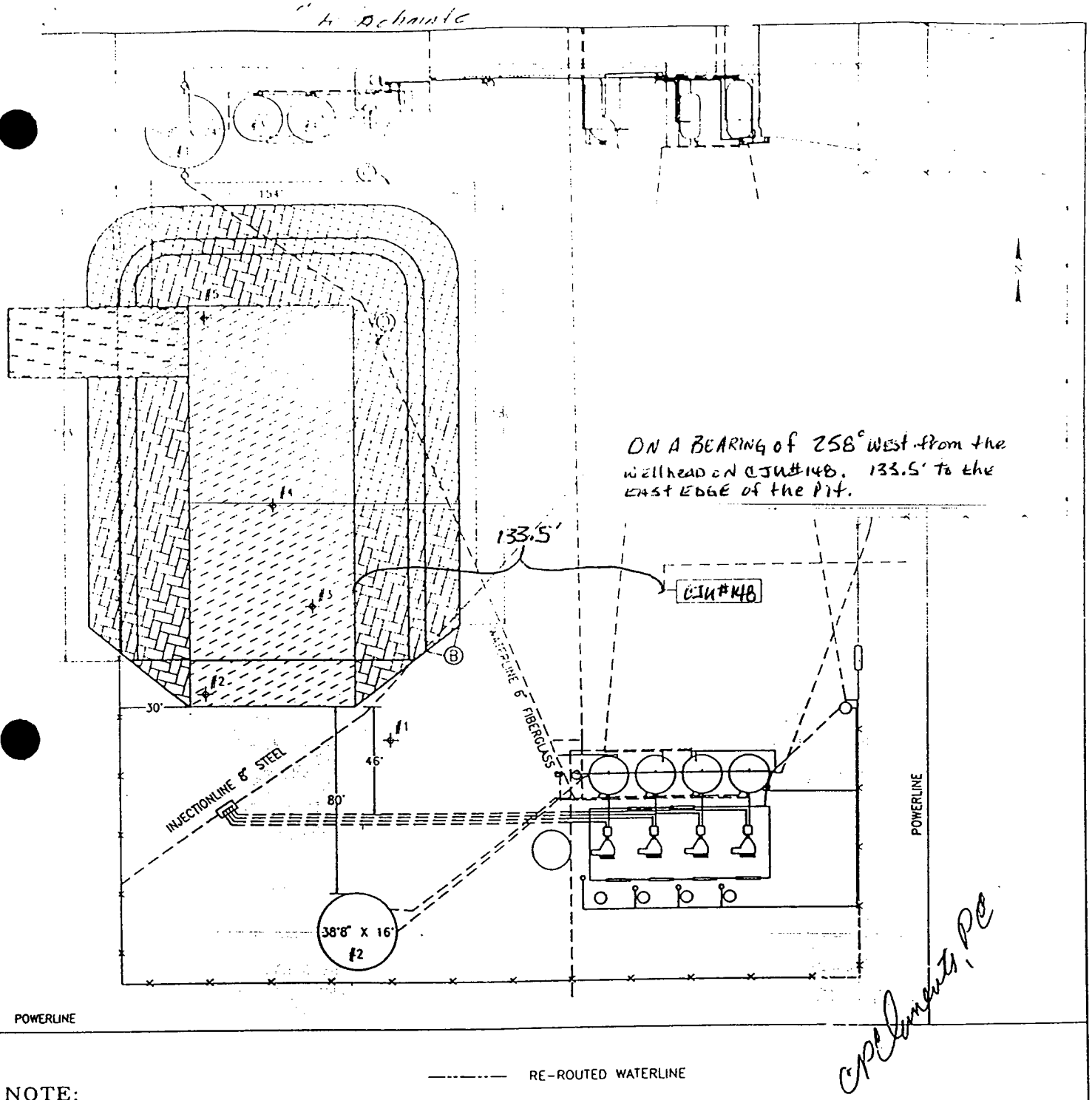
TPH 142

Ground Water Sample: Yes ___ No X (If yes, attach sample results)

I HEREBY CERTIFY THAT THE INFORMATION ABOVE IS TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF

DATE 10-8-96

SIGNATURE [signature] PRINTED NAME AND TITLE AARON D. DUBOIS TCPI OPER. TECH.



NOTE:

1. PRIOR TO STARTING THE EXCAVATION OF THE PIT, REMOVE ALL TOP SOIL FROM OVER THE PIPELINES THAT ARE TO REMAIN 43' FROM THE EDGE OF THE EXISTING PIT TO DETERMINE THE DEPTH, CONDITION OF THE PIPE, AND RELIEVE THE LINES OF THE ADDITIONAL OVER BURDEN LOAD.(EXCEPT LINES SOUTH OF PIT)
2. ALTHOUGH THE TOP SOIL (DUE TO SOME NATURAL COHESIVNESS OF THE SOIL IN UNDISTURBED CONDITIONS) MAY HOLD A MUCH STEEPER BANK THAN 3.5 TO 1, THIS CONDITION COULD CHANGE DUE TO THE AGATATION BY OPERATING EQUIPMENT OVER AND AROUND THE PIPE AND BY CHANGE IN MOISTURE CONTENT THAT COULD RESULT FROM RAIN OR LEAKING PIPE.
3. EXIT RAMPS WILL APPROXIMATE 3 1/2 ON 1 SLOPE.
4. TANK #1 & #2 ARE ON CEMENT PADS SAME DIAMETER AS TANK. TANK #3 & #4 ARE ARE SITTING ON GROUND.
5. REMOVE APPROXIMATELY 200' OF FENCE PRIOR TO STARTING EXCAVATION TO ALLOW FOR BOTH PROPOSED CUT AND EARTH STORAGE.

RE-ROUTED WATERLINE

UNDERGROUND LINES

FENCE LINE

BORE HOLE

EXISTING PIT

PROPOSED TOP OF EXCAVATION

PROPOSED EXIT RAMP

TEXACO Inc.

SITE AND PLAN VIEW
EXCAVATION FOR
ENVIRONMENTAL RESTORATION
SOUTH JAL COOPER UNIT
EMERGENCY OVERFLOW PIT
NW4/SE4, SEC 24, T24S, R36E
LEA Co., NEW MEXICO

ENVIRONMENTAL SPILL CONTROL, Inc.
PHONE (505) 392-6167

RESOURCE ALLIANCE
ALBUQUERQUE, NM
C. PRESTON CLEMENTS P.E.

DATE: 1-17-95	DRAWN M.F.C.	REV. DATE 6-20-95	BY: M.F.C.
SCALE: 1" = 60'		JOB #	
SHEET 1 OF 2		DWG #	

Western Environmental Consultants

PO Box 1816 *Hobbs, New Mexico 88241*
Phone (505) 392-5021 *Fax (505) 397-2597*

August 30, 1996

Texaco E & P Inc.
205 E. Bender Blvd.
Hobbs, NM 88240

Attn: Mr. Aaron Dobbs

Re: Closure report for the South Jal Cooper overflow pit.

Dear Mr. Dobbs

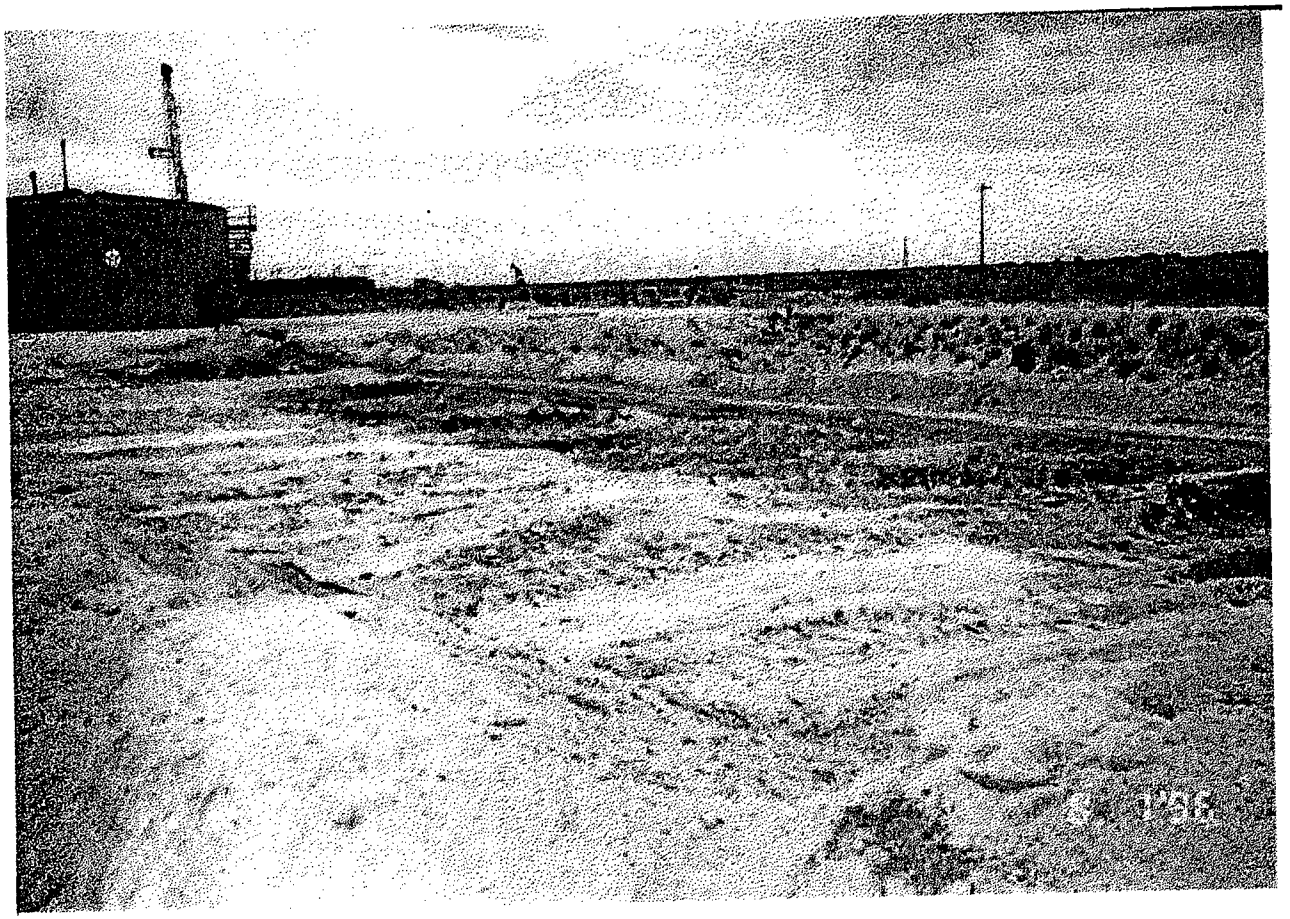
We would like to take this time to thank you and Texaco for this opportunity to be of service to you. The following is a report on the closure of the South Jal Cooper overflow pit.

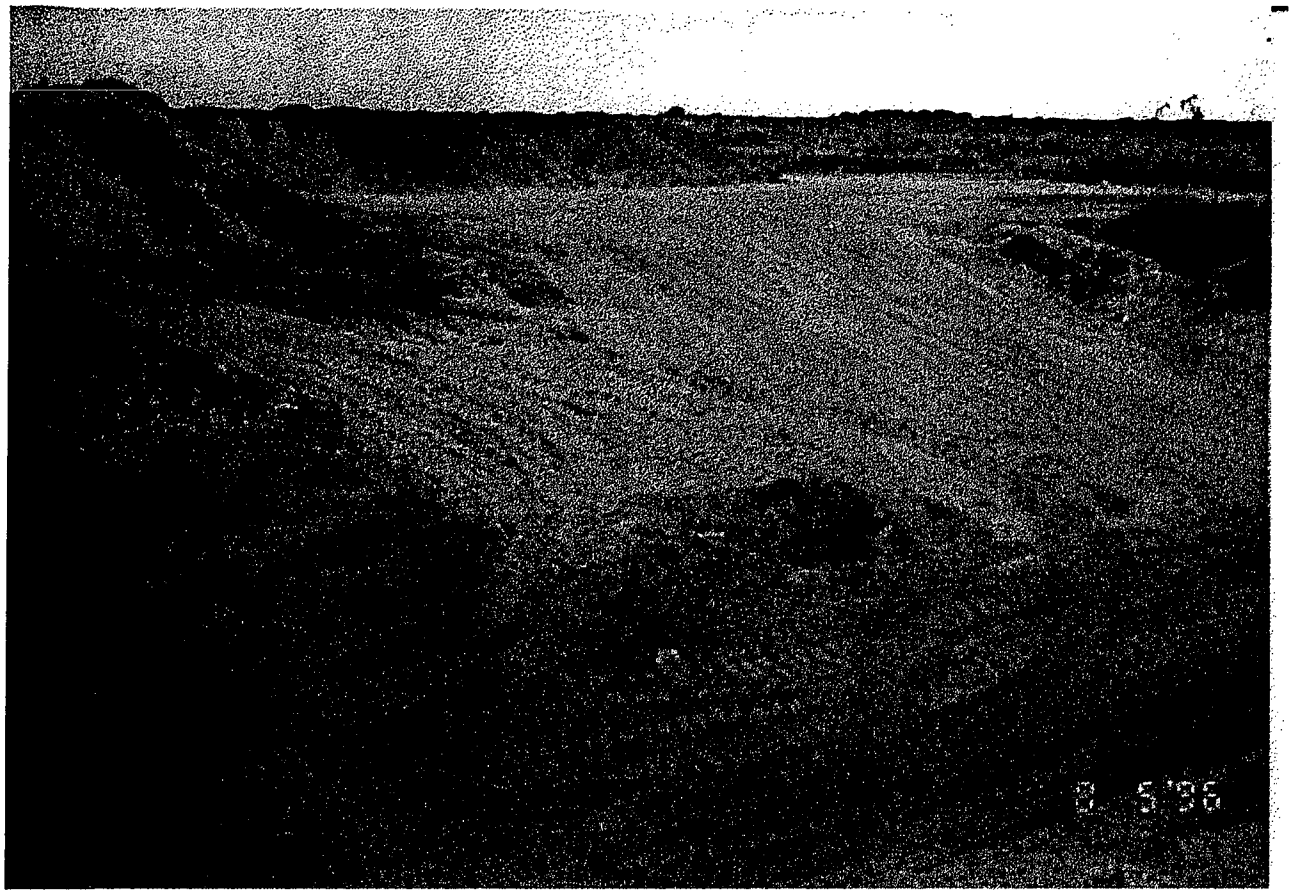
The closure of the pit began on 08/01/96 with Globe Construction mobilizing equipment so they could begin loading and hauling the impacted soils to Eunice for disposal at Parabo Disposal Facility. The fence was moved back to allow excavation equipment access to the overflow pit. A bulldozer was used to push up impacted soils for the loader to pick-up and load into the dump trucks to haul off to disposal facility. TPH tests were run on impacted soils being hauled to the disposal facility and were also run on overflow pit bottom to confirm that all impacted soils had been addressed. You may refer to soil report for these levels. At the same time we were hauling impacted soils to the disposal facility we were back hauling clay for the overflow pit bottom buffer zone. Once we were finished hauling impacted soils on 08/05/96 samples were taken again of the overflow pit bottom to confirm that all impacted soils had been removed. On 08/06/96 we started pushing clay into the bottom of the overflow pit. While dozer was pushing the clay into the bottom we were at the same time hauling in caliche fill material to finish filling overflow pit. On 08/08/96 closure of the overflow pit was completed. On 08/09/96 finals photos were taken after construction equipment had been removed from site. There was 1248 cyds. of impacted soils removed for disposal, 1091 cyds. of clay used to line the overflow pit bottom and 3360 cyds. of clean caliche used to backfill rest of overflow pit.

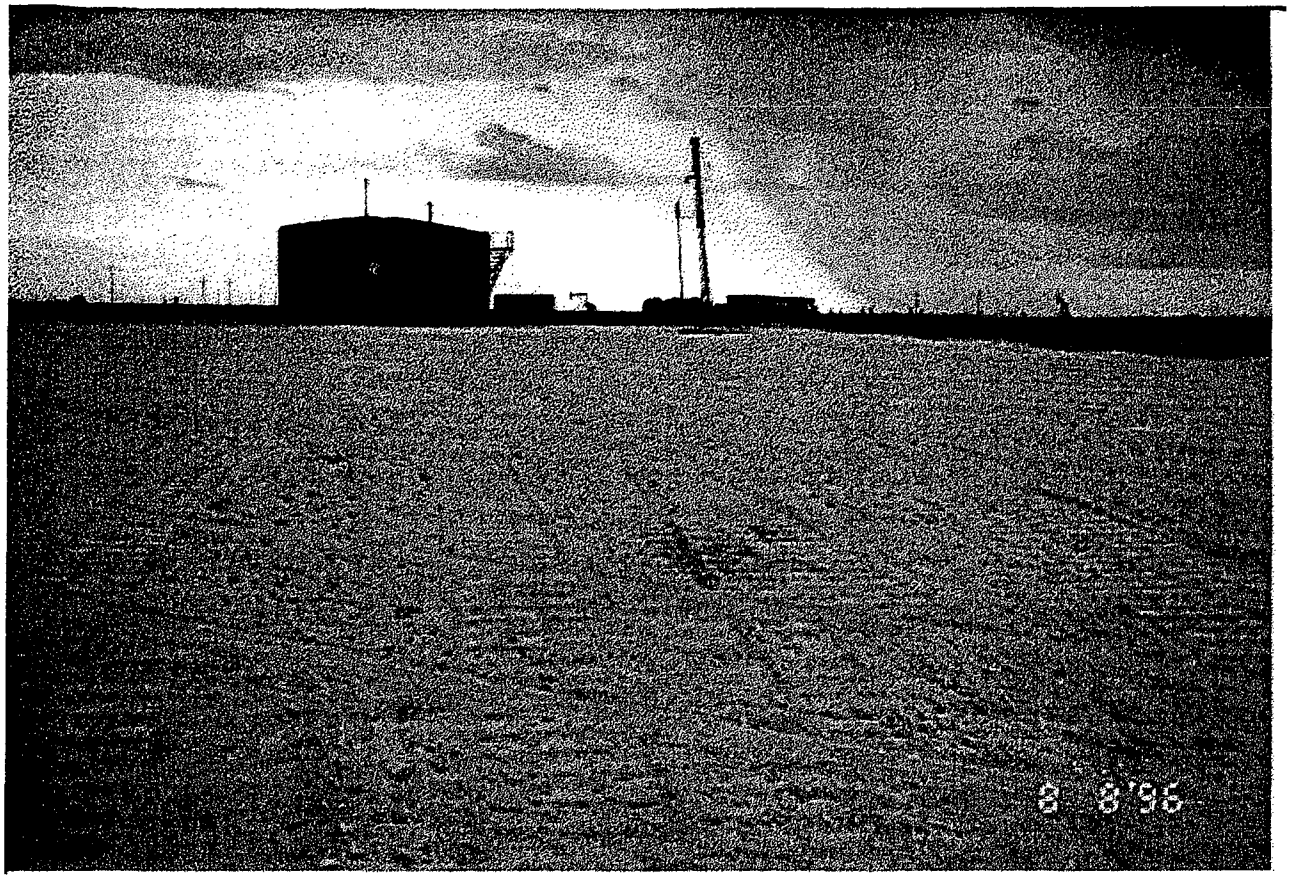
If you have any questions or need additional information in regards to this matter, please call me on my mobile at 505-370-1464 or at 505-392-5021.

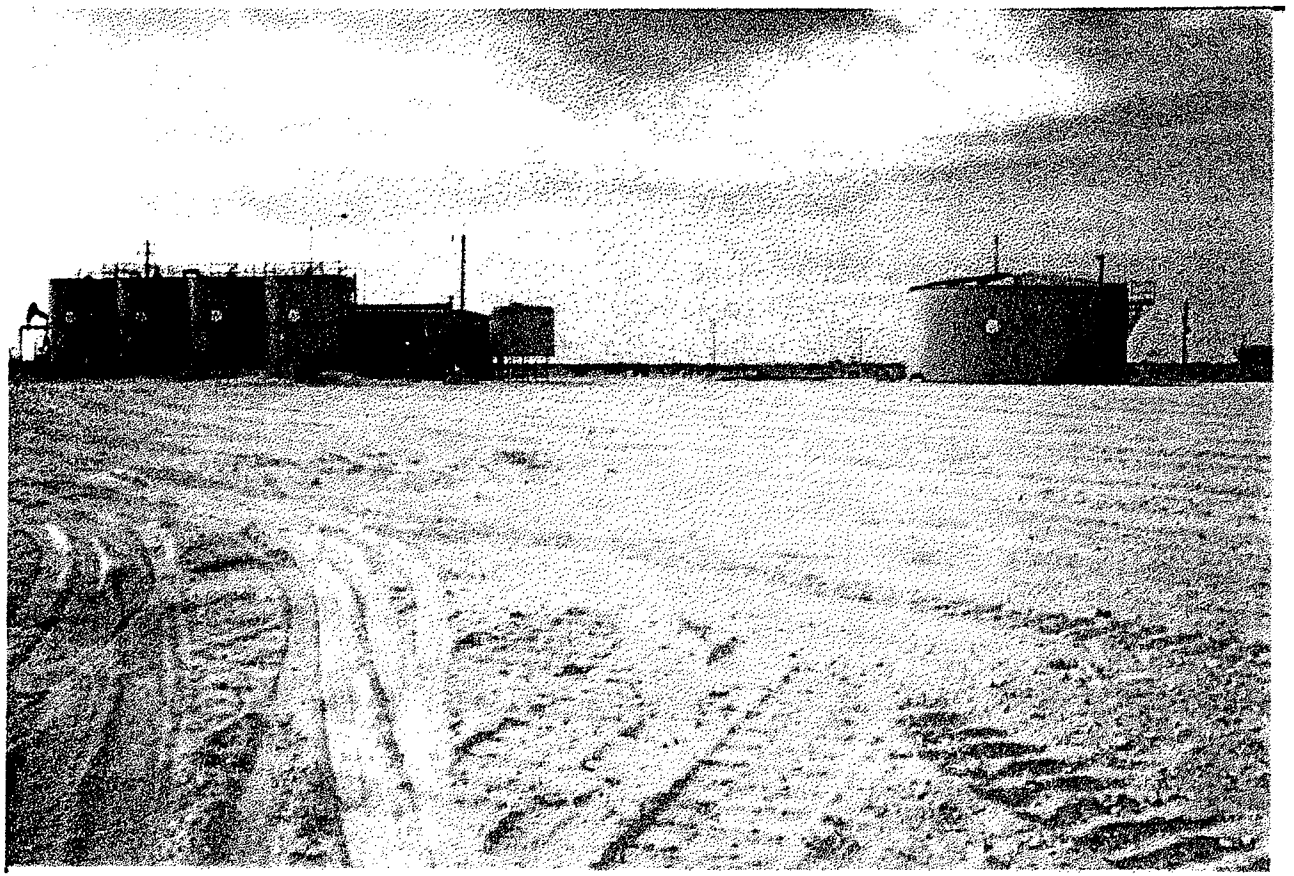
Sincerely,

Allen Hodge, REM
Western Environmental Consultants




8 5 96


8 8'96



STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
HOBBS DISTRICT OFFICE

January 17, 1996

POST OFFICE BOX 1980
HOBBS, NEW MEXICO 88241-1980
(505) 393-6161

Paula S. Ives
Engineering Assistant
Texaco E&P Inc. (TEPI)
205 E. Bender
Hobbs, NM 88240

Re: Pit Closure-Cooper Jal Unit Injection Station.
J-sec24-Ts24s-R36e.

Attention: Paula Ives

The New Mexico Oil Conservation Division (NMOCD) is in receipt of the pit closure form dated 12/13/96 submitted for the above referenced facility.

In order for the NMOCD to properly evaluate this closure please provide the following information.

