AP - 015

STAGE 1 & 2 WORKPLANS

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Stage 2 Abatement Plan
for
Groundwater Abatement

East Hobbs Junction Site
Phillips Pipe Line Company
Hobbs, New Mexico

Prepared For:

Mr. Anthony "Tony" C. Walker
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Prepared By:

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Higgins and Associates, LLC

November 2, 2000

Mr. Tony Walker
Phillips Pipe Line Company
3B10 Adams Building
Bartlesville, OK 74004

RE: Stage II Abatement Plan - East Hobbs Junction

Dear Mr. Walker:

Enclosed please find one original and five copies of the Stage II Abatement Plan for the East Hobbs Junction Release Site in Hobbs, New Mexico.

Should you have any questions or comments please contact me at 303/708-9846.

Sincerely,
Higgins and Associates, L.L.C.

Chris Higgins
Project Manager

8200 South Akron Street, Suite 120 • Englewood, Colorado 80112
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1.0 Description and Current Situation of Project Site

1.1 Initial Abatement Summary

The subject site is located in Unit N, NE 1/4, NE 1/4, Section 8, Township 19 South, Range 68 East, N.M.P.M., Lea County, New Mexico. The property on which the release occurred is largely undeveloped arid land. The primary land use is grazing land for cattle. There are no surface bodies of water within 0.5 miles of the site. Several pipelines and crude oil production wells are located near the release.

On March 23, 1999, Phillips Pipe Line Company (Phillips) personnel discovered a release of unrefined petroleum products (crude oil) associated with a local well field gathering pipeline located near the town of Hobbs, New Mexico. This area consists of several gathering lines which meet in one locality. The failed line was a six inch diameter line. This line reportedly carried both condensate and crude oil. The line leak was identified by the detection of oil impacts on the ground surface in the area of the release. The volume of the release is not known.

Phillips excavated approximately 200 cubic yards of petroleum impacted soil from around and below the release location. The limits of the excavation were approximately 10 feet wide by 60 feet long and averaged approximately 6-8 feet deep with the deepest extent around 12 feet. Excavation activities were halted because of the potential for damage to other active petroleum pipelines in the release area and continuation of petroleum impacts in the bottom and side walls of the excavation.

On April 27, 1999, Higgins and Associates personnel supervised the installation of three soil borings to 40 feet to investigate the extent of petroleum impacts. The borings were located to the north and south of the excavation. Groundwater was noted at approximately 27 feet. Based upon the soil analytical results of the soil borings, monitoring wells were installed and completed on July 12, 1999. Approximately 3 feet of crude oil was detected on the water table in each monitoring well.

Phillips initiated a LPH recovery program from the three monitoring wells on July 19, 1999. The program consisted of hand bailing LPH daily from each well for one week. Approximately 54 gallons of LPH were recovered.

Based on the presence of petroleum impacts in the three wells, additional assessment activities were conducted to complete the definition of the vertical and horizontal extent of petroleum impacts. This report summaries the activities and results of the assessment activities and presents proposed corrective measures to address the subsurface hydrocarbon impacts. Details of the assessment activities are presented in the Comprehensive Report dated July 5, 2000.

1.2 Stage 1 Abatement Summary

Three drilling events were conducted to define the extent of petroleum impacts. The first event occurred on January 11, 2000 through January 12, 2000 and consisted of the drilling and installation of monitoring

wells MW-4 through MW-10. The second drilling event occurred on April 6, 2000 and consisted of the installation of monitoring wells MW-11 and MW-12. The third drilling event occurred on May 30, 2000 through June 1, 2000 and consisted of the installation of wells MW-13 through MW-20 and well SP-1. The drilling activities were accomplished utilizing a truck mounted air rotary drill rig. Figure 1 (Appendix A) illustrates the monitoring well locations.

During the drilling activities, grab soil samples were collected at a minimum of five foot intervals. The samples were logged by a geologist and split into representative portions. One portion was placed in the appropriate laboratory container(s) and placed on ice for possible analysis. The remaining portion of the sample was placed in a container, allowed to equilibrate and screened with a photoionization detector (PID). One to two soil samples from each boring (except MW-9 and SP-1) were submitted for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Method 8021, and total petroleum hydrocarbons (TPH) by EPA Method 8015 Modified. The soil samples were shipped or transported on ice to a certified New Mexico laboratory under chain-of-custody.

Monitoring wells MW-4 through MW-8 and MW-10 through MW-20 were constructed to depths ranging from 30 to 35 feet utilizing 2-inch diameter schedule 40 PVC screen and casing. A minimum of 15 feet of 0.020 inch slot screen was utilized in the construction of wells MW-4 through MW-20. Three feet of screen was utilized in the construction of well SP-1. The annulus of each well was backfilled with 10/20 silica sand to 0.5 to two feet above the screen. Bentonite and cement was placed above the sand pack in the well annulus. A locking steel protective riser was installed on each monitoring well to a height of three feet above ground surface. Each well was fitted with a J-plug water tight cap and secured with a brass lock. Monitoring well MW-9 was constructed as above except that 4-inch diameter well materials were utilized. Well logs depicting the well construction details are included in Appendix A.

Following installation, each well absent of liquid phase hydrocarbons (LPH) was developed by bailing and surging with a bailer.