1. Laboratory and/or field data sheets for the bottom hole and final remediated soil samples required per NMOCD guidelines.
2. Please verify the actual depth to ground water. This information can be obtained from the NM St. Engr's office located in Roswell, NM. (505-622-6521).
3. Please provide documentation for all contaminated soils shipped off-site. Please include quantities, manifest, invoices, etc.
4. Please provide information on the bottom hole clay liner, such as type, thickness, compaction data, hydraulic conductivity, etc.
5. Provide any other pertinent information such as pictures, field logs, etc.
6. Since this pit was an emergency overflow which was designed to primarily hold "produced oilfield waters", did TEPI evaluate the vertical extent of the salt migration.

If you require any further assistance concerning this matter please do not hesitate to call (505-393-6161) or write.

Sincerely yours,

Wayne Price

Wayne Price-Environmental Engineer

cc: Jerry Sexton-NMOCD District I Supervisor
Bill Olson-NMOCD Hydrogeologist-Environmental Bureau

STATE OF NEW MEXICO

ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
HOBBS DISTRICT OFFICE

POST OFFICE BOX 1980
HOBBS, NEW MEXICO 88241-1980
(505) 393-6161

July 10, 1997

Mr. Rodney Bailey
EHS Coordinator
Texaco E&P Inc.
205 E. Bender
Hobbs, NM 88240

New Mexico Oil Conservation Division (NMOCD) District I office request information concerning the status for the pit closure project referenced below:

1. Cooper-Jal Unit Injection Station, J-sec 24-Ts24s-R36e;

   In order for the NMOCD to issue approval on closure please address the issues in letter dated January 17, 1996 (Price-Ives).

If you require any further information or assistance please do not hesitate to call (505-393-6161) or write this office.

Sincerely Yours,

Wayne Price-Environmental Engineer

cc: Chris Williams-NMOCD District I Supervisor

file: wprbtex

Date: July 14, 1997

Wayne Price
Environmental Engineer
NMOCD
Energy, Minerals & Resources Department

RE: Pit Closure-Cooper Jal Unit Injection Station.
J-sec 24, T 24S, R 36E

The following information is submitted for approval on the closure of Cooper Jal Unit Injection Station pit. Information requested from NMOCD letter dated January 17, 1996:

1. Laboratory and /or field data sheets for bottom hole and final remediated soil samples required per NMOCD guidelines.
A copy of this document is attached.

2. Verify the actual depth of ground water.
The State Engineers Office in Roswell , Mr Johnny Hernandez, stated there are no wells in section 24. The section West contains one well at a depth of 149.69' to water. The section North contains one well at a depth of 131.17' to water. The section East contains one well at a depth of 123.9' to water.

3. Documentation for all contaminated soils shipped off site.
Copies of all manifest, including invoices and quantities are attached.

4. Provide information on bottom clay liner.
Liner type is "CH". Thickness is 2.5' grid rolled with a dozer. Hydraulic conductivity is 10 to the 7+.

5. Provide any other information such as pictures, field logs, etc.
Copies of pictures and closure report from Western Environmental are included.

6. Did TEPI evaluate the vertical extent of the salt migration?
Vertical salt migration was not determined.

If you have any questions please contact me at 505-397-0422

Rodney Bailey

Rodney Bailey
EHS Coordinator
Hobbs Operating Unit

Highlander Environmental Corp.

Midland, Texas

October 10, 1997

Mr. William C. Olson
Environmental Bureau
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
2040 S. Pacheco
Santa Fe, NM 87505

Re: Preliminary Investigation Findings, Notification of Release and Proposed Additional Investigations, Emergency Overflow Pit (Closed), Texaco Exploration and Production, Inc., Cooper-Jal Unit South Injection Station and Tank Battery, NW/4, SE/4, Section 24, Township 24 South, Range 36 East, Lea County, New Mexico

Dear Mr. Olson:

Highlander Environmental Corp. (Highlander) has been retained by Texaco Exploration and Production, Inc. (Texaco) to conduct a preliminary subsurface investigation of a former emergency overflow pit at the Cooper-Jal Unit South Injection Station (Site), located approximately six (6) miles northwest of Jal, New Mexico. The Site is situated in the northwest quarter (NW/4) of the SE/4, Section 24, Township 24 South, Range 37 East, Lea County, New Mexico.

Background

The Site is currently the location of an oil and gas field tank battery and injection station. Previously, the Site included an unlined earthen emergency produced water overflow pit, which measured approximately 50' x 170' x 12'. The pit was operated until its closure in August 1996. Prior to closure, an assessment was performed by Environmental Spill Control, Inc., Hobbs, New Mexico. The purpose of the assessment was to conduct a preliminary subsurface evaluation to determine the horizontal and vertical extent of hydrocarbon impact. The assessment consisted of drilling five (5) boreholes in and adjacent to the pit, and collection of soil samples for laboratory testing. The boreholes were drilled between 15 and 100 feet below ground level (BGL), and soil samples were collected and analyzed for total petroleum hydrocarbons (TPH). The highest TPH concentration reported was 14,890 parts per million (ppm) from a shallow sample obtained near the southern one-half of the pit. The soil samples were also analyzed for benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX), and reported no levels above the test method detection limits. A sample was also tested for RCRA metals by Toxicity Characteristic Leaching Procedure (TCLP), and reported no concentrations above the test method detection limits. The results were reported to Texaco on October 14, 1993.

Closure of the pit began on August 1, 1996. Approximately 1,248 cubic yards of affected soil was removed from the pit and transferred to Parabo, Inc., Eunice, New Mexico for disposal. Soil samples from the bottom of the excavation were analyzed for TPH to confirm that all impacted soil had been removed. Approximately 1,091 cubic yards of clay was placed in the base of the excavation as a "buffer zone", and 3,360 cubic yards of caliche was placed over the clay and backfilled to grade. On August 30, 1996, WEC issued a closure (letter) report.

On December 13, 1996, a pit closure report was submitted to the Oil Conservation Division (OCD), and on January 17, 1997 and July 10, 1997, the OCD requested Texaco to submit additional information, including an evaluation of the vertical extent of salt migration. On July 17, 1997, Texaco submitted additional information, except information pertaining to the vertical salt migration, which was not available.

Preliminary Subsurface Investigation

On August 22, 1997, Highlander personnel supervised drilling of a borehole adjacent to the southeast corner of the pit. The borehole was drilled to an approximate depth of 100 feet BGL, and soil samples were collected from 15-17 feet BGL, and every ten (10) feet thereafter (i.e., 20'-22', 30-32', 40-42', etc.). The samples were analyzed for chloride and reported concentrations from 580 milligrams per kilogram (mg/kg) from 15'-17' to 2,500 mg/kg from 80'-82'. The chloride levels below 82 feet BGL varied in concentration from 540 mg/kg (120'-122') to 1,200 mg/kg (130'-132'). Table 1 presents a summary of the laboratory test results. Appendix A presents the laboratory data reports.

On September 9-10, 1997, additional soil samples collected to 173 feet BGL to further delineate the vertical extent of chloride migration. Groundwater was observed at approximately 142 feet BGL and shale (red bed) was encountered at 173 feet BGL. The soil samples were collected every ten feet (i.e., 110'-112', 120'-122', 130'-132' and 140'-142'), and chloride concentrations ranged from 500 mg/kg (110'-112' BGL) to 1,200 mg/kg (130'-132'). The chloride level in the sample from 140'-142' BGL was 210 mg/kg, and indicated that groundwater had been encountered. The soil samples were visually examined for lithology, and a borehole sample log was prepared (Appendix B).

On September 10, 1997, borehole BH was completed as a groundwater monitoring well (MW-1), and a groundwater sample was collected and analyzed for major ions and cations. The chloride level in the groundwater sample was 8,500 milligrams per liter (mg/L) and exceeded the New Mexico Water Quality control Commission (WQCC) standard of 250 mg/L (20 NMAC 6.2, 3103 B). The TDS level was 15,000 mg/L. Appendix A presents the laboratory report. Appendix B presents the monitoring well construction record.

Proposed Investigation

Highlander proposes to conduct an electromagnetic (EM-34) terrain conductivity survey to evaluate the area of elevated chloride in soil and groundwater. The EM-34 measures the conductivity of oil and groundwater by imparting an alternating electrical current to a transmitter coil which is positioned near the earth's surface. The magnetic field produced as the current passes through the transmitter coil induces small electrical currents into the subsurface soil. The electrical currents produce a secondary magnetic field which is sensed with the primary magnetic field by a receiver coil. The terrain conductivity which is linearly proportional to the ratio of the secondary magnetic field to the primary magnetic field is displayed on an analog scale in millimhos/meter (mmhos/m). The EM-34 has an effective depth of investigation of approximately 200 feet BGL. The EM-34 survey will be conducted using a grid station approach. A 50' x 50' grid network will be established across the Site and measurements will be collected at each grid intersection. A background station will also be established and compared to Site measurements.

Based on the EM-34 survey results, a minimum of three (3) additional monitor wells may be installed to evaluate the extent of the chloride impact. The wells will drilled to the to the top of the red bed (shale) using a truck-mounted rotary drill rig. The monitor wells will be constructed using two (2) inch diameter schedule 40 PVC threaded casing and factory slotted screen. The well screen, approximately forty (40) feet in length, will placed across the entire saturated thickness of the groundwater interval. The well screen will be surrounded with a graded silica sand to a depth approximately 2 feet above the screen. A layer of bentonite pellets, approximately 2-4 feet thick, will be placed in the borehole above the sand pack and hydrated with potable water. The remainder of the borehole will be filled with cement and bentonite grout to about one (1) foot below ground. The wells will be secured with locking steel protectors anchored in a concrete pad measuring approximately 3 feet by 3 feet. The wells will be surveyed by a New Mexico registered land surveyor to determine the approximate ground and top of casing elevations.

Following installation, the wells will be developed by pumping with an electric submersible pump. Water removed from the wells will be placed in an appropriate container (i.e., 55-gallon drums, portable tank, etc.) until disposed is arranged. Groundwater samples will be collected and analyzed for anions, cations, and TDS. Groundwater samples will be delivered to the laboratory via overnight delivery and under chain of custody control. Soil samples may also be collected from a background location and analyzed for chloride.

Highlander will conduct an inventory of water wells within 1-mile radius of the Site for the purpose of identifying possible receptors. The water well search will include a review of records available from the New Mexico State Engineer's Office and visual survey.

All down hole equipment associated with the investigation (i.e., drill rods, bit, water level indicator, submersible pump, etc.) will be thoroughly decontaminated between wells. Soil cuttings from drilling will be stockpiled next to the borehole until disposal is arranged.

Data Evaluation and Reporting

Upon receipt of analytical data from the laboratory, Highlander will assemble all data in tables for presentation in a report. The report will contain discussions of field sampling techniques and laboratory results. Highlander will compare the laboratory test results for soil and groundwater samples to applicable New Mexico OCD or WQCC action levels or cleanup standards. The report will also present a discussion of the EM-34 survey and findings. Detailed Site drawings will be presented in the report, and may include the EM-34 survey results, groundwater potentiometric surface contours, depth-to-groundwater and chloride concentrations.

Highlander will schedule the proposed field activities following your review and approval. Please call if you have questions.

Sincerely,
Highlander Environmental Corp.

Mark J. Larson
Senior Project Manager

Encl.
cc: Mr. Rodney Bailey, TEPI
Mr. Robert Browning, TEPI
Mr. Wayne Price, OCD-Hobbs District

TABLES

Table 1: Summary of Laboratory Analysis of Soil Samples, Texaco Exploration and Production, Inc., Cooper-Jal South Injection Station Emergency Overflow Pit, Lea County, New Mexico

Borehole Number	Sample Date	Sample Depth, Feet BGL	Chloride mg/kg
BH-1	8/22/97	15-17	580
		20-22	970
		30-32	580
		40-42	1,800
		50-52	1,400
		60-62	1,300
		70-72	1,100
		80-82	2,500
		90-92	770
		100-102	750
BH-11-1	9/09/97	110-112	500
		120-122	540
		130-132	1,200
		140-142	210

Notes:

1. BGL: Denotes sample depth in feet below ground
2. mg/kg: Denotes concentration in milligrams per killogram

APPENDIX A

Laboratory Reports

6701 Aberdeen Avenue
Lubbock, Texas 79424
806•794•1296
FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

August 28, 1997
Receiving Date: 08/26/97
Sample Type: Soil
Project No: NA
Project Location: Lea County, NM

Prep Date: 08/28/97
Analysis Date: 08/28/97
Sampling Date: 08/22/97
Sample Condition: Intact & Cool
Sample Received by: JH
Client/Project: Texaco Cooper-
Remoʌ Jal Central TB

TA#	FIELD CODE	CHLORIDE (mg/kg)
T80349	BH-1 (15-17')	580
T80350	BH-1 (20-22')	970
T80351	BH-1 (30-32'	580
T80352	BH-1 (40-42')	1,800
T80353	BH-1 (50-52')	1,400
QC	Quality Control	510
Reporting Limit		0.5
RPD		2
% Extraction Accuracy		100
% Instrument Accuracy		102

METHODS: SM 4500 Cl-B.
CHEMIST: JS
CHLORIDE SPIKE: 10,000 mg/kg Chloride.
CHLORIDE QC: 500 mg/L CHLORIDE.

Director, Dr. Blair Leftwich

8-28-97
DATE

6701 Aberdeen Avenue
Lubbock, Texas 79424
806•794•1296
FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

September 02, 1997
Receiving Date: 08/26/97
Sample Type: Soil
Project No: NA
Project Location: Lea County, NM

Prep Date: 08/29/97
Analysis Date: 08/29/97
Sampling Date: 08/22/97
Sample Condition: Intact & Cool
Sample Received by: JH
Client/Project: Texaco Cooper-
Remoʌ Jal Central TB

TA#	FIELD CODE	CHLORIDE (mg/kg)
T80354	BH-1 (60-62')	1,300
T80355	BH-1 (70-72')	1,100
T80356	BH-1 (80-82')	2,500
QC	Quality Control	504
Reporting Limit		0.5
RPD		3
% Extraction Accuracy		88
% Instrument Accuracy		100

METHODS: SM 4500 Cl-B.
CHEMIST: JS
CHLORIDE SPIKE: 10,000 mg/kg Chloride.
CHLORIDE QC: 500 mg/L CHLORIDE.

Director, Dr. Blair Leftwich

02SEP97
DATE

6701 Aberdeen Avenue
Lubbock, Texas 79424
806•794•1296
FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

September 11, 1997
Receiving Date: 08/26/97
Sample Type: Soil
Project No: NA
Project Location: Lea County, NM

Prep Date: 09/08/97
Analysis Date: 09/08/97
Sampling Date: 08/22/97
Sample Condition: Intact & Cool
Sample Received by: JH
Client/Project: Texaco Cooper-
Remov Jal Central TB

TA#	FIELD CODE	CHLORIDE (mg/kg)
T80357	BH-1 (90-92')	770
T80358	BH-2 (100-102')	750
QC	Quality Control	26
Reporting Limit		20
RPD		0
% Extraction Accuracy		102
% Instrument Accuracy		102

METHODS: EPA 300.0.
CHEMIST: RC
CHLORIDE SPIKE: 25 mg/kg Chloride.
CHLORIDE QC: 25 mg/L CHLORIDE.

Director, Dr. Blair Leftwich

9-11-97
DATE

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 2

CLIENT NAME: TEXACO

SITE MANAGER: IKE Tavarez

PROJECT NO.:

PROJECT NAME: TEXACO Cooper-Jal Central TB. Lea County, NM

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Arsenic
	8/22/97		S			BH-1 (5-7')	1									Hold														
			S			BH-1 (10-12')	1									Hold.														
			S			BH-1 (15-17')	1																							✓
			S			BH-1 (20-22')	1																							✓
			S			BH-1 (30-32')	1																							✓
			S			BH-1 (40-42')	1																							✓
			S			BH-1 (50-52')	1																							✓
			S			BH-1 (60-62')	1									Hold														
			S			BH-1 (70-72')	1									Hold														
	V		S			BH-1 (80-82')	1									Hold.														

RELINQUISHED BY: (Signature) Lynn Cliford Date: 8/25/97 Time: 10:05 AM

RECEIVED BY: (Signature) Helen Ketton Date: 8/26/97 Time: 10:05 AM

SAMPLED BY: (Print & Sign) IKE Tavarez Date: 8/22/97 Time:

RELINQUISHED BY: (Signature) Date: Time:

RECEIVED BY: (Signature) Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX HAND DELIVERED BUS UPS AIRBILL # OTHER:

RELINQUISHED BY: (Signature) Date: Time:

RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature)
DATE: TIME:

HIGHLANDER CONTACT PERSON: IKE Tavarez

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS:

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

10 samples - H

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

CLIENT NAME: TEXACO
SITE MANAGER: IKE Tavarez
PROJECT NO.:
PROJECT NAME: Texaco Cooper-Jal Central TB Lea County, NM.

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Archive.
	8/22/97		S		-	BH-1 (90-92')	1										Hold													
	8/22/97		S		-	BH-2 (100-102')	1										Hold.													

RELINQUISHED BY: (Signature) Tom C. Ward Date: 8/25/97 Time: 1010 AM
RECEIVED BY: (Signature) Helen Ketton Date: 8/25/97 Time: 1010 AM
SAMPLED BY: (Print & Sign) IKE Tavarez Date: 8/22/97 Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:
SAMPLE SHIPPED BY: (Circle) FEDEX BUS UPS HAND DELIVERED AIRBILL # OTHER:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:
HIGHLANDER CONTACT PERSON: IKE Tavarez
Results by:
RUSH Charges Authorized: Yes No

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:
RECEIVED BY: (Signature)
DATE: TIME:

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS:

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

7 samples - HS

6701 Aberdeen Avenue
Lubbock, Texas 79424
806•794•1296
FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

September 29, 1997
Receiving Date: 09/16/97
Sample Type: Soil
Project No: NA
Project Location: Lea Co., NM

Prep Date: 09/26/97
Analysis Date: 09/26/97
Sampling Date: 09/09/97
Sample Condition: Intact & Cool
Sample Received by: JH
Client Name: Texaco E & P
Project Name: Texaco Cooper-Jal
Central TB

TA#	FIELD CODE	CHLORIDE (mg/kg)
T81670	B11-1 (110-112')	500
T81671	B11-1 (120-122')	540
T81672	B11-1 (130-132')	1,200
T81673	B11-1 (140-142')	210
QC	Quality Control	20.9
REPORTING LIMIT		20
RPD		2
% Extraction Accuracy		85
% Instrument Accuracy		88*

METHODS: EPA 300.0.
CHEMIST: RC
CHLORIDE SPIKE: 25 mg/kg CHLORIDE.
CHLORIDE QC: 22 mg/L CHLORIDE.

Director, Dr. Blair Leftwich

9-29-97
DATE

81670 -23

251

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

CLIENT NAME: [illegible]

SITE MANAGER: [illegible]

PROJECT NO.:

PROJECT NAME: [illegible]

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	ANALYSIS REQUEST (Circle or Specify Method No.)
81670	9/15/97		S		X	BH 1 (110-112')							✓
71	9/15/97		S		X	BH 1 (105-107')							✓
72	9/15/97		S		X	BH 1 (125-127')							✓
73	9/15/97		S		X	BH 1 (140-142')							✓

BTEX 8020/602 | MTBE 8020/602 | TPH | PAH 8270 | Total Metals Ag As Ba Cd Cr Pb Hg Se | TCLP Metals Ag As Ba Cd Cr Pd Hg Se | TCLP Volatiles | TCLP Semi Volatiles | RCI | GC.MS Vol. 8240/8260/624 | GC.MS Semi. Vol. 8270/625 | PCB's 8080/608 | Pest. 808/608 | BOD, TSS, pH, TDS, Chloride | Gamma Spec. | Alpha Beta (Air) | PLM (Asbestos)

RELINQUISHED BY: (Signature) [illegible] Date: 9/15/97 Time: 3:55 PM

RECEIVED BY: (Signature) Helen Shelton Date: 9/15/97 Time: 3:55 PM

RELINQUISHED BY: (Signature) Helen Shelton Date: 9-15-97 Time: 6:30PM

RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:

RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY: [illegible]
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature) [illegible]
DATE: 9/16/97 TIME: 9:50A

SAMPLED BY: (Print & Sign) Date: Time:

SAMPLE SHIPPED BY: (Circle)
FEDEX BUS
HAND DELIVERED UPS
AIRBILL # 155-759-013-3
OTHER:

HIGHLANDER CONTACT PERSON:

Results by:

RUSH Charges Authorized:
Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS:

Please Fill out all copies – Project Manager retains White copy – Accounting receives Pink copy – Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

TRACEANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.

Sepetmber 24, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 09/19/97
Analysis Date: 09/22/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name: Texaco E & P

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS
T81829	MW-1	50	630	520	4,300	3,900
QC	Quality Control	53	51	52	53	
METHOD BLANK		<0.30			<0.40	
Reporting Limit		1.0	1.0	0.01	0.4	
HIGH*		528-106%	528-106%		528-106%	
RPD		1	1	2	2	
% Extraction Accuracy		99	93	94	104	
% Instrument Accuracy		105	102	103	105	

*Note: High is out of limits of 95-105%.
METHODS: EPA SW 846-6010.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
QC: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

9-24-97
Date

TRACEANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.

September 29, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 09/18/97
Analysis Date: 09/18/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name:Texaco E & P

TA#	FIELD CODE	pH (s.u.)	TDS (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3)
T81829	MW-1	7.1	15,000	8,500	1,100	280
QC	Quality Control	7.0	---	22	25	---
RPD		0	2	0	1	0
% Extraction Accuracy		---	---	91	101	---
% Instrument Accuracy		100	---	90	100	---
REPORTING LIMIT		---	---	50	50	1.00

METHODS: EPA 300.0, 310.1, 340.2, 150.1, 160.1.
CHEMIST: CHLORIDE/SULFATE/FLUORIDE: RC ALKALINITY/TDS/pH: JS
SPIKE: 25 mg/L CHLORIDE; 25 mg/L SULFATE.
QC: 23 mg/L CHLORIDE; 25 mg/L SULFATE.

Director, Dr. Blair Leftwich

9-29-97
Date

TRACE ANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

October 06, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Prep Date: 10/02/97
Analysis Date: 10/02/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name: Texaco E & P

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS
T81829	MW-1	50	630	520	4,300	3,900
QC	Quality Control	52	51	52	51	
Reporting Limit		0.3	0.01	0.01	0.4	---
RPD		1	0	1	0	
% Extraction Accuracy		109	104	109	102	
% Instrument Accuracy		104	101	103	102	

METHODS: EPA SW 846-6010.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
QC: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

10-6-97
Date

TRACE ANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.

September 29, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 09/18/97
Analysis Date: 09/18/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name:Texaco E & P

TA#	FIELD CODE	pH (s.u.)	TDS (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3)
T81829	MW-1	7.1	15,000	8,500	1,100	280
QC	Quality Control	7.0	—	22	25	—
RPD		0	2	0	1	0
% Extraction Accuracy		—	—	91	101	—
% Instrument Accuracy		100	—	90	100	—
REPORTING LIMIT		—	—	50	50	1.00

METHODS: EPA 300.0, 310.1, 340.2, 150.1, 160.1.
CHEMIST: CHLORIDE/SULFATE/FLUORIDE: RC ALKALINITY/TDS/pH: JS
SPIKE: 25 mg/L CHLORIDE; 25 mg/L SULFATE.
QC: 23 mg/L CHLORIDE; 25 mg/L SULFATE.

Director, Dr. Blair Leftwich

9-29-97
Date

81827 303

Analysis Request and Chain of Custody Record

PAGE: 1 OF:

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

CLIENT NAME: Texaco E&P
SITE MANAGER: Ike Tavarez
PROJECT NO.: 9916
PROJECT NAME: Texaco/Cooper-Jal Central Unit, Lea County.

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)		Major Ions		
81829	9/16/97					MW-1	1	N			✓	✓																			✓		

RELINQUISHED BY: (Signature) [signature] Date: 9/17/97 Time: 11:10
RECEIVED BY: (Signature) Helen Shelton Date: 9/17/97 Time: 4:40 PM

RELINQUISHED BY: (Signature) Helen Shelton Date: 9/17/97 Time: 6:30 PM
RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:
RECEIVED BY: (Signature) [signature]
DATE: 9/18/97 TIME: 9:30A

SAMPLED BY: (Print & Sign) Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX (BUS) UPS HAND DELIVERED AIRBILL # 155-759-016-6 OTHER:

HIGHLANDER CONTACT PERSON: Ike Tavarez

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: (W-Water) A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS: SEE ATTACHED SHEET FOR MAJOR IONS

1 sampler H.S 2101AH

APPENDIX B

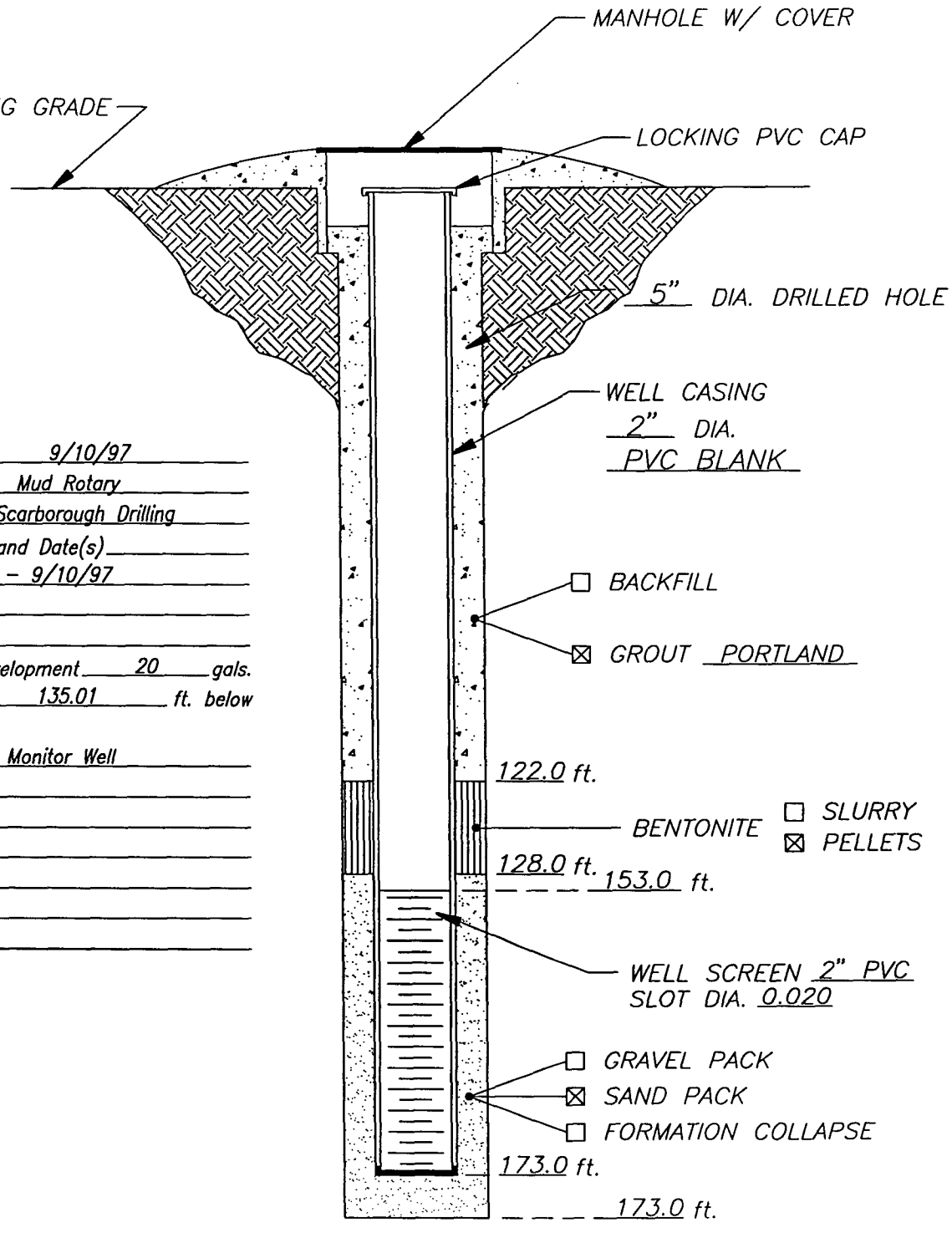
Borehole Sample and Well Construction Logs

SAMPLE LOG

Boring/Well: MW-1
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Total Depth: 173 feet
Date Installed: 9/9/97 - 9/10/97

DEPTH (Ft)	SAMPLE DESCRIPTION
0-5	Top soil, brown, fine grain sand, loose soil, some traces of clay matrix
5-10	Tan, fine grain sand, loose, some traces of caliche, clay encountered at 8.0'
10-15	80% clay material matrix, and 20 % tan, fine grain sand, loose
15-20	90% tan, fine grain sand, loose, and 10% white caliche, friable
20-30	90% tan, fine grain sand, loose, and 10% white caliche, friable
30-35	Caliche and limestone layer, dense formation, trace of fine grain sand
35-40	Tan, fine grain sand, clean, loose
40-50	Tan, fine grain sand, clean, loose
50-60	Tan, fine grain sand, clean, loose, some nodules of white caliche, friable
60-70	Tan, fine grain sand, clean, loose
70-80	Tan, fine grain sand, clean, loose, traces of white caliche layers, some dense
80-90	Tan, fine grain sand, clean, loose, traces of white caliche layers, friable, some dense
90-100	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
100-110	Tan, fine grain sand, clean, loose, traces of white caliche layers, damp
110-120	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone, moist at 140 '
150-160	Tan, fine grain sand, clean, loose, traces of layered cemented sandstone
160-170	Tan, fine grain sand, clean, loose, traces of thin layered cemented sandstone
170-173	Tan, fine grain sand, clean, loose, traces thin layers of cemented sandstone, redbed encountered at 173.0'
173	Redbed

WELL CONSTRUCTION LOG



Installation Date(s) 9/10/97
Drilling Method Mud Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
Hand Bailer - 9/10/97

Water Removed During Development 20 gals.
Static Depth to Water 135.01 ft. below Ground Level
Well Purpose Monitor Well

Remarks

DATE: 9/10/97	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper-Jal Central Unit	MW-1
	LOCATION: Lea County, New Mexico	

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

December 16, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. P-410-431-234

Mr. Rodney Bailey
Texaco E&P Inc.
205 E. Bender
Hobbs, New Mexico 88240

RE: COOPER-JAL UNIT
LEA COUNTY, NEW MEXICO

Dear Mr. Bailey:

The New Mexico Oil Conservation Division (OCD) has reviewed Texaco Exploration & Development's (TEXACO) October 10, 1997 "PRELIMINARY INVESTIGATION FINDINGS, NOTIFICATION OF RELEASE AND PROPOSED ADDITIONAL INVESTIGATIONS, EMERGENCY OVERFLOW PIT (CLOSED), TEXACO EXPLORATION AND PRODUCTION, INC., COOPER-JAL UNIT SOUTH INJECTION STATION AND TANK BATTERY, NW/4, SE/4, SECTION 24, TOWNSHIP 24 SOUTH, RANGE 36 EAST, LEA COUNTY, NEW MEXICO". This document which was submitted on behalf of TEXACO by their consultant Highlander Environmental Corp. contains TEXACO's work plan for investigating the extent of ground water contamination related to an unlined emergency pit at the Cooper-Jal Unit South Injection Station located in Unit J, Section 24, T24S, R36E NMPM, Lea County, New Mexico.

The above referenced work plan is approved with the following conditions:

1. Due to the apparent presence of a salt density driven plume, the OCD requires that TEXACO install shallow and deep nested monitor wells at each location.

    a. The shallow nested monitoring wells will be constructed with 15 feet of well screen, with 10 feet of screen below the top of the water table and 5 feet of screen above the water table. The remainder of the well will be constructed as outlined in the above referenced work plan.

b. The deep nested monitoring wells will be constructed with 10 feet of well screen placed directly on the top of the red beds. The remainder of the well will be constructed as outlined in the above referenced work plan.

2. TEXACO will sample and analyze ground water from all monitor wells for benzene, toluene, ethylbenzene and xylene (BTEX), major cations and anions, total dissolved solids (TDS), WQCC metals and polynuclear aromatic hydrocarbons (PAH) using EPA approved methods and quality assurance/quality control (QA/QC).

3. All wastes generated will be disposed of at an OCD approved facility.

4. TEXACO will submit a comprehensive report on all of the investigations to the OCD by March 13, 1998. The report will be submitted to the OCD Santa Fe Office with a copy provided to the OCD Hobbs District Office. The report will contain:

   a. A description of all past and present investigation activities including conclusions and recommendations.

   b. A summary of all past and present soil and water quality sampling results including copies of the laboratory analytical data sheets and associated QA/QC data.

   c. Geologic logs and well completion diagrams for all past and present monitor wells and boreholes.

   d. A site map showing the location of all monitor wells, boreholes and relevant site features.

   e. A water table elevation map constructed using the water table elevation of ground water in all site monitor wells.

5. TEXACO will notify the OCD at least 1 week in advance of all scheduled activities such that the OCD has the opportunity to witness the events and split samples.

Please be advised that OCD approval does not relieve TEXACO of liability should the investigation actions fail to adequately define the extent of contamination related to TEXACO's activities, or if contamination exists which is outside the scope of the work plan. In addition, OCD approval does not relieve TEXACO of responsibility for compliance with any other federal, state or local laws and regulations.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Wayne Price, OCD Hobbs Office
Mark J. Larson, Highlander Environmental Corp.

Highlander Environmental Corp.

Midland, Texas

March 2, 1998

Mr. William C. Olson, Hydrogeologist
State of New Mexico
Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505

Re: Request for Extension for Report Submittal, Texaco Exploration and Production, Inc., G. L. Erwin "A&B" Federal NCT-2 Tank Battery and Cooper-Jal Unit South Injection Station, Lea County, New Mexico

Dear Mr. Olson:

Highlander Environmental Corp. (Highlander) has been retained by Texaco Exploration and Production, Inc. (Texaco) to conduct subsurface investigations at the above-referenced facilities (Sites). The investigations are being conducted in accordance with work plans approved by the New Mexico Oil Conservation Division (OCD), which requires submittal of a final report by March 1, 1998, for the G. L. Erwin Site and March 13, 1998, for the Cooper-Jal Unit.

As of February 28, 1998, Highlander has completed the fieldwork associated with the Sites. However, the laboratory analysis is not complete, therefore, it is necessary to request extensions for submittal of the final reports. Highlander requests an extension of 30 days from the deadline for each Site in order to receive and evaluate the laboratory data, and prepare the reports. The final report for the G. L. Erwin Site will be submitted by April 1, 1998 and by April 13, 1998 for the Cooper-Jal Site.

Highlander appreciates your consideration of this request. Please call if you have any questions.

Sincerely,
Highlander Environmental Corp.

Mark J. Larson
Senior Project Manager

cc: Rodney Bailey, Texaco Exploration and Production, Inc.

March 2, 1998

Mr. William C. Olson
Hydrogeologist
Environmental Bureau
State of New Mexico
Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505

Re: Request for Extension for Report Submittal, Texaco Exploration and Production, Inc., G. L. Erwin "A&B" Federal NCT-2 Tank Battery and Cooper-Jal Unit South Injection Station, Lea County, New Mexico

Dear Mr. Olson:

Highlander Environmental Corp. (Highlander) has been retained by Texaco Exploration and Production, Inc. (Texaco) to conduct subsurface investigations at the above-referenced facilities (Sites). The investigations are being conducted in accordance with work plans approved by the New Mexico Oil Conservation Division (OCD), which requires submittal of a final report by March 1, 1998, for the G. L. Erwin Site and March 13, 1998, for the Cooper-Jal Unit.

As of February 28, 1998, Highlander has completed the fieldwork associated with the Sites. However, the laboratory analysis is not complete, therefore, it is necessary to request extensions for submittal of the final reports. Highlander requests an extension of 30 days from the deadline for each Site in order to receive and evaluate the laboratory data, and prepare the reports. The final report for the G. L. Erwin Site will be submitted by April 1, 1998 and by April 13, 1998 for the Cooper-Jal Site.

Highlander appreciates your consideration of this request. Please call if you have any questions.

Sincerely,
Highlander Environmental Corp.

Mark J. Larson
Senior Project Manager

cc: Rodney Bailey, Texaco Exploration and Production, Inc.

Highlander Environmental Corp.

Midland, Texas

April 16, 1998

Mr. William C. Olson, Hydrogeologist
Environmental Bureau
Oil Conservation Division
Energy, Minerals and Natural Resources Department
2040 S. Pacheco
Santa Fe, New Mexico 87505

Re: Request for Extension for Continuance of Subsurface Investigation, Texaco Exploration & Production, Inc., Cooper-Jal Unit South Injection Station, Lea County, New Mexico

Dear Mr. Olson:

This letter is written on behalf of Texaco Exploration & Production, Inc. (Texaco) and confirms our telephone conversation of April 15, 1998, regarding a time extension request for completion of investigations associated with the above-referenced matter. Highlander Environmental Corp. (Highlander) has been retained by Texaco to conduct the investigations.

Highlander has completed its initial investigations conducted in accordance with its work plan titled, "Preliminary Investigation Findings, Notification of Release and Proposed Additional Investigations, Emergency Overflow Pit (Closed), Texaco Exploration and Production, Inc., Cooper-Jal Unit South Injection Station and Tank Battery, NW/4, SE/4, Section 24, Township 24 South, Range 36 East, Lea County, New Mexico" (October 10, 1997). The New Mexico Oil Conservation Division (OCD) conditionally approved the work plan on December 16, 1997. The OCD requested that a report be submitted to the OCD by March 13, 1998. Due to the drilling contractor's schedule and receipt of data from the analytical laboratory, Highlander requested a thirty (30) day extension for submittal of the report. The extension was verbally approved by the OCD on March 9, 1998. Currently, Highlander has completed its investigations and has determined that additional investigations are required to determine the extent of impact to groundwater.

Per our April 15, 1998 telephone conversation, Highlander requests a sixty (60) day extension to complete the additional investigations. The additional investigations may include electromagnetic (EM-34) terrain conductivity surveying south and east of the Cooper-Jal South Injection Station, drilling and installation of groundwater monitoring wells, and collection and analysis of groundwater samples. Since it appears that the impact is principally associated with the deeper portion of the groundwater Mr.

system, the additional wells, if installed, will be constructed as deep wells with approximately 10 feet of well screen placed directly on top of the red beds. The remainder of the well will be constructed as outlined in the work plan dated October 10, 1997.

Highlander appreciates your consideration of this request. Please call if you have questions.

Sincerely,
Highlander Environmental Corp.

Mark J. Larson
Senior Project Manager

cc: Mr. Rodney Bailey, Texaco
Mr. Wayne Price, OCD-Hobbs District

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION
2040 S. PACHECO
SANTA FE, NEW MEXICO 87505
(505) 827-7131

December 16, 1997

CERTIFIED MAIL
RETURN RECEIPT NO. P-410-431-234

Mr. Rodney Bailey
Texaco E&P Inc.
205 E. Bender
Hobbs, New Mexico 88240

RE: COOPER-JAL UNIT
LEA COUNTY, NEW MEXICO

Dear Mr. Bailey:

The New Mexico Oil Conservation Division (OCD) has reviewed Texaco Exploration & Development's (TEXACO) October 10, 1997 "PRELIMINARY INVESTIGATION FINDINGS, NOTIFICATION OF RELEASE AND PROPOSED ADDITIONAL INVESTIGATIONS, EMERGENCY OVERFLOW PIT (CLOSED), TEXACO EXPLORATION AND PRODUCTION, INC., COOPER-JAL UNIT SOUTH INJECTION STATION AND TANK BATTERY, NW/4, SE/4, SECTION 24, TOWNSHIP 24 SOUTH, RANGE 36 EAST, LEA COUNTY, NEW MEXICO". This document which was submitted on behalf of TEXACO by their consultant Highlander Environmental Corp. contains TEXACO's work plan for investigating the extent of ground water contamination related to an unlined emergency pit at the Cooper-Jal Unit South Injection Station located in Unit J, Section 24, T24S, R36E NMPM, Lea County, New Mexico.

The above referenced work plan is approved with the following conditions:

1. Due to the apparent presence of a salt density driven plume, the OCD requires that TEXACO install shallow and deep nested monitor wells at each location.

   a. The shallow nested monitoring wells will be constructed with 15 feet of well screen, with 10 feet of screen below the top of the water table and 5 feet of screen above the water table. The remainder of the well will be constructed as outlined in the above referenced work plan.

b. The deep nested monitoring wells will be constructed with 10 feet of well screen placed directly on the top of the red beds. The remainder of the well will be constructed as outlined in the above referenced work plan.

2. TEXACO will sample and analyze ground water from all monitor wells for benzene, toluene, ethylbenzene and xylene (BTEX), major cations and anions, total dissolved solids (TDS), WQCC metals and polynuclear aromatic hydrocarbons (PAH) using EPA approved methods and quality assurance/quality control (QA/QC).

3. All wastes generated will be disposed of at an OCD approved facility.

4. TEXACO will submit a comprehensive report on all of the investigations to the OCD by March 13, 1998. The report will be submitted to the OCD Santa Fe Office with a copy provided to the OCD Hobbs District Office. The report will contain:

   a. A description of all past and present investigation activities including conclusions and recommendations.

   b. A summary of all past and present soil and water quality sampling results including copies of the laboratory analytical data sheets and associated QA/QC data.

   c. Geologic logs and well completion diagrams for all past and present monitor wells and boreholes.

   d. A site map showing the location of all monitor wells, boreholes and relevant site features.

   e. A water table elevation map constructed using the water table elevation of ground water in all site monitor wells.

5. TEXACO will notify the OCD at least 1 week in advance of all scheduled activities such that the OCD has the opportunity to witness the events and split samples.

Please be advised that OCD approval does not relieve TEXACO of liability should the investigation actions fail to adequately define the extent of contamination related to TEXACO's activities, or if contamination exists which is outside the scope of the work plan. In addition, OCD approval does not relieve TEXACO of responsibility for compliance with any other federal, state or local laws and regulations.

If you have any questions, please contact me at (505) 827-7154.

Sincerely,

William C. Olson
Hydrogeologist
Environmental Bureau

xc: Wayne Price, OCD Hobbs Office
Mark J. Larson, Highlander Environmental Corp.

April 16, 1998

Mr. William C. Olson, Hydrogeologist
Environmental Bureau
Oil Conservation Division
Energy, Minerals and Natural Resources Department
2040 S. Pacheco
Santa Fe, New Mexico 87505

Re: Request for Extension for Continuance of Subsurface Investigation, Texaco Exploration & Production, Inc., Cooper-Jal Unit South Injection Station, Lea County, New Mexico

Dear Mr. Olson:

This letter is written on behalf of Texaco Exploration & Production, Inc. (Texaco) and confirms our telephone conversation of April 15, 1998, regarding a time extension request for completion of investigations associated with the above-referenced matter. Highlander Environmental Corp. (Highlander) has been retained by Texaco to conduct the investigations.

Highlander has completed its initial investigations conducted in accordance with its work plan titled, "Preliminary Investigation Findings, Notification of Release and Proposed Additional Investigations, Emergency Overflow Pit (Closed), Texaco Exploration and Production, Inc., Cooper-Jal Unit South Injection Station and Tank Battery, NW/4, SE/4, Section 24, Township 24 South, Range 36 East, Lea County, New Mexico" (October 10, 1997). The New Mexico Oil Conservation Division (OCD) conditionally approved the work plan on December 16, 1997. The OCD requested that a report be submitted to the OCD by March 13, 1998. Due to the drilling contractor's schedule and receipt of data from the analytical laboratory, Highlander requested a thirty (30) day extension for submittal of the report. The extension was verbally approved by the OCD on March 9, 1998. Currently, Highlander has completed its investigations and has determined that additional investigations are required to determine the extent of impact to groundwater.

Per our April 15, 1998 telephone conversation, Highlander requests a sixty (60) day extension to complete the additional investigations. The additional investigations may include electromagnetic (EM-34) terrain conductivity surveying south and east of the Cooper-Jal South Injection Station, drilling and installation of groundwater monitoring wells, and collection and analysis of groundwater samples. Since it appears that the impact is principally associated with the deeper portion of the groundwater Mr.

system, the additional wells, if installed, will be constructed as deep wells with approximately 10 feet of well screen placed directly on top of the red beds. The remainder of the well will be constructed as outlined in the work plan dated October 10, 1997.

Highlander appreciates your consideration of this request. Please call if you have questions.

Sincerely,
Highlander Environmental Corp.

Mark J. Larson
Senior Project Manager

cc: Mr. Rodney Bailey, Texaco
Mr. Wayne Price, OCD-Hobbs District

APPENDIX B

EM-34 Field Sheets

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	Base Station	**EM-34 TERRAIN**	**DATE:**	1/13/98
GRID SPACING:	25'	**CONDUCTIVITY SURVEY**	**START TIME**	12:50
NOTES:	E - W		**END TIME:**	13:00

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
A	14	100	31	100	
B	14	100	30	100	
C	15	100	32	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 0	**EM-34 TERRAIN**	**DATE:**	1/13/98 & 5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	13:05
NOTES:	W-E		**END TIME:**	13:18

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	13	100	25	100	
E100	14	100	23	100	
E 200	12	100	22	100	
E 300	14	100	30	100	
E 400	15	100	I	100	P/L (NW/SE) appx 15'E
E 500	I	100	90	100 / 300	P/L (NW/SE) appx 40'E
E 600	16	100	I	100	
E 700	17	100	I	100	P/L (W/S) appx 20'W
E 800	14	100	I	100	
E 900	14	100	38	100	
E 1000	8	100	I	100	
E 1100	18	100	30	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 100	**EM-34 TERRAIN**	**DATE:**	1/13/98 & 5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	13:22
NOTES:	E - W		**END TIME:**	13:32

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	11	100	I	100	
E 100	13	100	26	100	
E 200	13	100	39	100	
E 300	13	100	I	100	P/L (NW/SE) appx 15'E
E 400	14	100	I	100	
E 500	20	100	25	100	P/L's (2)(NW/SE) appx 45'E & 65'E
E 600	22	100	46	100	
E 700	17	100	70	100 / 300	CJU Well #245 60'N
E 800	18	100	12	100	
E 900	14	100	I	100	
E 1000	16	100	58	100 / 300	
E 1100	18	100	22	100	

Notes: 1. I: Denotes interference

TEXACO E & P
G.L. ERWIN TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 200	**EM-34 TERRAIN**	**DATE:**	1/13/98 & 5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	13:35
NOTES:	W - E		**END TIME:**	13:48

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	12	100	I	100	E-W O/H appx 5'N
E 100	12	100	I	100	O/H appx 20'N
E 200	I	100	I	100	O/H (E-W) 30'N (Intersects N-S O/H)
E 300	I	100	I	100	P/L (NW/SE) appx 15'N
E 400	I	100	30	100	P/L (NW/SE) at station
E 500	I	100	I	100	P/L's (2) 20'E & 35'E (SE-NW)
E 600	22	100	20	100	
E 700	22	100	35	100	CJU Well #245 40'S
E 800	14	100	I	100	
E 900	14	100	I	100	
E 1000	16	100	28	100	
E 1100	16	100	20	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 300	EM-34 TERRAIN	DATE:	1/13/98 & 5/7/98
GRID SPACING:	100'	CONDUCTIVITY SURVEY	START TIME	14:31
NOTES:	E - W		END TIME:	14:40

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	12	100	27	100	Old lease road (NW/SE) appx 10'N
E 100	4	100	I	100	
E 200	I	100	I	100	O/H (N-S) appx 5'W
E 300	I	100	45	100	
E 400	I	100	I	100	
E 500	20	100	I	100	P/L (NW-SE) appx 65'E
E 600	20	100	48	100	
E 700	18	100	50	100 / 300	O/H appx 30'N (E-W)
E 800	14	100	I	100	
E 900	16	100	62	100 / 300	
E 1000	16	100	22	100	
E 1100	16	100	22	100	

Notes: 1. I: Denotes interference

TEXACO E & P
G.L. ERWIN TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 400	EM-34 TERRAIN	DATE:	1/13/98 & 5/7/98
GRID SPACING:	100'	CONDUCTIVITY SURVEY	START TIME	14:40
NOTES:	W - E		END TIME:	14:50

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	13	100	13	100	P/L (NW/SE)
E 100	12	100	14	100	P/L (NW/SE) appx 10'S
E 200	I	100	I	100	O/H (N-S) appx 5'W
E 300	34	100	I	100	U/G Electric (E-W) appx 30'N
E 400	I	100	I	100	
E 500	I	100	I	100	
E 600	20	100	82	100 / 300	E-W lease road appx 30'N
E 700	14	100	I	100	E-W lease road appx 30'N
E 800	16	100	I	100	
E 900	24	100	76	100 / 300	
E 1000	16	100	26	100	
E 1100	16	100	22	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 500	**EM-34 TERRAIN**	**DATE:**	1/13/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME:**	14:50
NOTES:	E - W		**END TIME:**	15:00

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	20	100	42	100	
E 100	15	100	46	100	
E 200	19	100	52	100 / 300	
E 300	44	100	140	300	
E 400	40	100	300	300	
E 500	32	100	I	100	
E 600	I	100	45	100	
E 700	19	100	68	100 / 300	
E 800	I	100	I	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 600	**EM-34 TERRAIN**	**DATE:**	1/14/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	08:06
NOTES:	W - E		**END TIME:**	08:10

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	9	100	I	100	
E 100	8	100	I	100	
E 200	10	100	I	100	
E 300	18	100	I	100	
E 400	7	100	I	100	
E 500	I	100	I	100	
E 600	I	100	50	100 / 300	
E 700	I	100	I	100	P/L appx 35'N (E-W)

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	N 700	**EM-34 TERRAIN**	**DATE:**	1/14/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	08:10
NOTES:	E - W		**END TIME:**	08:20

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	N/D		N/D		
E 100	N/D		N/D		
E 200	N/D		N/D		
E 300	N/D		N/D		
E 400	N/D		N/D		
E 500	N/D		N/D		
E 600	I	100	I	100	P/L (E-W) 5'S (twins NE appx 20'W)
E 700	7	100	I	100	P/L (E-W) appx 35'N

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 100	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	12:20
NOTES:	W - E		**END TIME:**	12:40

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	14	100	26	100	
E 100	12	100	22	100	
E 200	14	100	22	100	
E 300	14	100	34	100	
E 400	12	100	I	I	
E 500	12	100	78	100	
E 600	20	100	56	100	
E 700	16	100	I	I	No Reading
E 800	22	100	I	I	No Reading
E 900	130	300	30	300	
E 1000	110	300	I	I	No Reading
E 1100	8	100	28	100	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 100	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	12:50
NOTES:	W - E		**END TIME:**	

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	18	100	18	100	West edge reseve pit
E 100	12	100	12	100	In reserve pit
E 200	15	100	32	100	
E 300	14	100	24	100	
E 400	16	100	46	100	
E 500	16	100	I	I	Crossing Line
E 600	14	100	90	100	
E 700	20	100	10	100	
E 800	26	100	I	I	No Reading
E 900	46	100	64	100	
E 1000	110	300	I	I	Electrical Overload Line
E 1100	150	300	I	I	Electrical Overload Line

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 300	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	1:10
NOTES:	W - E		**END TIME:**	1:35

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	12	100	20	100	West of pad
E 100	10	100	18	100	On pad
E 200	10	100	48	100	On Pad
E 300	10	100	90	100	
E 400	180	300	24	100	
E 500	190	300	30	100	
E 600	76	100	22	100	
E 700	38	100	110	300	
E 800	30	100	110	300	
E 900	22	100	42	100	
E 1000	18	100	92	100	
E 1100	18	100	I	I	Edge of reserve pit (west edge)

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 400	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	1:36
NOTES:	W - E		**END TIME:**	

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	12	100	18	100	West of pad (off pad)
E 100	12	100	20	100	On Pad (Well #421)
E 200	12	100	22	100	On Pad (Well #421)
E 300	16	100	24	100	
E 400	18	100	28	100	
E 500	16	100	30	100	
E 600	16	100	59	100	
E 700	14	100	I	I	
E 800	16	100	70	100	
E 900	16	100	32	100	
E 1000	18	100	38	100	
E 1100	20	100	I	I	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 500	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	2:33
NOTES:	W - E		**END TIME:**	3:11

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	14	100	18	100	
E 100	14	100	18	100	
E 200	14	100	16	100	
E 300	14	100	18	100	
E 400	16	100	20	100	
E 500	16	100	22	100	
E 600	16	100	34	100	
E 700	14	100	30	300	
E 800	18	100	I	I	Pipeline crossing
E 900	16	100	60	100	
E 1000	16	100	34	100	
E 1100	14	100	120	300	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 600	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	3:12
NOTES:	W - E		**END TIME:**	3:45

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E 0	14	100	14	100	
E 100	14	100	20	100	
E 200	14	100	22	100	
E 300	16	100	24	100	
E 400	16	100	28	100	
E 500	14	100	30	100	
E 600	14	100	66	100	
E 700	14	100	30	100	
E 800	12	100	100	300	
E 900	14	100	I	I	
E 1000	16	100	62	300	
E 1100	16	100	50	300	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 700	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	6:00
NOTES:	E - W		**END TIME:**	6:36

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
E (N) O	20	100	30	100	
E (S) 100	90	100	I	I	
E 200	I	I	I	I	
E 300	I	I	I	I	Edge road
E 400	110	100	I	I	No Reading
E 500	50	100	I	I	
E 600	I	I	I	I	
E 700	I	I	I	I	
E 800	250	100	I	I	No Reading
E 900	24	100	200	300	
E 1000	14	100	70	100	
E 1100	14	100	170	300	

Notes: 1. I: Denotes interference

TEXACO E & P
COOPER-JAL TANK BATTERY
LEA COUNTY, NEW MEXICO

PROFILE NO:	S 800	**EM-34 TERRAIN**	**DATE:**	5/7/98
GRID SPACING:	100'	**CONDUCTIVITY SURVEY**	**START TIME**	6:30
NOTES:			**END TIME:**	

STATION NO.	20 METER HD READING	SCALE	20 METER VD READING	SCALE	NOTES
N 0	14	100	18	100	
E 1000	14	100	18	100	
E 200	16	100	20	100	
E 300	14	100	22	100	
E 400	14	100	26	100	
E 500	12	100	22	100	
E 600	12	100	14	100	
E 700	14	100	40	300	East of road
E 800	14	100	10	100	
E 900	14	100	46	100	
E 1000	12	100	60	300	
E 1100	14	100	I	I	

Notes: 1. I: Denotes interference

APPENDIX C

Borehole Sample Logs

SAMPLE LOG

Boring/Well: MW-1
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Total Depth: 173 feet
Date Installed: 9/9/97 - 9/10/97

DEPTH (Ft)	SAMPLE DESCRIPTION
0-5	Top soil, brown, fine grain sand, loose soil, some traces of clay matrix
5-10	Tan, fine grain sand, loose, some traces of caliche, clay encountered at 8.0'
10-15	80% clay material matrix, and 20 % tan, fine grain sand, loose
15-20	90% tan, fine grain sand, loose, and 10% white caliche, friable
20-30	90% tan, fine grain sand, loose, and 10% white caliche, friable
30-35	Caliche and limestone layer, dense formation, trace of fine grain sand
35-40	Tan, fine grain sand, clean, loose
40-50	Tan, fine grain sand, clean, loose
50-60	Tan, fine grain sand, clean, loose, some nodules of white caliche, friable
60-70	Tan, fine grain sand, clean, loose
70-80	Tan, fine grain sand, clean, loose, traces of white caliche layers, some dense
80-90	Tan, fine grain sand, clean, loose, traces of white caliche layers, friable, some dense
90-100	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
100-110	Tan, fine grain sand, clean, loose, traces of white caliche layers, damp
110-120	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone, moist at 140 '
150-160	Tan, fine grain sand, clean, loose, traces of layered cemented sandstone
160-170	Tan, fine grain sand, clean, loose, traces of thin layered cemented sandstone
170-173	Tan, fine grain sand, clean, loose, traces thin layers of cemented sandstone, redbed encountered at 173.0'
173	Redbed-clay

SAMPLE LOG

Boring/Well: MW-2
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 173 feet
Date Installed: 2/12/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Top soil, brown, fine grain sand, loose soil, caliche encountered at 3.0'
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
50-60	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
60-70	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
70-80	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
80-90	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
90-100	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
100-110	Tan, fine grain sand, clean, loose, traces of white caliche layers, some dense
110-120	Tan, fine grain sand, clean, loose ,trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, traces of white caliche layers, damp
140-150	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
150-160	Tan, fine grain sand, clean, loose, trace of gravel, damp
160-170	Tan, fine grain sand, clean, and gravel, trace of red clay
170-173	Tan, fine grain sand and gravel , loose, red clay – Redbed encountered at 173'
	TD – 173'

SAMPLE LOG

Boring/Well: MW-2A
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 145 feet
Date Installed: 2/13/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Top soil, brown, fine grain sand, loose soil, caliche encountered at 3.0'
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
50-60	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
60-70	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
70-80	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
80-90	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
90-100	Tan, fine grain sand, clean, loose, small layer of cemented sandstone
100-110	Tan, fine grain sand, clean, loose, traces of white caliche layers, some dense
110-120	Tan, fine grain sand, clean, loose ,trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, traces of white caliche layers, damp
140-145	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
	TD - 145'

SAMPLE LOG

Boring/Well: MW-3
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 171 feet
Date Installed: 2/9/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Top soil, brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone, sandy at 31'
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	50% tan, fine grain sand, loose, 50 % dense layers of cemented sandstone, traces of white caliche
50-60	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
90-100	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
100-110	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
150-160	Tan, fine grain sand, clean, loose, trace of gravel, damp
160-170	Tan, fine grain sand, clean, and gravel, trace of red clay
170-171	Tan, fine grain sand and gravel , loose, and red clay – Redbed encountered at 171'
	TD – 171'

SAMPLE LOG

Boring/Well: MW-4
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 171 feet
Date Installed: 2/10/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	50% tan, fine grain sand, loose, 50 % dense layers of cemented sandstone, traces of white caliche
50-60	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
100-110	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
150-160	Tan, fine grain sand, clean, loose, trace of gravel, damp
160-170	Tan, fine grain sand, clean, and gravel layer encountered at 165', trace of red clay
170-171	Tan, fine grain sand and gravel , loose, red clay - Redbed encountered at 171'
	TD - 171'

SAMPLE LOG

Boring/Well: MW-4A
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 143feet
Date Installed: 2/11/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	50% tan, fine grain sand, loose, 50 % dense layers of cemented sandstone, traces of white caliche
50-60	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
100-110	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-143	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
	TD - 143'

SAMPLE LOG

Boring/Well: MW-5
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 171 feet
Date Installed: 2/10/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose , 30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone
150-160	Tan, fine grain sand, clean, loose, and trace of gravel, traces of clay
160-171	Tan, fine grain sand, clean, loose, and gravel - white, yellow, and red clay encountered at 171'
	TD - 171

SAMPLE LOG

Boring/Well: MW-5A
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 141 feet
Date Installed: 2/12/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose ,30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-141	Tan, fine grain sand, clean, loose, damp
	TD - 141'

SAMPLE LOG

Boring/Well: MW-6
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 170 feet
Date Installed: 2/13/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil, dense caliche layer encountered at 2'
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose , 30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone
150-160	Tan, fine grain sand, clean, loose, and trace of gravel
160-170	Tan, fine grain sand, clean, loose, and gravel - white, and redbed -red clay encountered at 170'
	TD - 170

SAMPLE LOG

Boring/Well: MW-7
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 166 feet
Date Installed: 5/14/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	50% tan, fine grain sand, loose, 50 % dense layers of cemented sandstone, traces of white caliche
50-60	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
100-110	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
150-160	Tan, fine grain sand, clean, loose, trace of gravel
160-166	Tan, fine grain sand, clean, and gravel layer encountered at 165', red clay @ 166'
	TD - 166'

SAMPLE LOG

Boring/Well: MW-8
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 170 feet
Date Installed: 5/12/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	50% tan, fine grain sand, loose, 50 % dense layers of cemented sandstone, traces of white caliche
50-60	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
100-110	50 % tan, fine grain sand, loose, 50% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of white caliche layers and cemented sandstone, damp
150-160	Tan, fine grain sand, clean, loose, trace of gravel, damp
160-170	Tan, fine grain sand, clean, and gravel layer encountered at 165', redbed encountered at 170'
	TD - 170'

SAMPLE LOG

Boring/Well: MW-9
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 164 feet
Date Installed: 5/12/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Tan, fine grain sand, loose soil, dense caliche layer encountered at 3'
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose , 30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone
150-164	Tan, fine grain sand, clean, loose, and gravel , and redbed-red clay encountered at 163'
	TD-164'

SAMPLE LOG

Boring/Well: MW-9A
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 142 feet
Date Installed: 5/14/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Tan, fine grain sand, loose soil, dense caliche layer encountered at 3'
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose , 30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone, becoming sandy with depth
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-142	Tan, fine grain sand, clean, loose, damp
	TD - 142'

SAMPLE LOG

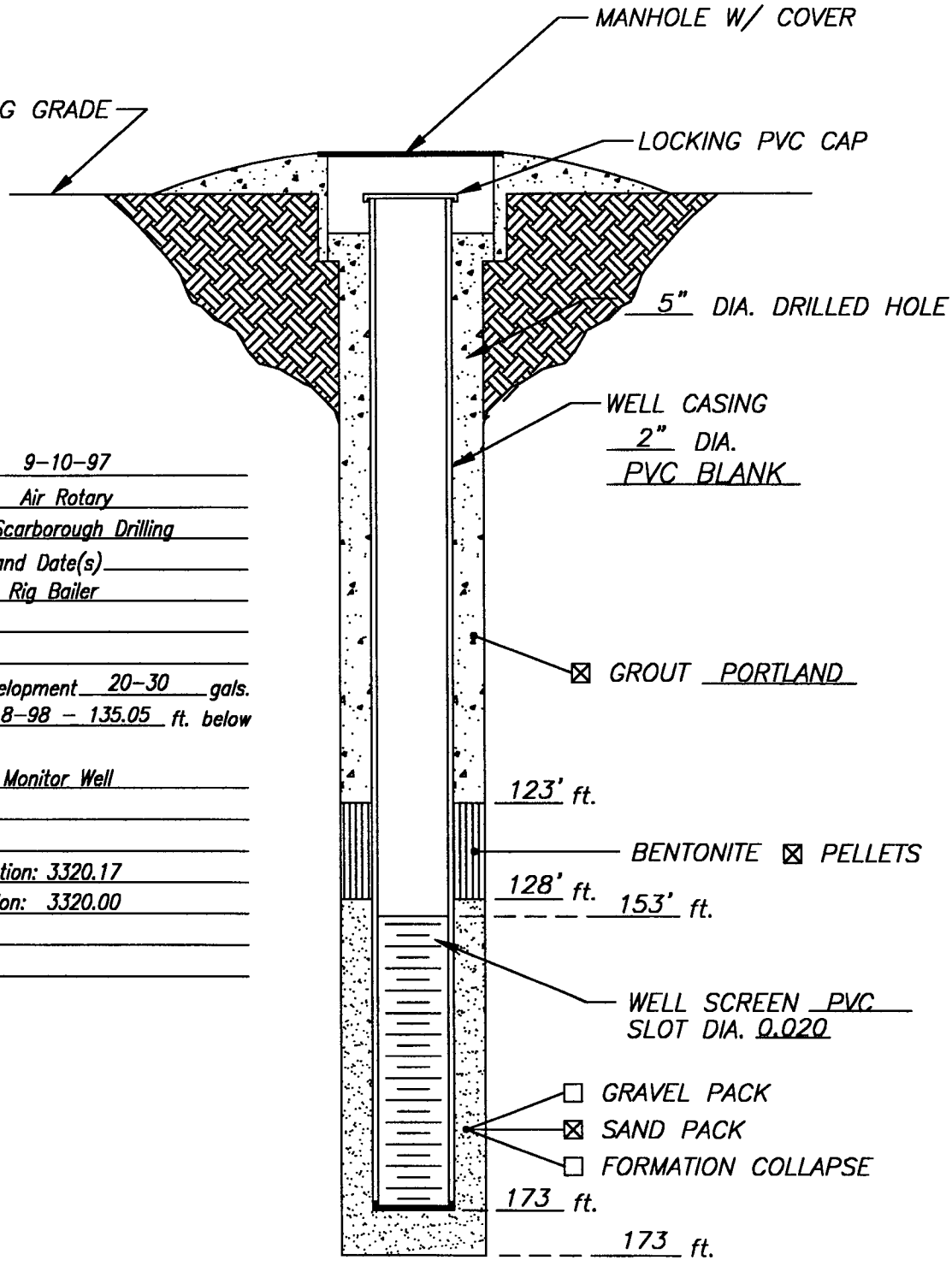
Boring/Well: MW-10
Client: Texaco Exploration and Production, Inc.
Project: Texaco / Cooper-Jal Central Tank Battery
Location: Lea County, New Mexico
Total Depth: 166 feet
Date Installed: 5/13/98

DEPTH (Ft)	SAMPLE DESCRIPTION
0-10	Brown, fine grain sand, loose soil
10-20	Tan, fine grain sand, loose, some traces of cemented sandstone layers
20-30	Tan, fine grain sand, loose, dense layers of cemented sandstone
30-40	Tan, fine grain sand, loose, dense layers of cemented sandstone, traces of white caliche
40-50	80% tan, fine grain sand, loose, 20 % dense layers of cemented sandstone, traces of white caliche
50-60	80 % tan, fine grain sand, loose, 20% dense layers of cemented sandstone, traces of white caliche
60-70	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
70-80	75% tan, fine grain sand, clean, loose, 25 % small layers of cemented sandstone
80-90	80% tan, fine grain sand, clean, loose, 20 % small layers of cemented sandstone
90-100	70 % tan, fine grain sand, loose , 30% dense layers of cemented sandstone
100-110	70 % tan, fine grain sand, loose, 30% dense layers of cemented sandstone
110-120	Tan, fine grain sand, clean, loose, trace of cemented sandstone
120-130	Tan, fine grain sand, clean, loose, trace of cemented sandstone, damp
130-140	Tan, fine grain sand, clean, loose, damp
140-150	Tan, fine grain sand, clean, loose, traces of cemented sandstone
150-160	Tan, fine grain sand, clean, loose, and trace of gravel, traces of clay
160-166	Tan, fine grain sand, clean, loose, and gravel @ 164', yellow and red clay encountered at 171'
	TD - 166'

APPENDIX D

Monitor Well Construction Diagrams

WELL CONSTRUCTION LOG



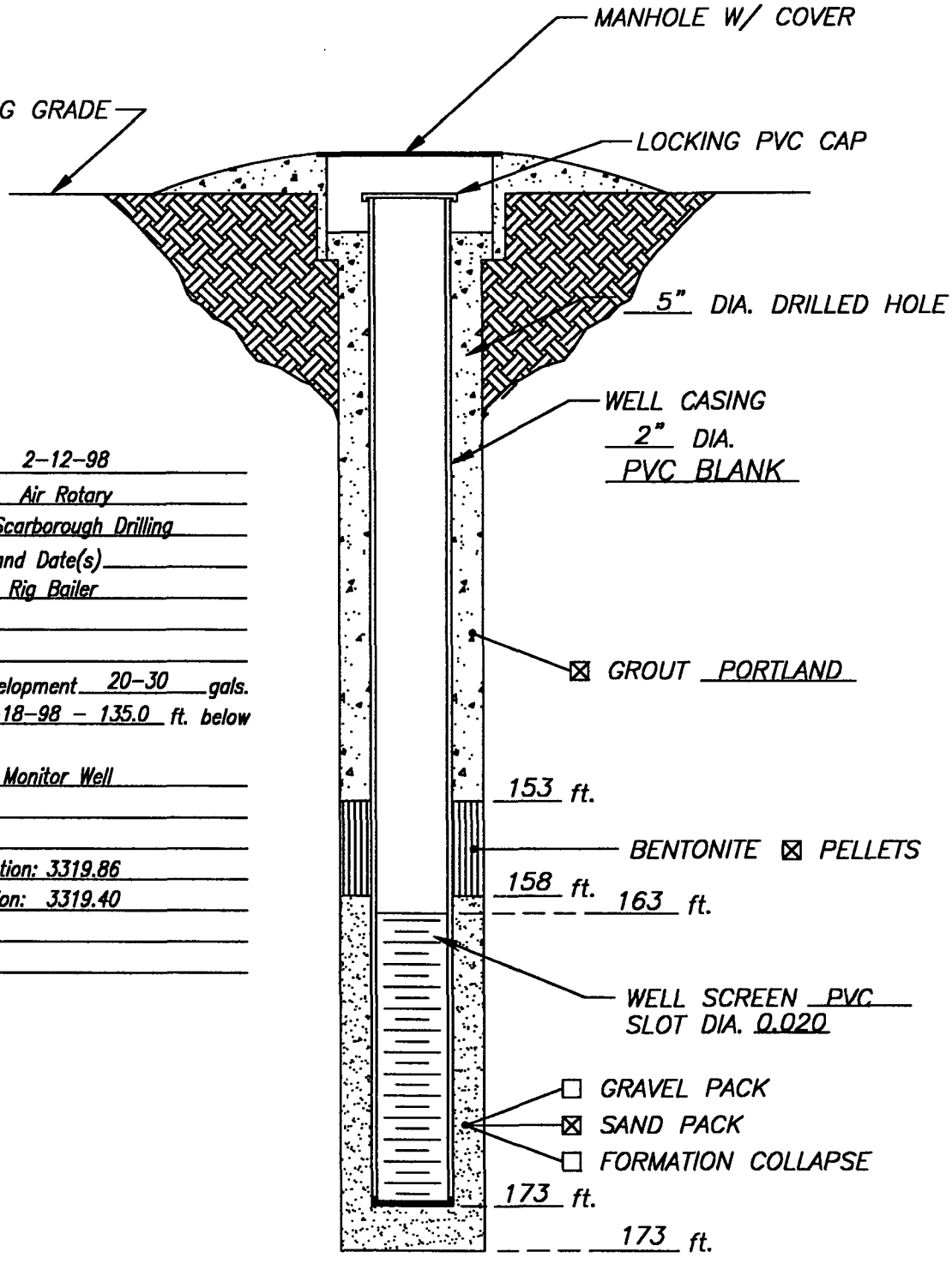
Installation Date(s) 9-10-97
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
9-10-97 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 135.05 ft. below M.P.
Well Purpose Monitor Well

Remarks
Ground Elevation: 3320.17
T.O.C. Elevation: 3320.00

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Central Tank Battery	MW-1
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



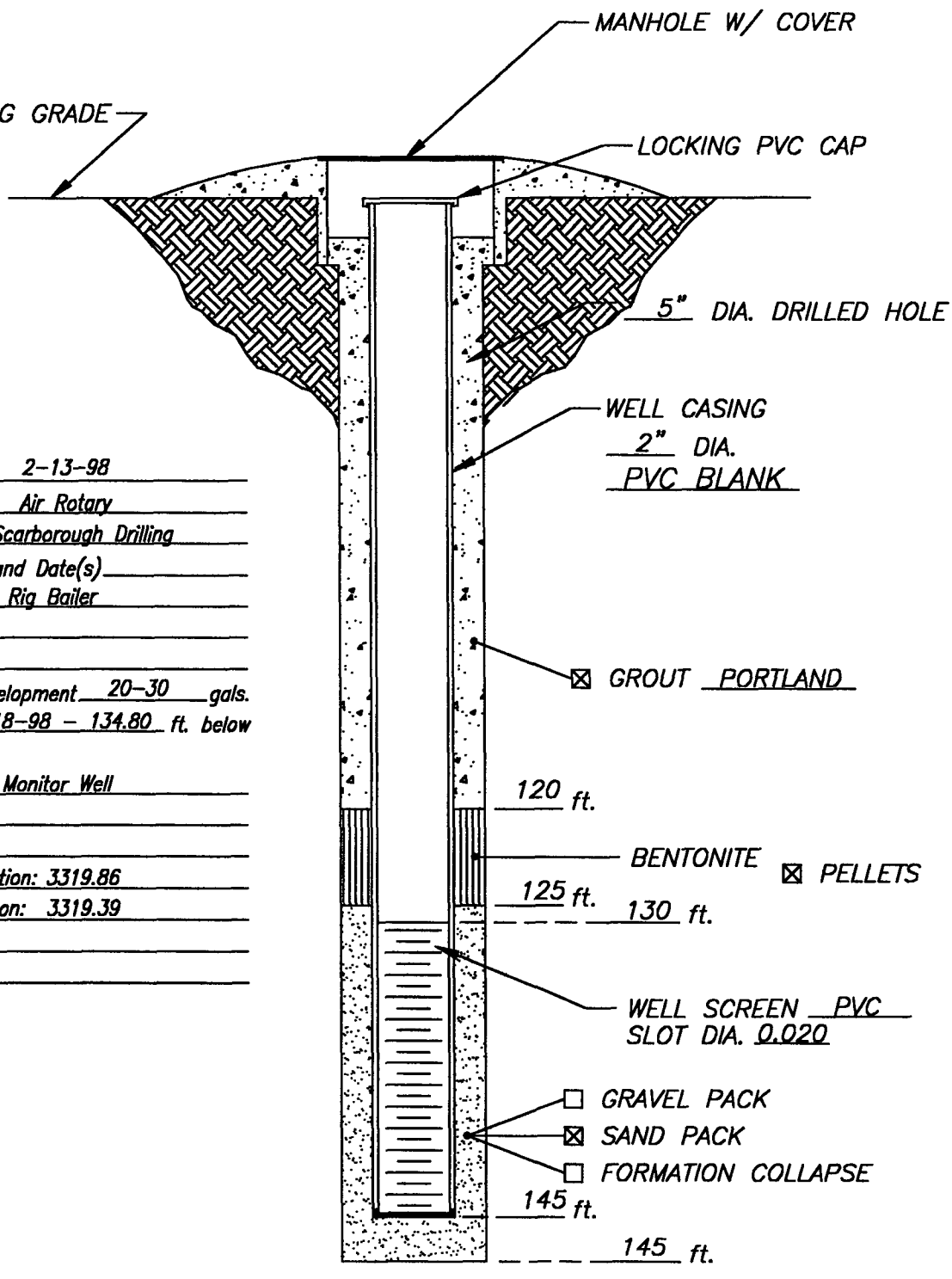
Installation Date(s) 2-12-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-12-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 135.0 ft. below M.P.
Well Purpose Monitor Well

Remarks
Ground Elevation: 3319.86
T.O.C. Elevation: 3319.40

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Central Tank Battery	MW-2
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



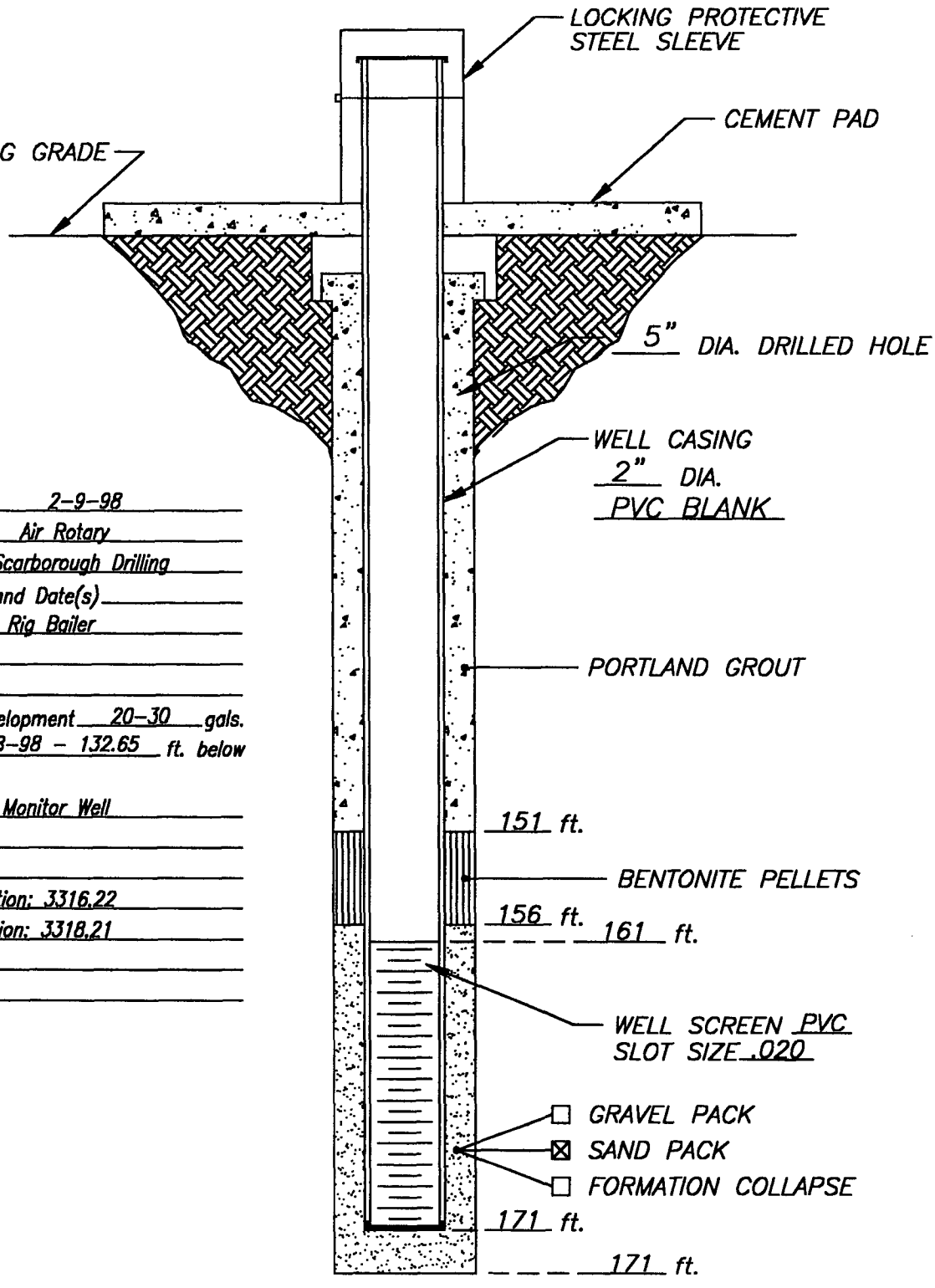
Installation Date(s) 2-13-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-13-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 134.80 ft. below M.P.
Well Purpose Monitor Well

Remarks
Ground Elevation: 3319.86
T.O.C. Elevation: 3319.39

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Central Tank Battery	MW-2A
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



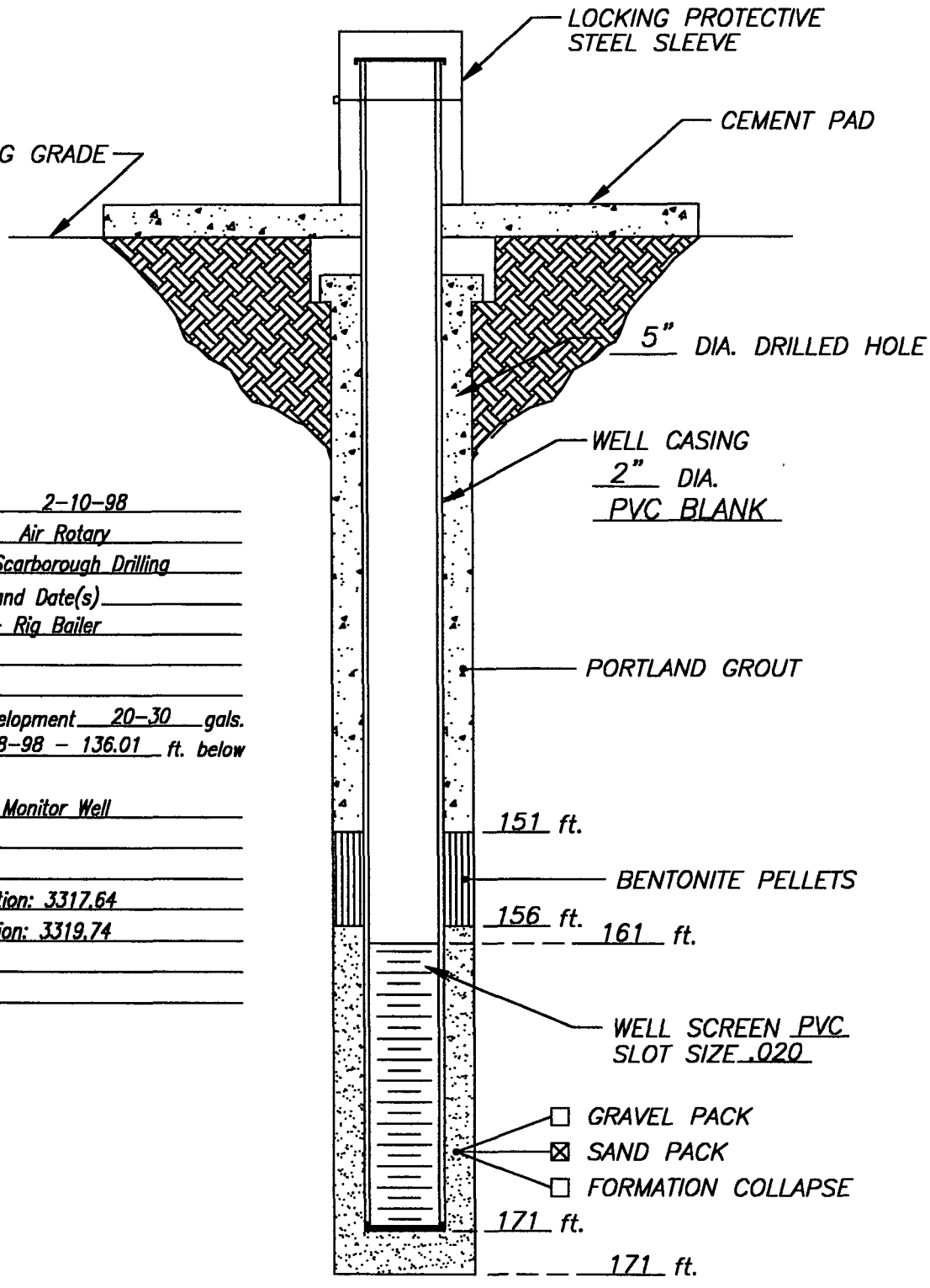
Installation Date(s) 2-9-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-9-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 132.65 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3316.22
T.O.C. Elevation: 3318.21

DATE: 5-26-98 Highlander Environmental	CLIENT: Texaco Exploration & Production, Inc. PROJECT: Texaco Cooper Tank Battery LOCATION: Lea County, New Mexico	WELL NO. MW-3

WELL CONSTRUCTION LOG



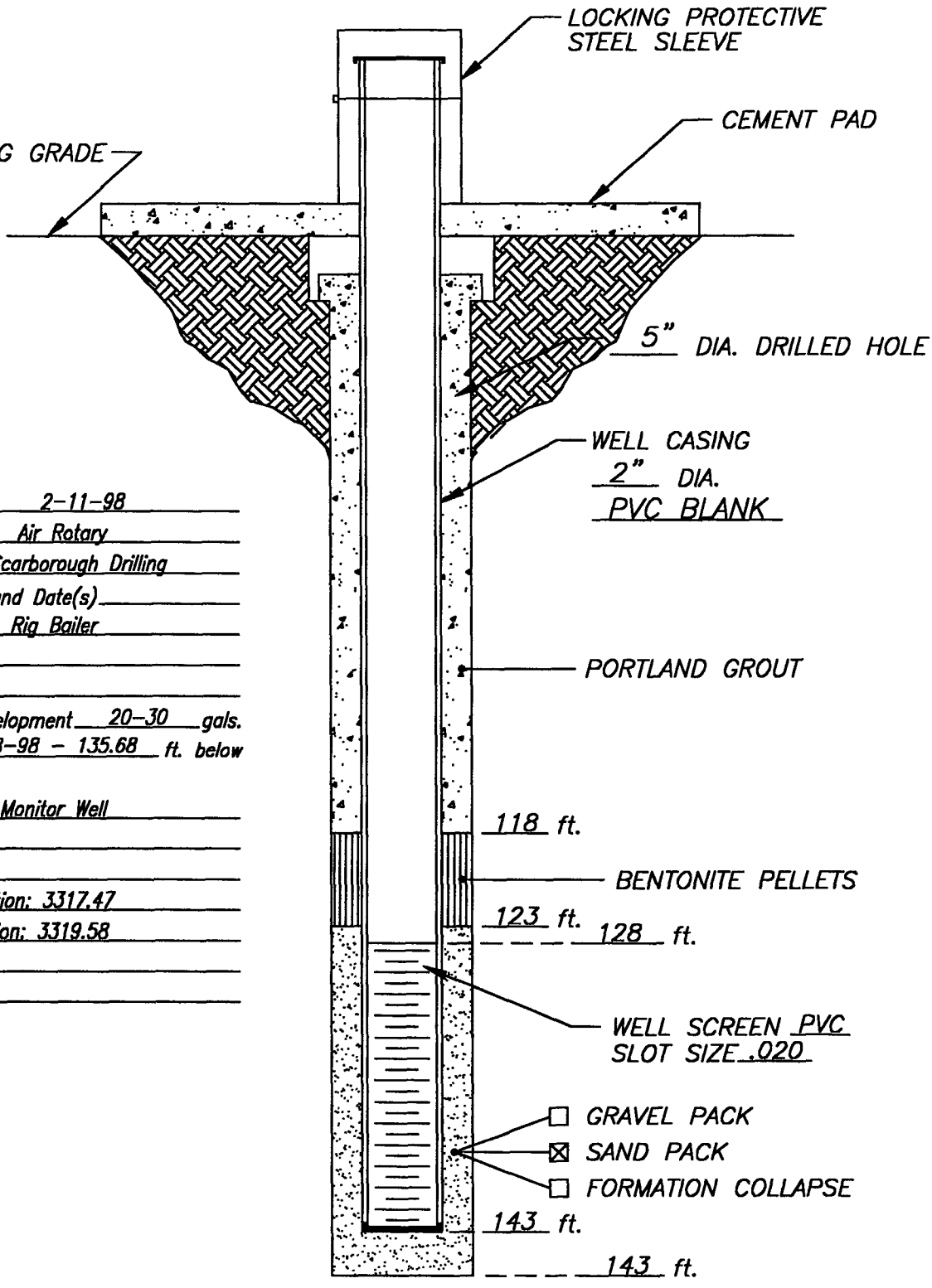
Installation Date(s) 2-10-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-10-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 136.01 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3317.64
T.O.C. Elevation: 3319.74

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-4
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



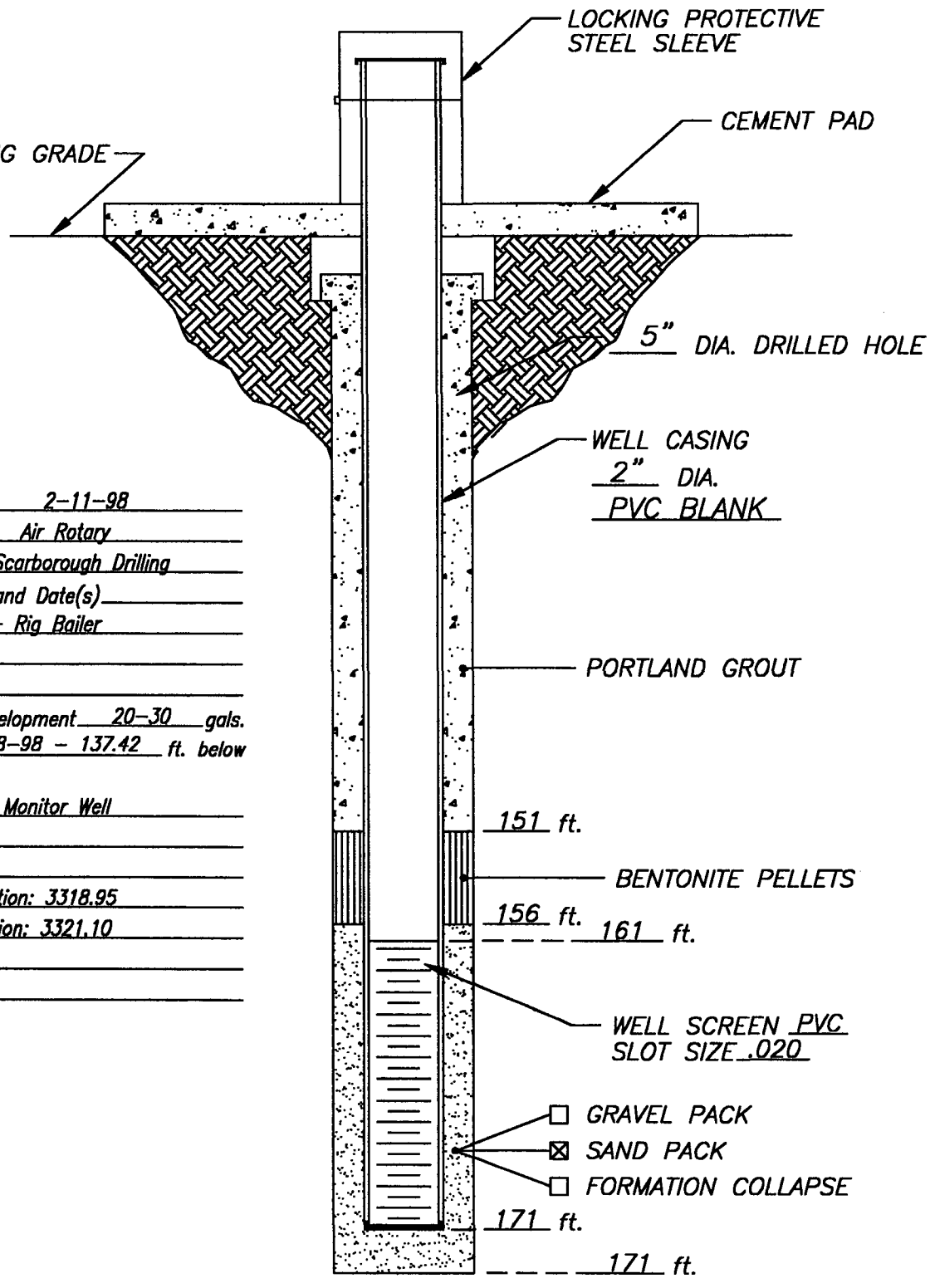
Installation Date(s) 2-11-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-11-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 135.68 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3317.47
T.O.C. Elevation: 3319.58

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-4A
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



Installation Date(s) 2-11-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-11-98 - Rig Bailer

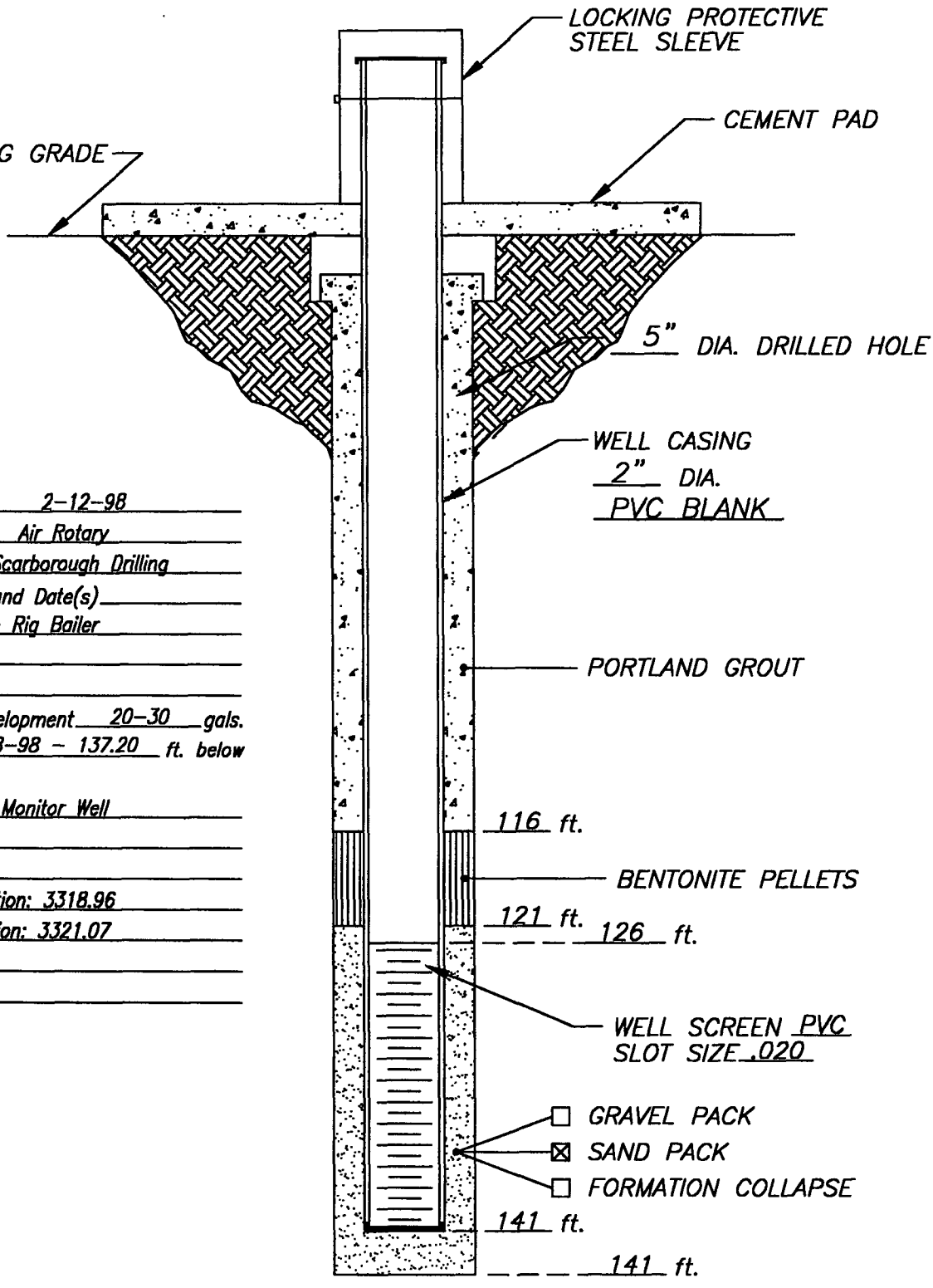
Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 137.42 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3318.95
T.O.C. Elevation: 3321.10

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc. PROJECT: Texaco Cooper Tank Battery LOCATION: Lea County, New Mexico	WELL NO. MW-5

Highlander Environmental

WELL CONSTRUCTION LOG



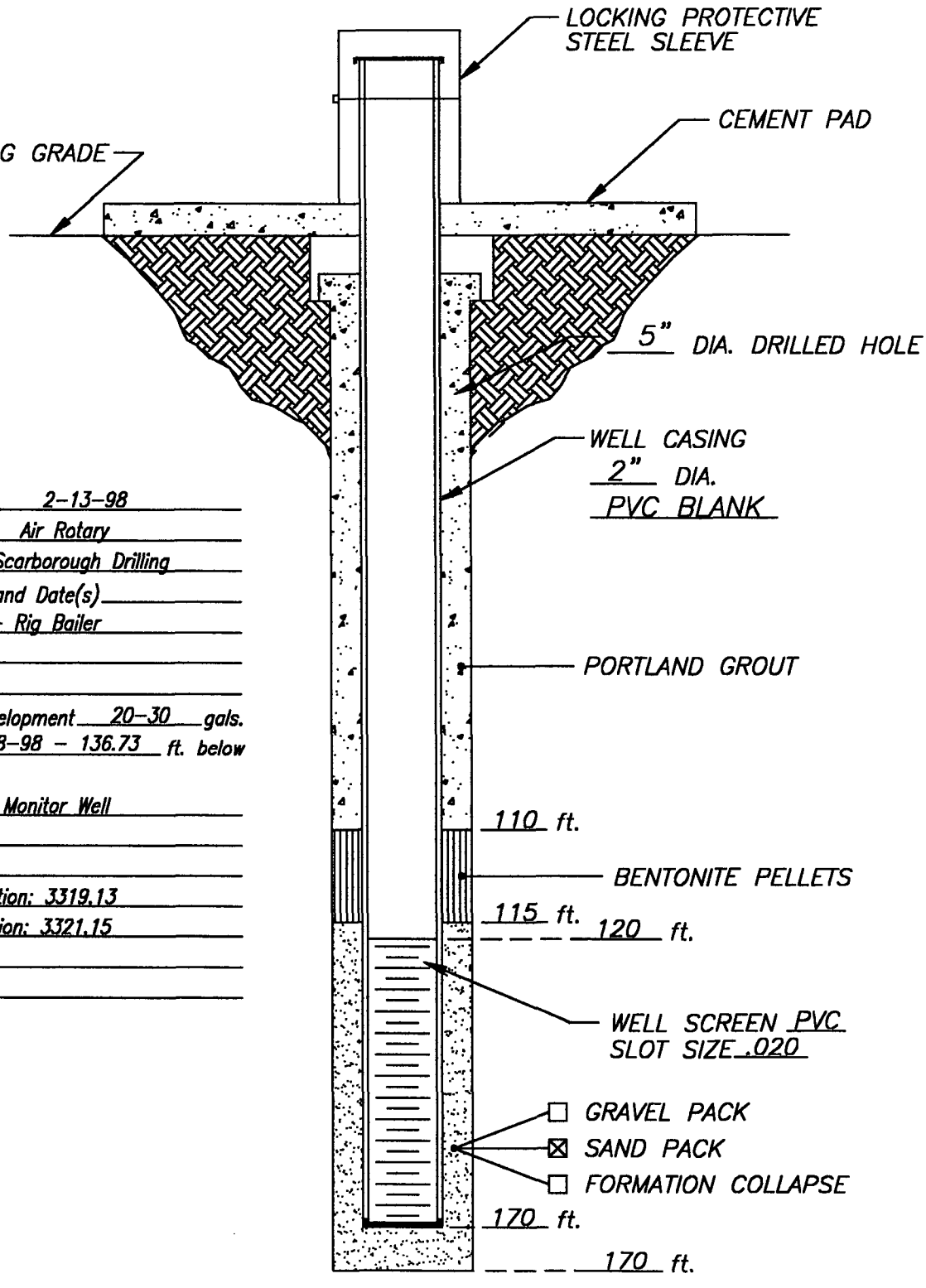
Installation Date(s) 2-12-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-12-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 137.20 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3318.96
T.O.C. Elevation: 3321.07

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-5A
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



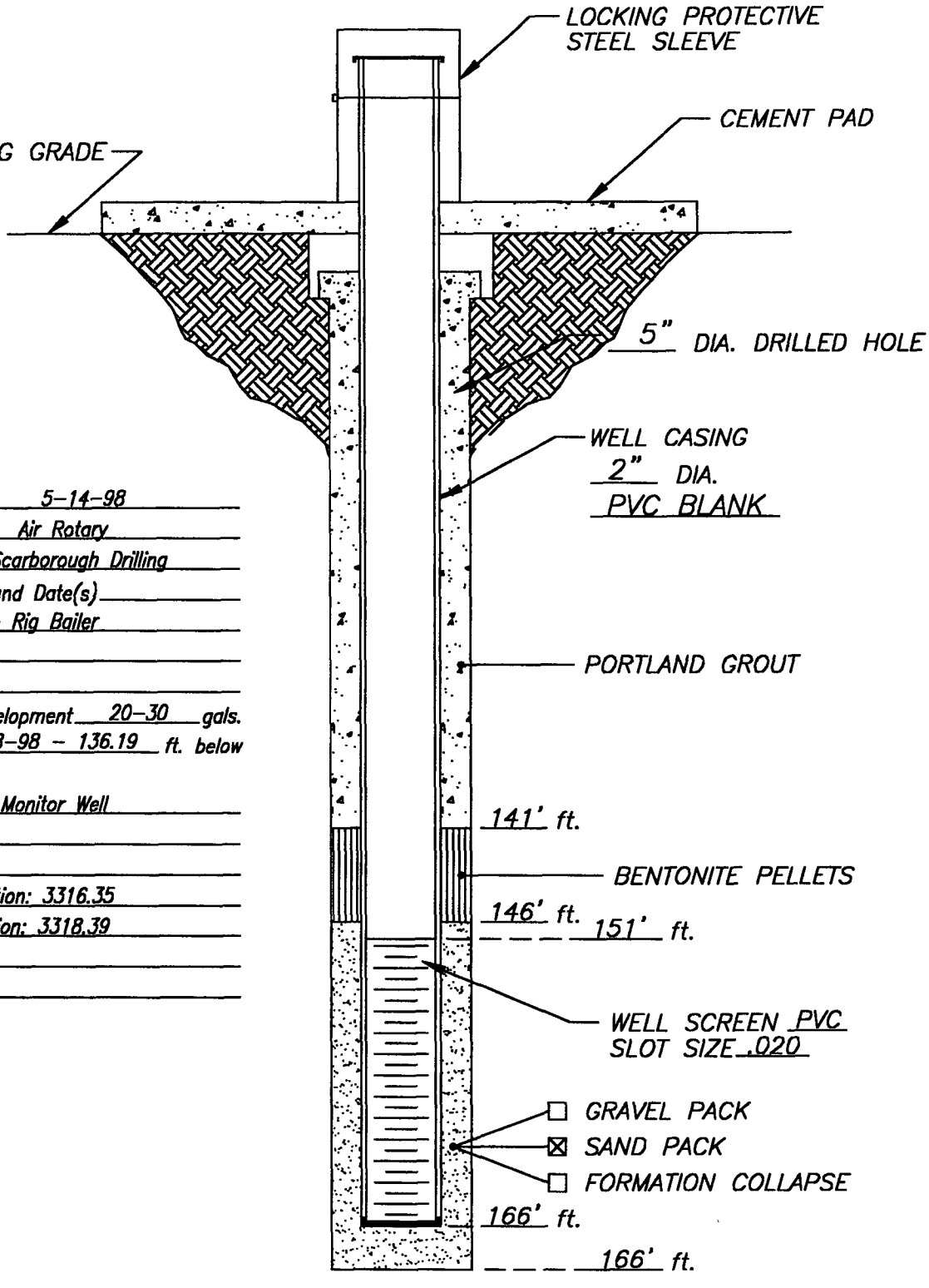
Installation Date(s) 2-13-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
2-13-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 136.73 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3319.13
T.O.C. Elevation: 3321.15

DATE: 5-26-98	CLIENT: *Texaco Exploration & Production, Inc.*	WELL NO.
Highlander Environmental	PROJECT: *Texaco Cooper Tank Battery*	MW-6
	LOCATION: *Lea County, New Mexico*	

WELL CONSTRUCTION LOG



Installation Date(s) 5-14-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
5-14-98 - Rig Bailer

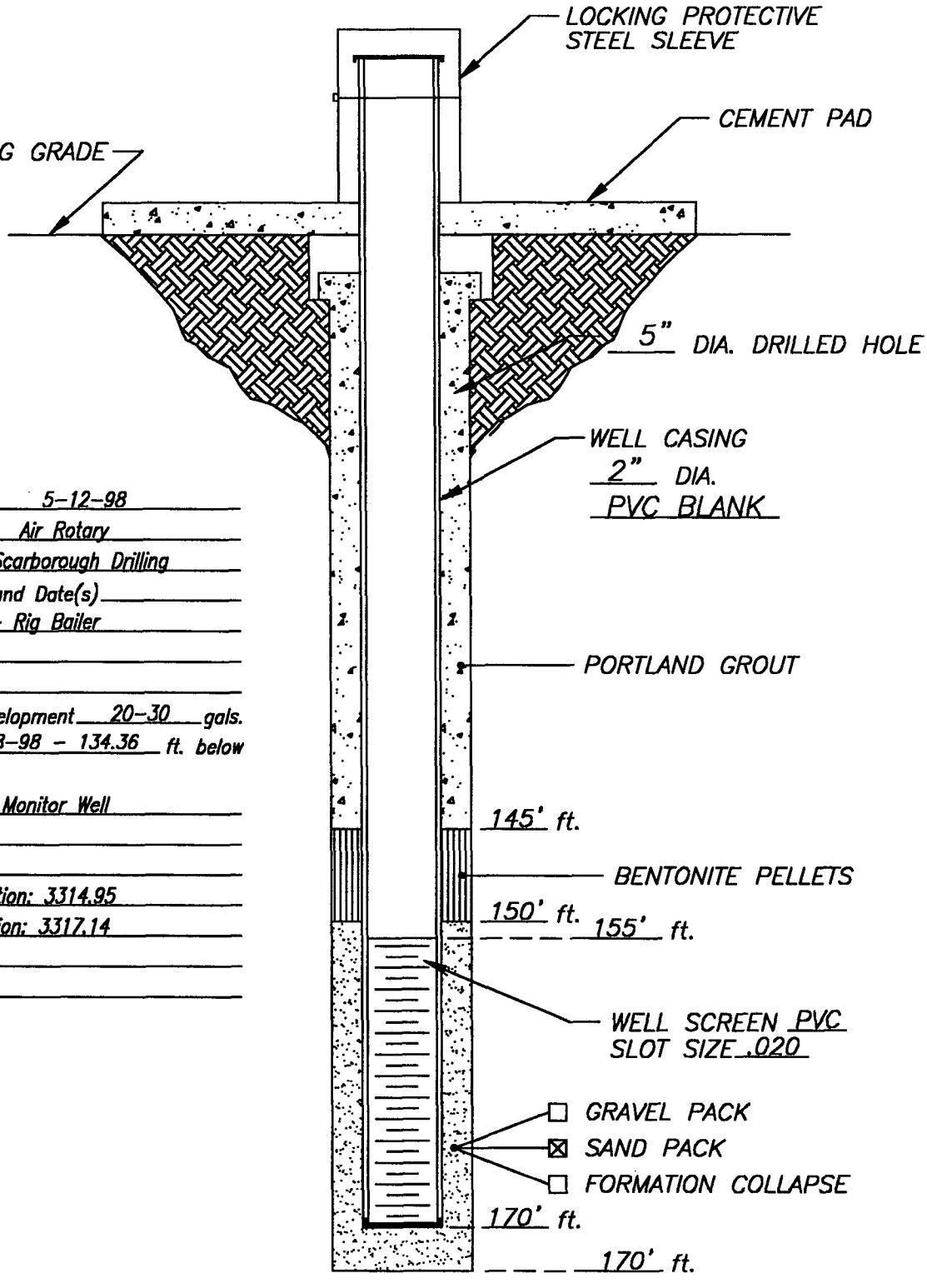
Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 136.19 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3316.35
T.O.C. Elevation: 3318.39

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc. PROJECT: Texaco Cooper Tank Battery LOCATION: Lea County, New Mexico	WELL NO. MW-7

Highlander Environmental

WELL CONSTRUCTION LOG



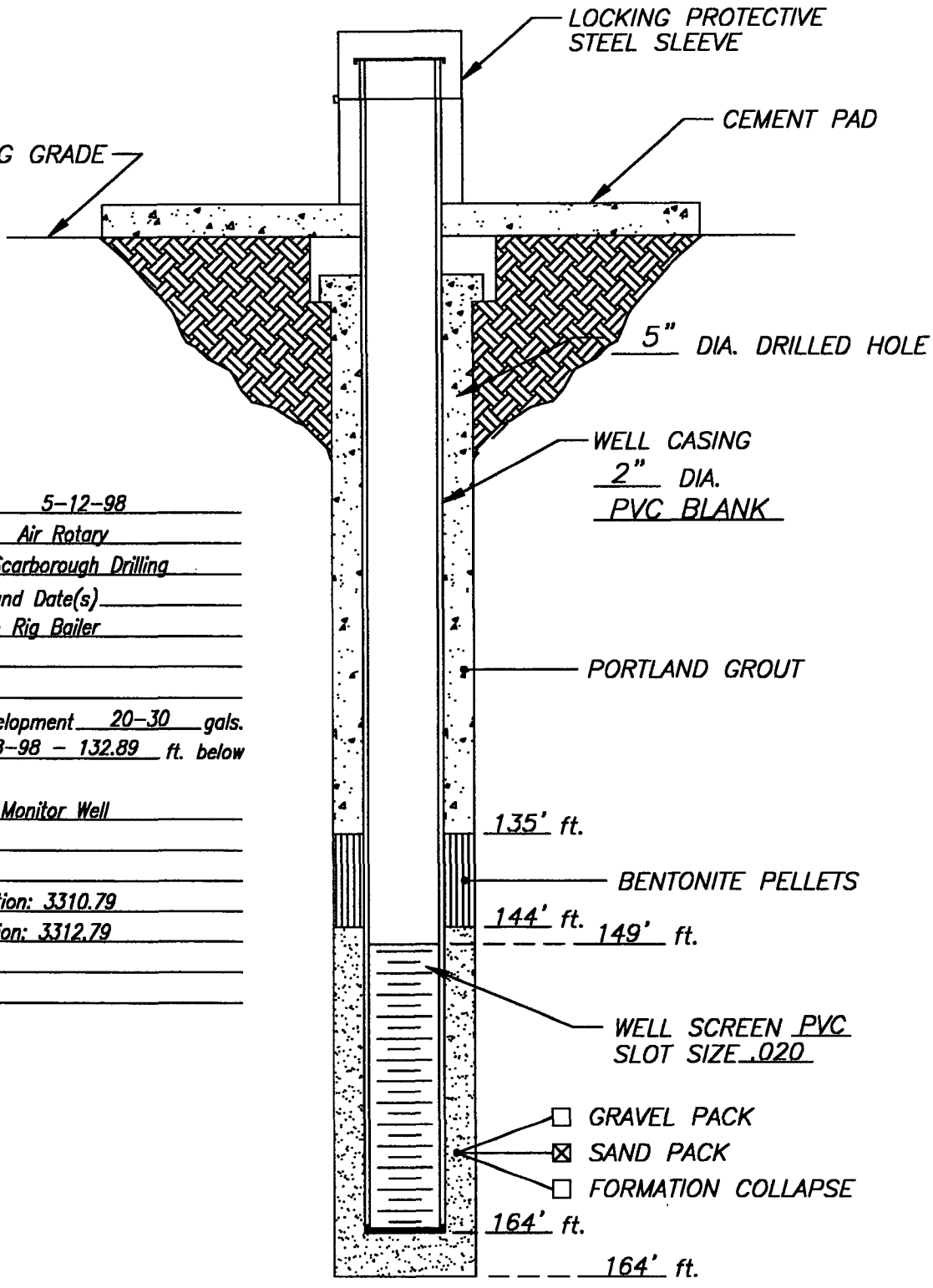
Installation Date(s) 5-12-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
5-12-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 134.36 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3314.95
T.O.C. Elevation: 3317.14

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-8
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



Installation Date(s) 5-12-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
5-12-98 - Rig Bailer

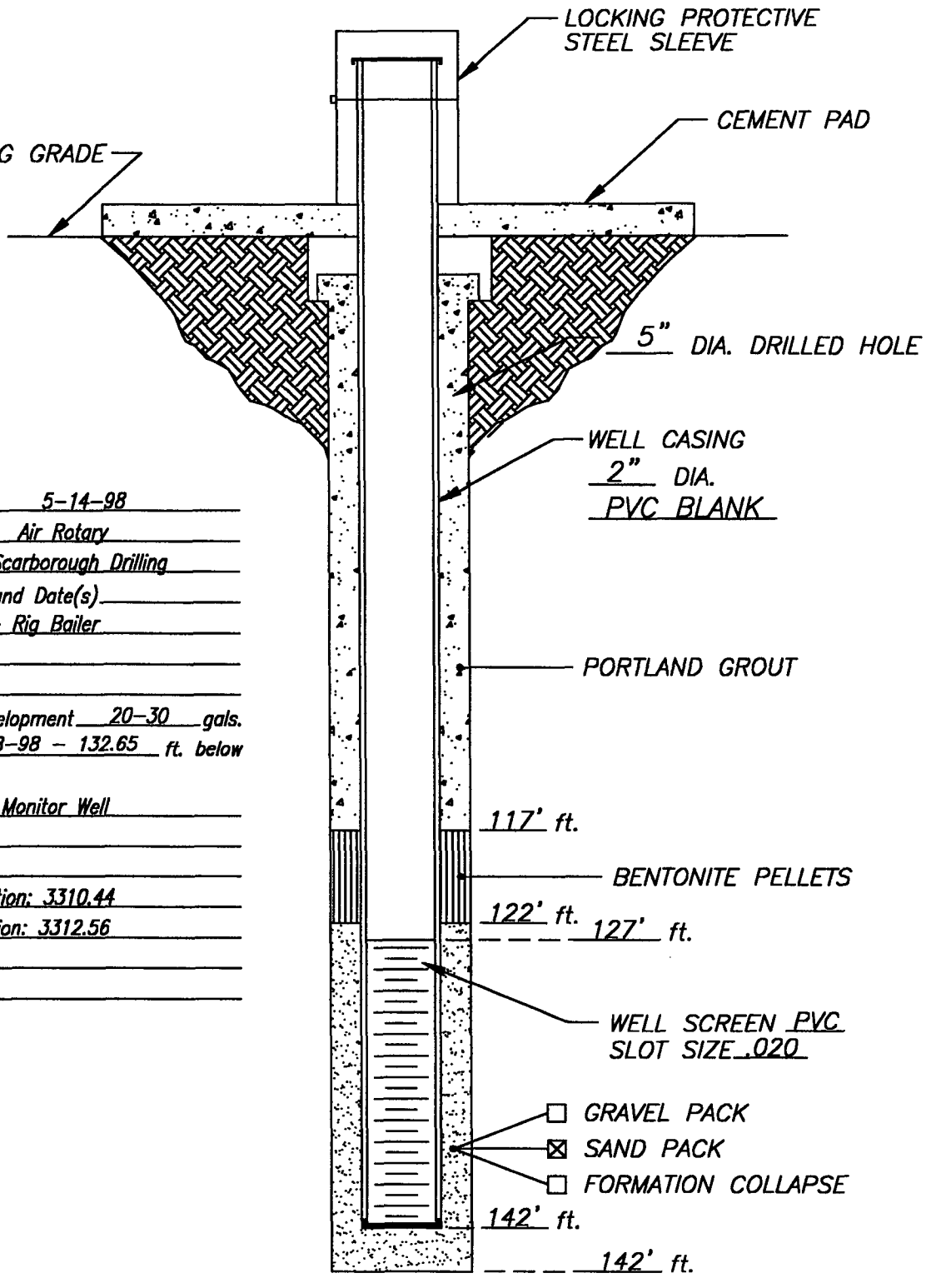
Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 132.89 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3310.79
T.O.C. Elevation: 3312.79

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc. PROJECT: Texaco Cooper Tank Battery LOCATION: Lea County, New Mexico	WELL NO. MW-9

Highlander Environmental

WELL CONSTRUCTION LOG



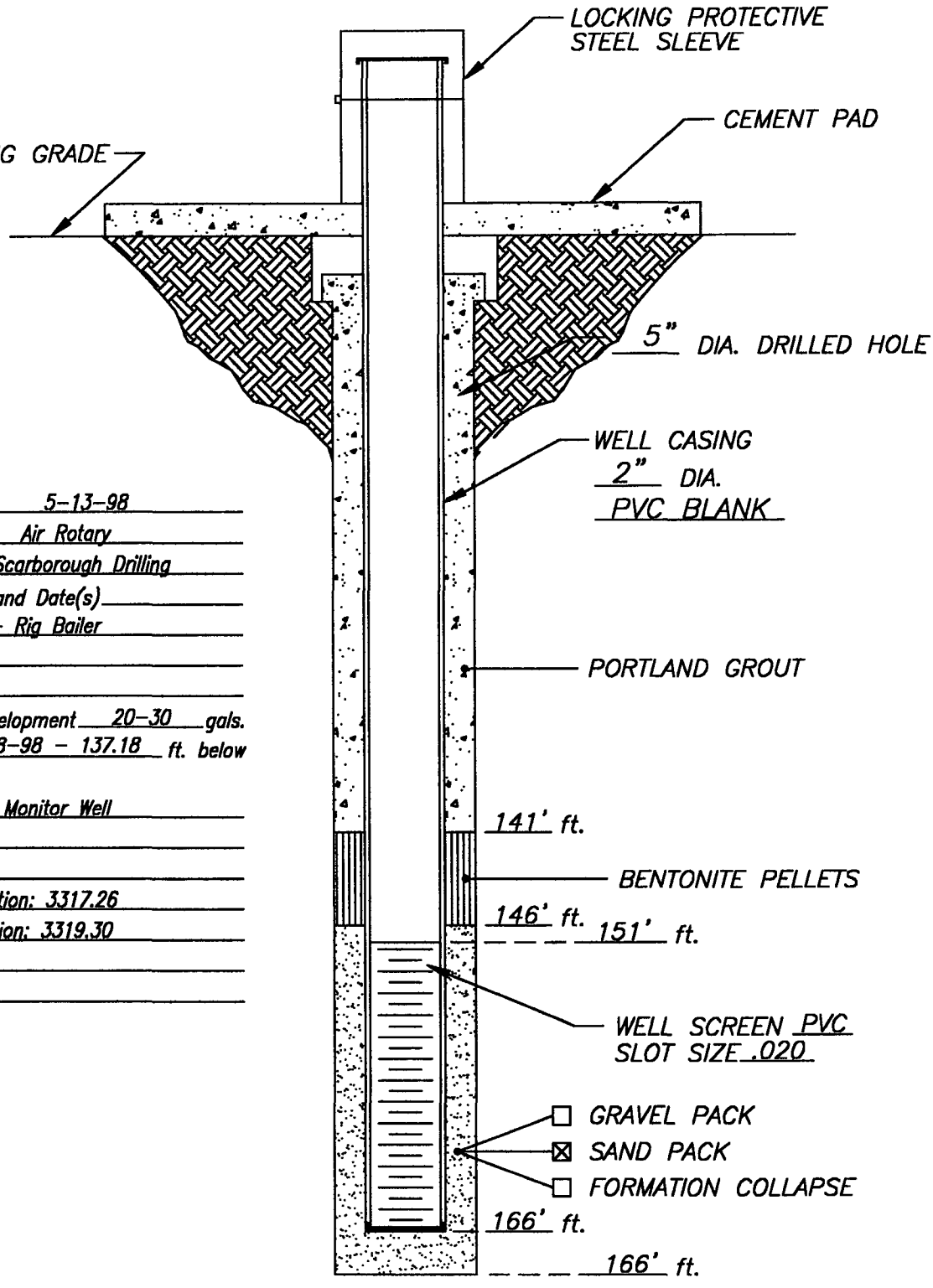
Installation Date(s) 5-14-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
5-14-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 132.65 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3310.44
T.O.C. Elevation: 3312.56

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-9A
	LOCATION: Lea County, New Mexico	

WELL CONSTRUCTION LOG



Installation Date(s) 5-13-98
Drilling Method Air Rotary
Drilling Contractor Scarborough Drilling
Development Technique(s) and Date(s)
5-13-98 - Rig Bailer

Water Removed During Development 20-30 gals.
Static Depth to Water 5-18-98 - 137.18 ft. below Ground Level
Well Purpose Monitor Well

Remarks
Ground Elevation: 3317.26
T.O.C. Elevation: 3319.30

DATE: 5-26-98	CLIENT: Texaco Exploration & Production, Inc.	WELL NO.
Highlander Environmental	PROJECT: Texaco Cooper Tank Battery	MW-10
	LOCATION: Lea County, New Mexico	

APPENDIX E

Trace Analysis, Inc. Reports

TRACE ANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.

September 29, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 09/18/97
Analysis Date: 09/18/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name:Texaco E & P

TA#	FIELD CODE	pH (s.u.)	TDS (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3)
T81829	MW-1	7.1	15,000	8,500	1,100	280
QC	Quality Control	7.0	---	22	25	---
RPD		0	2	0	1	0
% Extraction Accuracy		---	---	91	101	---
% Instrument Accuracy		100	---	90	100	---
REPORTING LIMIT		---	---	50	50	1.00

METHODS: EPA 300.0, 310.1, 340.2, 150.1, 160.1.
CHEMIST: CHLORIDE/SULFATE/FLUORIDE: RC ALKALINITY/TDS/pH: JS
SPIKE: 25 mg/L CHLORIDE; 25 mg/L SULFATE.
QC: 23 mg/L CHLORIDE; 25 mg/L SULFATE.

Director, Dr. Blair Leftwich

9-29-97
Date

TRACEANALYSIS, INC.
6701 Aberdeen Avenue Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.

October 06, 1997
Receiving Date: 09/18/97
Sample Type: Water
Project No: 996
Project Location: Texaco/Cooper-Jal Central Unit
Lea County

Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 10/02/97
Analysis Date: 10/02/97
Sampling Date: 09/16/97
Sample Condition: Intact & Cool
Sample Received by: JH
Project Name: Texaco E & P

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS
T81829	MW-1	50	630	520	4,300	3,900
QC	Quality Control	52	51	52	51	
Reporting Limit		0.3	0.01	0.01	0.4	---
RPD		1	0	1	0	
% Extraction Accuracy		109	104	109	102	
% Instrument Accuracy		104	101	103	102	

METHODS: EPA SW 846-6010.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
QC: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

10-6-97
Date

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

CLIENT NAME: Texaco E&P

SITE MANAGER: Ike Tavarez

PROJECT NO.: 6716

PROJECT NAME: Texaco / Cooper-Jal Central Unit Lea. County.

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Major Ions.
	9/16/97					MW-1	1	N			✓	✓																		✓

ANALYSIS REQUEST (Circle or Specify Method No.)

RELINQUISHED BY: (Signature)	Date: 9/17/97 Time: 4:40	RECEIVED BY: (Signature) Helen Shelton	Date: 9/17/97 Time: 4:40 PM	SAMPLED BY: (Print & Sign)	Date: Time:
RELINQUISHED BY: (Signature)	Date: Time:	RECEIVED BY: (Signature)	Date: Time:	SAMPLE SHIPPED BY: (Circle) FEDEX BUS HAND DELIVERED UPS	AIRBILL # OTHER:
RELINQUISHED BY: (Signature)	Date: Time:	RECEIVED BY: (Signature)	Date: Time:		

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature)
DATE: TIME:

HIGHLANDER CONTACT PERSON: Ike Tavarez

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS:

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

81828 303

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

CLIENT NAME: [illegible]
SITE MANAGER: [illegible]
PROJECT NO.: [illegible]
PROJECT NAME: [illegible]

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)		[illegible]	
81829	[illegible]					MW-1	1	N			✓	✓																			✓	

RELINQUISHED BY: (Signature) [illegible]	Date: [illegible] Time: [illegible]	RECEIVED BY: (Signature) [illegible]	Date: [illegible] Time: [illegible]
RELINQUISHED BY: (Signature) Helen Shelton	Date: 9/17/97 Time: 6:30PM	RECEIVED BY: (Signature)	Date: Time:
RELINQUISHED BY: (Signature)	Date: Time:	RECEIVED BY: (Signature)	Date: Time:

RECEIVING LABORATORY:
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature) [illegible signature]
DATE: 9/18/97 TIME: 9:30A

SAMPLED BY: (Print & Sign) Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX HAND DELIVERED BUS (circled) UPS
AIRBILL # 155-759-016-6
OTHER:

HIGHLANDER CONTACT PERSON: [illegible]

Results by:
RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water (circled) S-Soil A-Air SL-Sludge SD-Solid O-Other

REMARKS: SEE ATTACHED SHEET FOR MAJOR IONS

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

[illegible handwriting]

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
Highlander Environmental Services
Attention Ike Tavarez
1910 N. Big Spirng St.
Midland TX 79705

Lab Receiving # : 9803000015
Sampling Date: 2/25/98 - 2/27/98
Sample Condition: Intact and Cool
Sample Received By: VW

Date: Mar 09, 1998
Date Rec: 3/3/98
Project: 996
Proj Name: Texaco /Cooper-Jal Central Unit
Proj Loc: Lea County, NM

TA#	Field Code	MATRIX	BENZENE (mg/L)	TOLUENE (mg/L)	ETHYL-BENZENE (mg/L)	M,P,O XYLENE (mg/L)	TOTAL BTEX (mg/L)
T 92323	MW-1	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92324	MW-2	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92325	MW-2A	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92326	MW-3	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92327	MW-4	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92328	MW-4A	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92329	MW-5	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92330	MW-5A	Water	<0.001	<0.001	<0.001	<0.001	<0.001
T 92331	MW-6	Water	<0.001	<0.001	<0.001	<0.001	<0.001
Method Blank			<0.001	<0.001	<0.001	<0.001	
Reporting Limit			0.001	0.001	0.001	0.001	
QC			0.094	0.098	0.101	0.302	
RPD			1	1	1	1	
% Extraction Accuracy			104	105	104	105	
% Instrument Accuracy			94	98	101	101	

TEST	PREP METHOD	PREP DATE	ANALYSIS METHOD	ANALYSIS COMPLETED	CHEMIST	QC: (mg/L)	SPIKE: (mg/L)
BTEX	EPA 5030	3/4/98	EPA 8021B	3/4/98	JG	0.100 ea	0.1 ea

BC 3-9-98

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 23, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Prep Date: 03/04/98
Analysis Date: 03/05/98
Sampling Date: 02/25-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB

DISSOLVED METALS (mg/L)

TA#	Field Code	U	As	Se	Cd	Cr	Pb	Ag	Ba	Cu	Fe	Mn	Zn	Hg
T92323	MW-1	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92324	MW-2	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	0.14	<0.0010
T92325	MW-2A	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92326	MW-3	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	0.12	<0.0010
T92327	MW-4	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92328	MW-4A	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92329	MW-5	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92330	MW-5A	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
T92331	MW-6	<0.10	<0.10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.0010
ICV		5.0	0.96	0.98	0.95	1.0	0.97	0.21	0.95	1.0	1.0	0.99	0.96	0.0052
CCV		5.2	0.90	1.0	0.96	0.98	0.97	0.20	0.97	1.0	0.98	1.0	0.95	0.0054
Reporting Limit		0.10	0.10	0.05	0.01	0.05	0.05	0.05	0.10	0.10	0.10	0.10	0.10	0.0010
RPD		1	0	0	0	0	0	0	0	0	0	0	7	2
% Extraction Accuracy		85	96	65*	65*	47*	44*	126*	75	115	75	65*	73*	105
% Instrument Accuracy		102	93	99	95	99	97	100	96	100	99	99	95	104

***NOTE: Extraction Accuracy is out of accepted limits of 75-125%.**
CHEMIST: As, Se, Cd, Cr, Pb, Ag, Ba, Cu, Fe, Mn, Zn, U: RR Hg: HC
METHODS: EPA SW 846-3005, 6010B, 7470.
DISSOLVED METALS SPIKE: 2.5 mg/L As; 2.0 mg/L Se, Cd, Cr, Pb, Ba, Cu, Fe, Mn, Zn; 0.50 mg/L Ag; 1.0 mg/L U; 0.0050 mg/L Hg.
DISSOLVED METALS CV: 1.0 mg/L As, Se, Cd, Cr, Pb, Ba, Fe, Mn, Zn; 0.20 mg/L Ag; 100 mg/L Cu; 5.0 mg/L U; 0.0050 mg/L Hg.

BL

Director, Dr. Blair Leftwich

3-23-98

Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/25/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/02/98
Analysis Date: 03/09/98

PAH Reporting T92323

8270 Compounds (mg/L)	Limit	MW-1	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	60
2-Fluorobiphenyl SURR	60
Terphenyl-d14 SURR	70

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

3-13-98

Director, Dr. Blair Leftwich DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/25/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH Reporting T92324

8270 Compounds (mg/L)	Limit	MW-2	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	50
2-Fluorobiphenyl SURR	50
Terphenyl-d14 SURR	70

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/26/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/02/98
Analysis Date: 03/09/98

PAH	Reporting	T92325				
8270 Compounds (mg/L)	Limit	MW-2A	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	60
2-Fluorobiphenyl SURR	60
Terphenyl-d14 SURR	60

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/27/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH Reporting T92326

8270 Compounds (mg/L)	Limit	MW-3	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY	
Nitrobenzene-d5 SURR	0**	(35-114)
2-Fluorobiphenyl SURR	15	
Terphenyl-d14 SURR	70	

*NOTE: RPD out of standard range.

**NOTE: Surrogate Recovery out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

3-13-98

Director, Dr. Blair Leftwich DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/27/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH Reporting T92327

8270 Compounds (mg/L)	Limit	MW-4	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	75
2-Fluorobiphenyl SURR	75
Terphenyl-d14 SURR	60

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/27/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH 8270 Compounds (mg/L)	Reporting Limit	T92328 MW-4A	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	60
2-Fluorobiphenyl SURR	60
Terphenyl-d14 SURR	60

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/26/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH Reporting T92329

8270 Compounds (mg/L)	Limit	MW-5	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	70
2-Fluorobiphenyl SURR	70
Terphenyl-d14 SURR	60

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

3-13-98

Director, Dr. Blair Leftwich DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

Receiving Date: 03/03/98

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Sample Type: Water
Project No: 996
Sampling Date: 02/26/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH Reporting T92330

8270 Compounds (mg/L)	Limit	MW-5A	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	60
2-Fluorobiphenyl SURR	60
Terphenyl-d14 SURR	55

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

ANALYST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 13, 1998

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Sampling Date: 02/26/98
Sample Condition: I & C
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB
Extraction Date: 03/03/98
Analysis Date: 03/09/98

PAH	Reporting	T92331				
8270 Compounds (mg/L)	Limit	MW-6	QC	RPD	%EA	%IA
Naphthalene	0.001	ND	69	14	75	86
Acenaphthylene	0.001	ND	69	12	90	86
Acenaphthene	0.001	ND	69	18	90	86
Fluorene	0.001	ND	70	18	90	88
Phenanthrene	0.001	ND	70	14	75	88
Anthracene	0.001	ND	69	14	75	86
Fluoranthene	0.001	ND	70	21*	80	88
Pyrene	0.001	ND	70	19	85	88
Benzo[a]anthracene	0.001	ND	72	31*	75	90
Chrysene	0.001	ND	72	32*	90	90
Benzo[b]fluoranthene	0.001	ND	76	40*	60	95
Benzo[k]fluoranthene	0.001	ND	69	40*	90	86
Benzo[a]pyrene	0.001	ND	71	40*	75	89
Indeno[1,2,3-cd]pyrene	0.001	ND	71	40*	75	89
Dibenz[a,h]anthracene	0.001	ND	73	40*	75	91
Benzo[g,h,i]perylene	0.001	ND	71	40*	75	89

ND = Not Detected

SURROGATES	% RECOVERY
Nitrobenzene-d5 SURR	35
2-Fluorobiphenyl SURR	35
Terphenyl-d14 SURR	45

*NOTE: RPD out of standard range.

METHODS: EPA SW 846-8270, 3510.

CHEMIST: MB

Director, Dr. Blair Leftwich

3-13-98
DATE

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 26, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 03/03/98
Analysis Date: 03/03/98
Sampling Date: 02/25-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Central TB

TA#	FIELD CODE	CYANIDE (mg/L)	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T92323	MW-1	<0.010	7.4	5,600	9,300	570	280	<1.0
T92325	MW-2A	<0.010	7.9	280	1,200	330	190	<1.0
T92326	MW-3	<0.010	7.9	452	1,500	406	190	<1.0
T92327	MW-4	<0.010	7.1	12,000	22,000	1,300	230	<1.0
ICV		0.039	7.0	23	---	24	---	---
CCV		0.039	7.0	23	---	24	---	---
REPORTING LIMIT		0.010	---	50	---	50	1.0	1.0
RPD		3	0	0	5	0	1	1
% Extraction Accuracy		86	---	92	---	96	---	---
% Instrument Accuracy		98	100	93	---	96	---	---

METHODS: EPA 150.1, 160.1, 300.0, 310.1, 335.2.
CHEMIST: pH: CS TDS/ALKALINITY/CYANIDE: RS/JS CHLORIDE/SULFATE: JS
CHLORIDE SPIKE: 1,250 mg/L CHLORIDE. CHLORIDE CV: 25 mg/L CHLORIDE.
SULFATE SPIKE: 1,250 mg/L SULFATE. SULFATE CV: 25 mg/L SULFATE.
CYANIDE SPIKE: 0.040 mg/L CYANIDE. CYANIDE CV: 0.040 mg/L CYANIDE.

Director, Dr. Blair Leftwich

3-26-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 26, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 03/03/98
Analysis Date: 03/03/98
Sampling Date: 02/26-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Central TB

TA#	FIELD CODE	CYANIDE (mg/L)	pH (s.u.)	FLUORIDE (mg/L)	CHLORIDE (mg/L)	TDS (mg/L)	N03-N (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T92328	MW-4A	<0.010	7.6	0.59	1,600	3,300	4.5	410	180	<1.0
T92329	MW-5	<0.010	7.2	0.48	6,600	12,000	5.9	910	180	<1.0
T92330	MW-5A	<0.010	7.9	0.86	190	740	3.4	180	170	<1.0
T92331	MW-6	<0.010	7.7	1.39	260	1,200	7.1	400	200	<1.0
ICV		0.039	7.0	0.96	23	---	1.33	24	---	---
CCV		0.039	7.0	0.88	23	---	1.30	24	---	---
REPORTING LIMIT		0.010	---	0.1	50	---	0.01	50	1.0	1.0
RPD		3	0	16	0	5	2	1	1	1
% Extraction Accuracy		86	---	89	91	---	115	96	---	---
% Instrument Accuracy		98	100	92	91	---	99	96	---	---

METHODS: EPA 150.1, 160.1, 300.0, 340.2, 310.1, 335.2, 352.1.
CHEMIST: pH: CS TDS/ALKALINITY/CYANIDE: RS/JS FLUORIDE/CHLORIDE/N03-N/SULFATE: JS
CHLORIDE SPIKE: 125 mg/L CHLORIDE.
FLUORIDE SPIKE: 1.0 mg/L FLUORIDE.
N03-N SPIKE: 13.33 mg/L N03-N.
SULFATE SPIKE: 125 mg/L SULFATE.
CYANIDE SPIKE: 0.040 mg/L CYANIDE.
CHLORIDE CV: 25 mg/L CHLORIDE.
FLUORIDE CV: 1.0 mg/L FLUORIDE.
N03-N CV: 1.333 mg/L N03-N.
SULFATE CV: 25 mg/L SULFATE.
CYANIDE CV: 0.040 mg/L CYANIDE.

Director, Dr. Blair Leftwich

3-26-98
Date

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 26, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 03/04/98
Analysis Date: 03/15/98
Sampling Date: 02/25-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS (mg/L CaC03)
T92323	MW-1	116	520	285	2,900	2,850
T92324	MW-2	30	380	840	2,650	3,660
T92325	MW-2A	5.7	36	144	215	508
T92326	MW-3	11	50	200	237	705
T92327	MW-4	48	880	1,700	5,300	7,870
T92328	MW-4A	11	130	470	620	1,710
T92329	MW-5	31	470	1,400	2,400	5,430
T92330	MW-5A	3.5	23	107	117	362
T92331	MW-6	6.2	44	180	205	631
ICV		49	50	50	47	---
CCV		47	50	50	49	---
Reporting Limit		0.20	0.20	0.20	0.50	---
RPD		0	7	6	4*	---
% Extraction Accuracy		144	132	124	106*	---
% Instrument Accuracy		96	100	100	96	---

***NOTE: LSC used for RPD and % Extraction Accuracy.**
METHODS: EPA 200.7, SM 2340B.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
CV: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

3-26-98
Date

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

March 26, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 03/03/98
Analysis Date: 03/03/98
Sampling Date: 02/25/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Central TB

TA#	FIELD CODE	CYANIDE (mg/L)	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T92324	MW-2	<0.010	7.4	5,900	9,400	760	210	<1.0
ICV		0.039	7.0	23	---	24	---	---
CCV		0.039	7.0	23	---	24	---	---
REPORTING LIMIT		0.010	---	50	---	50	1.0	1.0
RPD		3	0	0	5	0	1	1
% Extraction Accuracy		86	---	92	---	96	---	---
% Instrument Accuracy		98	100	93	---	96	---	---

METHODS: EPA 150.1, 160.1, 300.0, 310.1, 335.2.
CHEMIST: pH: CS TDS/ALKALINITY/CYANIDE: RS/JS CHLORIDE/SULFATE: JS
CHLORIDE SPIKE: 1,250 mg/L CHLORIDE. CHLORIDE CV: 25 mg/L CHLORIDE.
SULFATE SPIKE: 1,250 mg/L SULFATE. SULFATE CV: 25 mg/L SULFATE.
CYANIDE SPIKE: 0.040 mg/L CYANIDE. CYANIDE CV: 0.040 mg/L CYANIDE.

Director, Dr. Blair Leftwich

3-26-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

March 23, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

Prep Date: 03/18/98
Analysis Date: 03/18/98
Sampling Date: 02/25-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB

TA#	FIELD CODE	NITRATE-N (mg/L)	FLUORIDE (mg/L)
T92323	MW-1	5.7	1.78
T92324	MW-2	4.9	1.03
T92325	MW-2A	6.4	1.13
T92326	MW-3	8.5	1.07
T92327	MW-4	8.7	0.49
ICV		1.1	1.00
CCV		1.2	0.94
Reporting Limit		0.01	0.1
RPD		6	1
% Extraction Accuracy		91	99
% Instrument Accuracy		91	97

METHODS: EPA 340.2, 353.3.
CHEMIST: JS
NITRATE-N SPIKE: 13.33 mg/L NITRATE-N.
NITRATE-N CV: 1.333 mg/L NITRATE-N.
FLUORIDE SPIKE: 1.0 mg/L FLUORIDE.
FLUORIDE CV: 1.0 mg/L FLUORIDE.

Director, Dr. Blair Leftwich

3-23-98
DATE

92323-

15

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

ANALYSIS REQUEST (Circle or Specify Method No.)

CLIENT NAME: Texaco E & P, Inc.
SITE MANAGER: Ike Tavarez
PROJECT NO.: 996
PROJECT NAME: Texaco/Cooper-Jal Central T.B.

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3 metals	ICE	NONE MM	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	RCRA Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Major Minerals (See List)	Total Metal (See List)
92323	2/25/98	2:15	W		✓	MW-1	7	Y		✓	✓	✓	✓			✓														✓	✓
24	2/25/98	1:45	W		✓	MW-2	5	Y		✓	✓	✓	✓			✓														✓	✓
25	2/26/98	3:15	W		✓	MW-2A	5	Y		✓	✓	✓	✓			✓														✓	✓
26	2/27/98	2:15	W		✓	MW-3	5	Y		✓	✓	✓	✓			✓														✓	✓
27	2/27/98	1:45	W		✓	MW-4	7	Y		✓	✓	✓	✓			✓														✓	✓
28	2/27/98	1:30	W		✓	MW-4A	5	Y		✓	✓	✓	✓			✓														✓	✓
29	2/26/98	2:00	W		✓	MW-5	5	Y		✓	✓	✓	✓			✓														✓	✓
30	2/26/98	2:30	W		✓	MW-5A	5	Y		✓	✓	✓	✓			✓														✓	✓
31	2/26/98	2:30			✓	MW-6	5	Y		✓	✓	·	✓			✓														✓	✓

RELINQUISHED BY: (Signature) Ike Tavarez Date: 3-2-98 Time: 3:00 PM
RECEIVED BY: (Signature) Helen Shelton Date: 3-2-98 Time: 3:00 PM

RELINQUISHED BY: (Signature) Helen Shelton Date: 3/2/98 Time: 6:30 PM
RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY: Trace
ADDRESS:
CITY: STATE: ZIP:
CONTACT: DAN PHONE:

RECEIVED BY: (Signature) [signature] B
DATE: 3-3-98 TIME: 9:45 PM

SAMPLED BY: (Print & Sign) Ike Tavarez / V.J. Kinske Date:
SAMPLE SHIPPED BY: (Circle) FEDEX, BUS (circled), AIRBILL #155 7588758, HAND DELIVERED, UPS, OTHER:

HIGHLANDER CONTACT PERSON: Ike Tavarez

Results by: ASAP
RUSH Charges Authorized: Yes No (circled)

SAMPLE CONDITION WHEN RECEIVED:
MATRIX: W-Water (circled) S-Soil A-Air SL-Sludge SD-Solid O-Other
REMARKS: 3°

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: [illegible]

CLIENT NAME: Texaco E & P, Inc.

SITE MANAGER: I.K. Tavarez

PROJECT NO.: 996

PROJECT NAME: Texaco/Cooper-Jal Central T.B.

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3 (metals)	ICE	NONE N/M	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	RCRA Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)		Major Minerals	[illegible]
	1/6/97	:5	W		✓	MW-1	7	Y		✓	✓		✓			✓															✓	✓
	1/6/97	:45	W		✓	MW-2	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	8:15	W		✓	MW-2A	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	:15	W		✓	MW-3	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	1:15	W		✓	MW-4	7	Y		✓	✓		✓			✓															✓	✓
	1/6/97	1:30	W		✓	MW-4A	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	9:00	W		✓	MW-5	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	9:30	W		✓	MW-5A	5	Y		✓	✓		✓			✓															✓	✓
	1/6/97	2:50	W		✓	MW-6	5	Y		✓	✓		✓			✓															✓	✓

RELINQUISHED BY: (Signature) I.K. Tavarez Date: 1-6-97 Time: [illegible]

RECEIVED BY: (Signature) [illegible] Date: [illegible] Time: [illegible]

RELINQUISHED BY: (Signature) Date: Time:

RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:

RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY: Trace

ADDRESS:

CITY: STATE: ZIP:

CONTACT: PHONE:

RECEIVED BY: (Signature)

DATE: TIME:

SAMPLED BY: (Print & Sign) I.K. Tavarez / [illegible] Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX, BUS (circled), AIRBILL #, HAND DELIVERED, UPS, OTHER:

HIGHLANDER CONTACT PERSON: I.K. Tavarez

Results by: [illegible]

RUSH Charges Authorized: Yes No (circled)

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water (circled) S-Soil A-Air SL-Sludge SD-Solid O-Other

REMARKS:

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

April 15, 1998
Receiving Date: 04/10/98
Sample Type: Water
Project No: 996
Project Location: NA

Prep Date: 04/13/98
Analysis Date: 04/15/98
Sampling Date: 04/09/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal TB

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS
T95935	MW-2	29	490	1,100	3,430	4,800
T95936	MW-4	42	840	1,740	5,400	7,800
ICV		25	23	25	25	---
CCV		25	23	25	24	---
Reporting Limit		0.50	0.50	0.50	0.50	---
METHOD BLANK		<0.50	<0.50	<0.50	<0.50	---
RPD		1	3	2	2	---
% Extraction Accuracy		111	110	155*	45*	---
% Instrument Accuracy		100	92	100	96	---

***NOTE: No spike recovery for Na, Ca due to high dilution.**

METHODS: EPA 200.7.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM,
CV: 25 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

BS

Director, Dr. Blair Leftwich

4-15-98

Date

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

April 15, 1998
Receiving Date: 04/10/98
Sample Type: Water
Project No: 996
Project Location: NA

Prep Date: 04/10/98
Analysis Date: 04/10/98
Sampling Date: 04/09/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal TB

TA#	FIELD CODE	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T95935	MW-2	7.0	8,200	15,000	990	290	<1.0
T95936	MW-4	6.7	13,000	23,000	1,500	240	<1.0
ICV		7.0	11	---	12	---	---
CCV		7.0	11	---	12	---	---
REPORTING LIMIT		---	2.0	---	0.5	1.0	1.0
RPD		0	2	3	1	0	0
% Extraction Accuracy		---	84	---	97	---	---
% Instrument Accuracy		100	93	---	97	---	---

METHODS: EPA 150.1, 160.1, 300.0, 310.1.
CHEMIST: pH: CS TDS/ALKALINITY: RS CHLORIDE/SULFATE: JS
CHLORIDE SPIKE: 1,250 mg/L CHLORIDE. CHLORIDE CV: 12.5 mg/L CHLORIDE.
SULFATE SPIKE: 1,250 mg/L SULFATE. SULFATE CV: 12.5 mg/L SULFATE.

Director, Dr. Blair Leftwich

4-15-98
Date

75935-36

222

PAGE: 1 OF: 1

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705
(915) 682-4559 Fax (915) 682-3946

CLIENT NAME: Texaco E & P, Inc.
SITE MANAGER: Ike Tavarez
PROJECT NO: 996
PROJECT NAME: Texaco Cooper-Jal TB.

ANALYSIS REQUEST (Circle or Specify Method No.)

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Major Ions
95935	4-9-98	11:30	W			MW-2	1					X																		✓
36	4-9-98	11:15	W			MW-4	1					X																		✓

FILTERED (Y/N): N circled

RELINQUISHED BY: (Signature) [signature] Date: 4-9-98 Time: 4:35 PM
RECEIVED BY: (Signature) Helen Shelton Date: 4/9/98 Time: 4:35 PM

RELINQUISHED BY: (Signature) Helen Shelton Date: 4-9-98 Time: 10:30 PM
RECEIVED BY: (Signature) Date: Time:

RELINQUISHED BY: (Signature) Date: Time:
RECEIVED BY: (Signature) Date: Time:

RECEIVING LABORATORY: Trace
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:
RECEIVED BY: (Signature) Vicla Windham
DATE: 4-10-98 TIME: 10:00 Am

SAMPLED BY: (Print & Sign) Ike Tavarez & V.T. Kirchi Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX BUS (circled) UPS HAND DELIVERED AIRBILL # OTHER:

HIGHLANDER CONTACT PERSON: Ike Tavarez

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED: Good 4°C
Bus 155 758 899 0

MATRIX: W-Water (circled) S-Soil A-Air SL-Sludge SD-Solid O-Other

REMARKS: LIST ATTACHED.

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

Midland Greyhound 2 samples - HS

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

CLIENT NAME: Rice E+P, Inc. SITE MANAGER: [illegible]

PROJECT NO.: [illegible] PROJECT NAME: Rice Four Jal TB.

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	[illegible]	[illegible]	[illegible]
	4/9/96	9:30	W			MW-2	1					X																		✓		
	4/9/96	11:15	W			MW-4	1					X																		✓		

ANALYSIS REQUEST (Circle or Specify Method No.)

RELINQUISHED BY: (Signature)	Date: 4/10/96 Time: 11:00 AM	RECEIVED BY: (Signature)	Date: 4/10/96 Time: 11:00 AM	SAMPLED BY: (Print & Sign) [illegible]	Date: Time:
RELINQUISHED BY: (Signature)	Date: Time:	RECEIVED BY: (Signature)	Date: Time:	SAMPLE SHIPPED BY: (Circle) FEDEX BUS HAND DELIVERED UPS	AIRBILL # OTHER:
RELINQUISHED BY: (Signature)	Date: Time:	RECEIVED BY: (Signature)	Date: Time:		

RECEIVING LABORATORY: Trace
ADDRESS:
CITY: STATE: ZIP:
CONTACT: PHONE:

RECEIVED BY: (Signature)
DATE: TIME:

HIGHLANDER CONTACT PERSON: [illegible]

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: W-Water A-Air SD-Solid S-Soil SL-Sludge O-Other

REMARKS:

Please Fill out all copies - Project Manager retains White copy - Accounting receives Pink copy - Lab retains Yellow copy Return Gold copy to Highlander Environmental Corp.

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

June 08, 1998
Receiving Date: 05/19/98
Sample Type: Water
Project No: 996
Project Location: Lea County

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 05/21/98
Analysis Date: 06/06/98
Sampling Date: 05/13-15/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco/Cooper-Jal Central TB
Lea County

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS (mg/L as CaCO3
T98771	MW-7	13	66	214	165	810
T98773	MW-9	12	61	207	200	770
T98774	MW-9A	12	96	338	334	1,240
T98775	MW-10	11	62	211	190	780
ICV		49	49	50	50	---
CCV		52	53	53	52	---
Reporting Limit		0.50	0.50	0.50	0.50	---
RPD		1	1	0	1	---
% Extraction Accuracy		105	108	107	97	---
% Instrument Accuracy		102	102	104	102	---

METHODS: EPA 200.7, SM 2340B.
CHEMIST: RR
SPIKE: 100 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
CV: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

6-8-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

June 08, 1998
Receiving Date: 05/19/98
Sample Type: Water
Project No: 996
Project Location: Lea County

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

Prep Date: 05/21/98
Analysis Date: 06/05/98
Sampling Date: 05/13-15/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco/Cooper-Jal Central TB
Lea County

TA#	Field Code	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	CALCIUM (mg/L)	SODIUM (mg/L)	HARDNESS (mg/L as CaCO3
T98772	MW-8	12	60	190	170	720
ICV		48	49	50	50	---
CCV		49	50	50	50	---
Reporting Limit		0.50	0.50	0.50	0.50	---
RPD		0	8	5	5	---
% Extraction Accuracy		84	100	95	100	---
% Instrument Accuracy		96	98	100	100	---

METHODS: EPA 200.7, SM 2340B.
CHEMIST: RR
SPIKE: 150 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.
CV: 50 mg/L POTASSIUM, MAGNESIUM, CALCIUM, SODIUM.

Director, Dr. Blair Leftwich

6-8-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

June 05, 1998
Receiving Date: 05/19/98
Sample Type: Water
Project No: 996
Project Location: Lea County

Prep Date: 05/19/98
Analysis Date: 05/19/98
Sampling Date: 05/14/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco/Cooper-Jal Central TB
Lea County

TA#	FIELD CODE	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T98771	MW-7	7.5	430	1,200	340	230	<1.0
ICV		7.0	12	---	12	---	---
CCV		7.0	12	---	12	---	---
REPORTING LIMIT		---	0.5	---	0.5	1.0	1.0
RPD		0	1	1	1	0	0
% Extraction Accuracy		---	59*	---	85	---	---
% Instrument Accuracy		100	99	92	101	---	---

LRB SPIKES: Chloride - RPD = 1
% Extraction Accuracy = 101
% Instrument Accuracy = 99
***NOTE: Chloride matrix % Extraction Accuracy low. Blank spikes used due to matrix difficulties. Blank spikes in range.**

METHODS: EPA 310.1, 300.0, 160.1, 150.1.
CHEMIST: pH: CS CHLORIDE/SULFATE: JS TDS: RS ALKALINITY: CS
SPIKE: 62.5 mg/L CHLORIDE; 62.5 mg/L SULFATE.
QC: 12.5 mg/L CHLORIDE; 12.5 mg/L SULFATE.

Director, Dr. Blair Leftwich

6-5-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

June 05, 1998
Receiving Date: 05/19/98
Sample Type: Water
Project No: 996
Project Location: Lea County

Prep Date: 05/19/98
Analysis Date: 05/19/98
Sampling Date: 05/13-14/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco/Cooper-Jal Central TB
Lea County

TA#	FIELD CODE	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T98772	MW-8	7.4	270	1,200	390	200	<1.0
T98773	MW-9	7.6	350	1,300	470	190	<1.0
ICV		7.0	12	---	12	---	---
CCV		7.0	12	---	12	---	---
REPORTING LIMIT		---	0.5	---	0.5	1.0	1.0
RPD		0	0	1	0	0	0
% Extraction Accuracy		---	92	---	92	---	---
% Instrument Accuracy		100	98	92	100	---	---

METHODS: EPA 310.1, 300.0, 160.1, 150.1.
CHEMIST: pH: CS CHLORIDE/SULFATE: JS TDS: RS ALKALINITY: CS
SPIKE: 62.5 mg/L CHLORIDE; 62.5 mg/L SULFATE.
QC: 12.5 mg/L CHLORIDE; 12.5 mg/L SULFATE.

Director, Dr. Blair Leftwich

6-5-98
Date

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER SERVICES CORP.
Attention: Ike Tavarez
1910 N. Big Spring Street
Midland, TX 79705

June 05, 1998
Receiving Date: 05/19/98
Sample Type: Water
Project No: 996
Project Location: Lea County

Prep Date: 05/19/98
Analysis Date: 05/19/98
Sampling Date: 05/14-15/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco/Cooper-Jal Central TB
Lea County

TA#	FIELD CODE	pH (s.u.)	CHLORIDE (mg/L)	TDS (mg/L)	SULFATE (mg/L)	ALKALINITY (mg/L as CaCo3) HC03	C03
T98774	MW-9A	7.3	600	2,200	770	280	<1.0
T98775	MW-10	7.3	360	1,400	450	240	<1.0
ICV		7.0	12	---	12	---	---
CCV		7.0	12	---	12	---	---
REPORTING LIMIT		---	0.5	---	0.5	1.0	1.0
RPD		0	0	1	1	0	0
% Extraction Accuracy		---	88	---	90	---	---
% Instrument Accuracy		100	98	92	100	---	---

METHODS: EPA 310.1, 300.0, 160.1, 150.1.
CHEMIST: pH: CS CHLORIDE/SULFATE: JS TDS: RS ALKALINITY: CS
SPIKE: 62.5 mg/L CHLORIDE; 62.5 mg/L SULFATE.
QC: 12.5 mg/L CHLORIDE; 12.5 mg/L SULFATE.

Director, Dr. Blair Leftwich

6-5-98
Date

Cation-Anion Balance Sheet

Sample # 98771 Date: 6/5/98

Cations

	ppm	meq/L
Calcium	214	10.6786
Magnesium	66	5.43114
Sodium	165	7.1775
Potassium	13	0.33254

Total Cations 23.6198 in meq/L

Anions

	ppm		meq/L
Alkalinity	230		4.6
Sulfate	340		7.0788
Chloride	430		12.1303
Nitrate as N	10	*	0.7139
Fluoride	0		0

Total Anions 24.523 in meq/L

Percentage Error 3.75226 %

(needs to be < 10%)

OTHER INFORMATION

TDS	1200
EC	

Measure EC and Cation Sums	2361.978	Range should be:	#VALUE!	to	#VALUE!
Measure EC and Anion Sums	2452.3	Range should be:	#VALUE!	to	#VALUE!
Calculated TDS/Conductivity	#VALUE!	Range should be:	0.55	to	0.77
Measure TDS and Cation Sums	0.5080488	Range should be:	0.55	to	0.77
Measure TDS and Anion Sums	0.4893365	Range should be:	0.55	to	0.77

*NOTE: Nitrate is an estimated concentration

Cation-Anion Balance Sheet

Sample # 98772 Date: 6/5/98

Cations

	ppm	meq/L
Calcium	190	9.481
Magnesium	60	4.9374
Sodium	170	7.395
Potassium	12	0.30696

Total Cations
22.1204 in meq/L

Anions

	ppm		meq/L
Alkalinity	200		4
Sulfate	390		8.1198
Chloride	270		7.6167
Nitrate as N	11	*	0.78529
Fluoride	0		0

Total Anions
20.5218 in meq/L

Percentage Error
7.49761 %
(needs to be < 10%)

OTHER INFORMATION

TDS	1200
EC	

Measure EC and Cation Sums	2212.036	Range should be:	#VALUE!	to	#VALUE!
Measure EC and Anion Sums	2052.179	Range should be:	#VALUE!	to	#VALUE!
Calculated TDS/Conductivity	#VALUE!	Range should be:	0.55	to	0.77
Measure TDS and Cation Sums	0.5424867	Range should be:	0.55	to	0.77
Measure TDS and Anion Sums	0.5847443	Range should be:	0.55	to	0.77

*NOTE: Nitrate is an estimated concentration

Cation-Anion Balance Sheet

Sample # 98773 Date: 6/5/98

Cations

	ppm	meq/L
Calcium	207	10.3293
Magnesium	61	5.01969
Sodium	200	8.7
Potassium	12	0.30696

Total Cations
24.356 in meq/L

Anions

	ppm		meq/L
Alkalinity	190		3.8
Sulfate	470		9.7854
Chloride	350		9.8735
Nitrate as N	12	*	0.85668
Fluoride	0		0

Total Anions
24.3156 in meq/L

Percentage Error
0.16589 %
(needs to be < 10%)

OTHER INFORMATION

TDS	1300
EC	

Measure EC and Cation Sums	2435.595	Range should be:	#VALUE!	to	#VALUE!
Measure EC and Anion Sums	2431.558	Range should be:	#VALUE!	to	#VALUE!
Calculated TDS/Conductivity	#VALUE!	Range should be:	0.55	to	0.77
Measure TDS and Cation Sums	0.5337505	Range should be:	0.55	to	0.77
Measure TDS and Anion Sums	0.5346366	Range should be:	0.55	to	0.77

*NOTE: Nitrate is an estimated concentration

Cation-Anion Balance Sheet

Sample # 98774 Date: 6/5/98

Cations

	ppm	meq/L
Calcium	338	16.8662
Magnesium	96	7.89984
Sodium	334	14.529
Potassium	12	0.30696

Total Cations
39.602 in meq/L

Anions

	ppm		meq/L
Alkalinity	280		5.6
Sulfate	770		16.0314
Chloride	600		16.926
Nitrate as N	19	*	1.35641
Fluoride	0		0

Total Anions
39.9138 in meq/L

Percentage Error
0.78427 %
(needs to be < 10%)

OTHER INFORMATION

TDS	2200
EC	

Measure EC and Cation Sums	3960.2	Range should be:	#VALUE!	to	#VALUE!
Measure EC and Anion Sums	3991.381	Range should be:	#VALUE!	to	#VALUE!
Calculated TDS/Conductivity	#VALUE!	Range should be:	0.55	to	0.77
Measure TDS and Cation Sums	0.5555275	Range should be:	0.55	to	0.77
Measure TDS and Anion Sums	0.5511877	Range should be:	0.55	to	0.77

*NOTE: Nitrate is an estimated concentration

Cation-Anion Balance Sheet

Sample # 98775 Date: 6/5/98

Cations

	ppm	meq/L
Calcium	211	10.5289
Magnesium	62	5.10198
Sodium	190	8.265
Potassium	11	0.28138

Total Cations
24.1773 in meq/L

Anions

	ppm		meq/L
Alkalinity	240		4.8
Sulfate	450		9.369
Chloride	360		10.1556
Nitrate as N	12	*	0.85668
Fluoride	0		0

Total Anions
25.1813 in meq/L

Percentage Error
4.06827 %
(needs to be < 10%)

OTHER INFORMATION

TDS	1400
EC	

Measure EC and Cation Sums	2417.726	Range should be:	#VALUE!	to	#VALUE!
Measure EC and Anion Sums	2518.128	Range should be:	#VALUE!	to	#VALUE!
Calculated TDS/Conductivity	#VALUE!	Range should be:	0.55	to	0.77
Measure TDS and Cation Sums	0.5790565	Range should be:	0.55	to	0.77
Measure TDS and Anion Sums	0.5559686	Range should be:	0.55	to	0.77

*NOTE: Nitrate is an estimated concentration

15111-15

356

Analysis Request and Chain of Custody Record

HIGHLANDER ENVIRONMENTAL CORP.

1910 N. Big Spring St.
Midland, Texas 79705

(915) 682-4559 Fax (915) 682-3946

PAGE: 1 OF: 1

CLIENT NAME: Texaco E & P Inc. SITE MANAGER: IKE Tavarez

PROJECT NO.: 996 PROJECT NAME: Texaco / Cooper-Jal Central TB. Lea County.

LAB I.D. NUMBER	DATE	TIME	MATRIX	COMP.	GRAB	SAMPLE IDENTIFICATION	NUMBER OF CONTAINERS	FILTERED (Y/N)	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	BTEX 8020/602	MTBE 8020/602	TPH	PAH 8270	RCRA Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pd Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol. 8240/8260/624	GC.MS Semi. Vol. 8270/625	PCB's 8080/608	Pest. 808/608	BOD, TSS, pH, TDS, Chloride	Gamma Spec.	Alpha Beta (Air)	PLM (Asbestos)	Major Ions (See List)
98771	5/14/98	4:00	W		X	MW-7	1				✓	✓																		X
72	5/14/98	2:00	W		X	MW-8	1				✓	✓																		X
73	5/13/98	4:20	W		X	MW-9	1				✓	✓																		X
74	5/13/98	2:25	W		X	MW-9A	1				✓	✓																		X
75	5/14/98	5:00	W		X	MW-10	1				✓	✓																		X

RELINQUISHED BY: (Signature) — Date: 5/18/98 Time: 4:50PM — RECEIVED BY: (Signature) Ellen Shelton — Date: 5/18/98 Time: 4:50 PM

RELINQUISHED BY: (Signature) Ellen Shelton — Date: 5/18/98 Time: 6:45PM — RECEIVED BY: (Signature) — Date: Time:

RELINQUISHED BY: (Signature) — Date: Time: — RECEIVED BY: (Signature) — Date: Time:

RECEIVING LABORATORY: ADDRESS: CITY: STATE: ZIP: CONTACT: PHONE:

RECEIVED BY: (Signature) Vicki Wadham — DATE: 5-19-98 TIME: 9:35 AM

SAMPLED BY: (Print & Sign) IKE Tavarez — Date: Time:

SAMPLE SHIPPED BY: (Circle) FEDEX HAND DELIVERED BUS UPS — AIRBILL #: 155 758 9242 OTHER: GREYHOUND

HIGHLANDER CONTACT PERSON: IKE Tavarez

Results by:

RUSH Charges Authorized: Yes No

SAMPLE CONDITION WHEN RECEIVED:

MATRIX: (W-Water) S-Soil A-Air SL-Sludge SD-Solid O-Other

REMARKS: F 6-8 BL

Please Fill out all copies - Laboratory retains yellow copy - Return original copy to Highlander Environmental Corp. - Project Manager retains pink copy - Accounting receives Gold copy.

TRACE ANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
4725 Ripley Avenue, Suite A El Paso, Texas 79922 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

ANALYTICAL RESULTS FOR
HIGHLANDER ENVIRONMENTAL SERVICES
Attention: Ike Tavarez
1910 N. Big Spring St.
Midland, TX 79705

April 02, 1998
Receiving Date: 03/03/98
Sample Type: Water
Project No: 996
Project Location: NA

Prep Date: 04/02/98
Analysis Date: 04/02/98
Sampling Date: 02/25-27/98
Sample Condition: Intact & Cool
Sample Received by: VW
Client Name: Texaco E & P, Inc.
Project Name: Texaco Cooper - Jal Center TB

TA#	FIELD CODE	CHLORIDE (mg/L)
T92323	MW-1	5,400
T92324	MW-2	5,800
T92327	MW-4	12,000
T92328	MW-4A	1,400
T92329	MW-5	6,600
ICV		490
CCV		489
REPORTING LIMIT		0.5
RPD		0
% Extraction Accuracy		98
% Instrument Accuracy		98

METHODS: EPA SM 4500 Cl-B.
CHEMIST: JS
CHLORIDE SPIKE: 5,000 mg/L CHLORIDE.
CHLORIDE CV: 500 mg/L CHLORIDE.

Director, Dr. Blair Leftwich

4-2-98
DATE

APPENDIX F

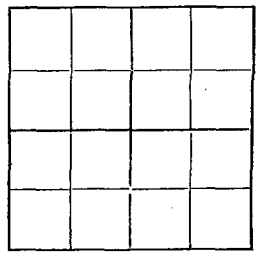
Water Well Records

Form WR-23 STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed. E. E. Hunter Well #1

Section 1



(Plat of 640 acres)

(A) Owner of well Humble Oil Co.

Street and Number

City State

Well was drilled under Permit No. and is located in the SE ¼ NW ¼ SW ¼ of Section 13 Twp. 24 S Rge. 36E

(B) Drilling Contractor ED Burke License No.

Street and Number

City State

Drilling was commenced 19

Drilling was completed 9 19 41

Elevation at top of casing in feet above sea level Total depth of well 160'

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received Copied from USGS Well
Schedule by A. Nicholson in July1954

File No. Use Location No. 24.36.13.314

24.36.13.3144 E.E.Hunter Well #1 Humble Oil Co.

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	3			Soil
3	13			Soft white lime
13	35			Brown sand
35	45			Grey sand
45	50			Brown sand rock
50	60			Brown soft sand
60	91			Dry brown sand
91	115			Lime
115	138			Dry sand
138	158			Water Sand
158	160			Red Clay
				L S Elev 331
				~~Depth to K~~ Tre 156
				Elev of K Tre 360 ±
				Loc. No. 24.36.13.3144
				Hydro. Survey ____ Field Check X (NOT FOUND)
				SOURCE OF ALTITUDE GIVEN
				Interpolated from Topo Sheet X
				Determined by Inst. Leveling ____
				Other ____

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

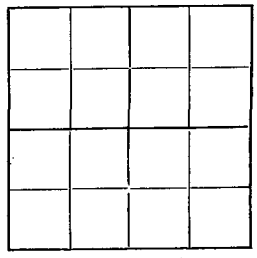
Ed Burke
Well Driller

Form WR-23 STATE ENGINEER OFFICE

WELL RECORD

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the nearest district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1A and Section 5 need be completed. E. E. Hunter Well #2

Section 1



(Plat of 640 acres)

(A) Owner of well Humble Oil Co.

Street and Number

City State

Well was drilled under Permit No. and is located in the NE ¼ SW ¼ SW ¼ of Section 13 Twp. 24S Rge. 36E

(B) Drilling Contractor Ed Burke License No.

Street and Number

City State

Drilling was commenced 19

Drilling was completed 19

Elevation at top of casing in feet above sea level Total depth of well 160'

State whether well is shallow or artesian Depth to water upon completion

Section 2 PRINCIPAL WATER-BEARING STRATA

No.	Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation
1				
2				
3				
4				
5				

Section 3 RECORD OF CASING

Dia in.	Pounds ft.	Threads in	Depth Top	Depth Bottom	Feet	Type Shoe	Perforations From	Perforations To

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Diameter Hole in in.	Tons Clay	No. Sacks of Cement	Methods Used

Section 5 PLUGGING RECORD

Name of Plugging Contractor License No.

Street and Number City State

Tons of Clay used Tons of Roughage used Type of roughage

Plugging method used Date Plugged 19

Plugging approved by:

Basin Supervisor

Cement Plugs were placed as follows:

No.	Depth of Plug From	Depth of Plug To	No. of Sacks Used

FOR USE OF STATE ENGINEER ONLY

Date Received Copied from USGS Well Schedule (24.36.13.314) by A. Nicholson July 1954.

File No. Use Location No. 24.36.13.3322

24.36.13.3322

Humble Oil Co. E.E. Hunter Well #2

Section 6

LOG OF WELL

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color	Type of Material Encountered
0	3			Soil
3	13			Soft White lime
13	35			Brown sand
35	45			Grey sand
45	50			Brown sand rock
50	60			Brown soft sand
60	91			Dry brown sand
91	115			Lime
115	138			Dry sand
138	158			Water sand
158	160			Red clay
				L S Elev [illegible]
				Depth to K. [illegible] Trc. 155
				Elev of K. [illegible] Trc. 3161
				Loc. No. 24.36.13.3322
				Hydro. Survey [illegible] Field Check X (NOT FOUND)
				SOURCE OF ALTITUDE GIVEN
				Interpolated from Topo Sheet X
				Determined by Inst. Leveling
				Other

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described well.

ED Burke
Well Driller

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Fred B. Cooper Owner's Well No. _____

Street or Post Office Address Star Route

City and State Jal, New Mexico 88252

Well was drilled under Permit No. CP-564 and is located in the:

a. NE ¼ NE¼ ¼ ¼ of Section 23 Township 24-S Range 36-E N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in Lea County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor W. L. Van Noy License No. WD-208

Address P. O. Box 75 Oil Center, New Mexico 88266

Drilling Began Mar. 7 Completed Mar. 10, 1977 Type tools spudder Size of hole 10 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 180 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 160 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
165	180	15	fine water sand.	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
7	welded		0	180	180	none	159	175

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received March 17, 1977

Quad _____ FWL _____ FSL _____

File No. CP-564 Use Dom & Stk. Location No. 24.36.23. 220

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	5	5	top soil
5	25	20	caliche
25	165	140	course sand
165	180	15	fine water sand.

Section 7. REMARKS AND ADDITIONAL INFORMATION

gravel packed

77 MAR 17 AM 8 20

STATE ENGINEER OFFICE
ROSWELL, N.M.

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is