Four groundwater sampling events have been conducted at the site. The first sampling event occurred on January 13, 2000 and consisted of wells MW-4 through MW-6, MW-8, and MW-10. The second sampling event was conducted on April 6, 2000 and consisted of the above wells plus MW-11 and MW-12. The third sampling event occurred on June 2, 2000 and consisted of wells MW-13 through MW-20 and SP-1. The latest sampling event occurred on August 2, 2000 and consisted of all wells except MW-1 through MW-3, MW-6, MW-7, MW-9 and SP-1. Prior to collection of groundwater samples, a minimum of three well volumes of groundwater were purged from each well with a bailer. The groundwater samples were analyzed for BTEX by EPA Method 8021, TPH by EPA Method 8015 Modified and chloride. Groundwater samples from monitoring wells MW-4, MW-5, MW-6, MW-8, and MW-10 were also analyzed for polyaromatic hydrocarbons (PAHs) by EPA Method 8270, heavy metals (including uranium) by EPA Method 6010/6020, alkalinity, chloride, fluoride, sulfate, and total dissolved solids by EPA series 300, bromide by method 4500B, and mercury by EPA Method 7470. The groundwater samples were placed on ice and shipped or transported under chain-of-custody to a certified New Mexico laboratory. The results of the groundwater analytical data will be discussed later in this report.

Industry accepted standard operating practices were followed for all field activities to insure the quality of the data obtained. A quality assurance plan was included in the Stage I Abatement Plan dated August 25, 1999.

On January 13, 2000, rising head permeability tests (slug out tests) were conducted in wells MW-4, MW-5, and MW-6. The tests were conducted by instantaneous removal of a volume of water from the wells and measuring the rate of groundwater recharge into the well. The data was evaluated using the Graphical Well Analysis Package (GWAP). The data from the slug out tests will be discussed in the Hydrogeology section of this report.

1.3 Chronology of Reports Submitted to OCD

- Stage 1 Abatement Plan - dated August 25, 1999
- Comprehensive Report - dated July 5, 2000

1.4 Current Soil and Groundwater Analytical Data

The known phases of petroleum impacts associated with this site are adsorbed phase, dissolved phase, and liquid phase hydrocarbons. The lateral extent of petroleum impacts to the soil and groundwater associated with the subject release have been defined. The following is a summary of each of these phases as defined by the assessment activities.

1.4.1 Adsorbed Phase Hydrocarbons

Petroleum impacts were apparent throughout the limits of the excavation from near surface to the total depth. Results of the Stage I assessment activities detected petroleum hydrocarbon impacts exceeding the New Mexico action level of 100 mg/kg TPH for soil in borings MW-1, MW-2, and MW-3. Soil samples from wells MW-9 and SP-1 were not submitted to the laboratory for analysis due their proximity to wells MW-1 and MW-3. The following table summarizes the soil analytical data during the assessment activities.

Table 1
Soil Analytical Results for East Hobbs Junction
Hobbs, New Mexico

All results reported in mg/kg.

Well ID	Date	Depth (ft)	PID reading (ppmv)	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH
NM Action Levels			**100**	**10**				**100**
MW-1	04/27/99	22 - 24	264	0.071	1.202	1.014	3.487	5,420
MW-1	04/27/99	35 - 36	13	<0.002	0.008	0.007	0.024	372

Well ID	Date	Depth (ft)	PID reading (ppmv)	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH
NM Action Levels			**100**	**10**				**100**
MW-2	04/27/99	20 - 22	>2,000	0.082	1.589	1.369	5.002	7,930
MW-2	04/27/99	36 - 40	21	0.002	0.023	0.018	0.061	801
MW-3	04/27/99	18 - 20	>2,000	0.448	4.767	2.338	7.485	5,790
MW-3	04/27/99	36 - 38	12	<0.002	0.002	<0.002	0.006	293
MW-4	01/14/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-4	01/14/00	24 - 26	2.8	<0.025	<0.025	<0.025	<0.025	<10
MW-5	01/11/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-5	01/11/00	24 - 26	1.6	<0.025	<0.025	<0.025	<0.025	<10
MW-6	01/11/00	14 - 16	1.7	<0.025	<0.025	<0.025	<0.025	<10
MW-6	01/11/00	24 - 26	20	<0.025	<0.025	<0.025	<0.025	12
MW-7	01/12/00	14 - 16	1.1	<0.025	<0.025	<0.025	<0.025	<10
MW-7	01/12/00	24 - 26	177	<0.025	<0.025	<0.025	<0.025	32.7
MW-8	01/12/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-8	01/11/00	24 - 26	3.3	<0.025	<0.025	<0.025	<0.025	<10
MW-9	01/12/00	14 - 16	66	-	-	-	-	-
MW-9	01/12/00	24 - 26	462	-	-	-	-	-
MW-10	01/12/00	14 - 16	13	<0.025	<0.025	<0.025	<0.025	<10
MW-10	01/12/00	24 - 26	39	<0.025	<0.025	<0.025	<0.025	<10
MW-11	04/06/00	22	1	<0.002	<0.002	<0.002	<0.002	<9.8
MW-11	04/06/00	24 - 26	1.4	<0.002	<0.002	<0.002	<0.002	<9.8
MW-12	04/06/00	14 - 16	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-12	04/06/00	20 - 22	1.1	<0.002	<0.002	<0.002	<0.002	<9.7
MW-13	05/31/00	20-22	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-14	05/31/00	20-22	0	<0.002	<0.002	<0.002	<0.002	<9.8
MW-15	05/31/00	5	0	<0.002	<0.002	<0.002	<0.002	<9.8
MW-15	05/31/00	24-26	37	<0.002	<0.002	<0.002	<0.002	<9.7
MW-15	05/31/00	28-30	68	<0.002	<0.002	<0.002	<0.002	<9.8

Well ID	Date	Depth (ft)	PID reading (ppmv)	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH
NM Action Levels			**100**	**10**				**100**
MW-16	05/31/00	20-22	0	<0.002	<0.002	<0.002	<0.002	<9.7
MW-17	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-18	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-19	06/01/00	20-22	0	<0.002	<0.002	<0.002	<0.002	<9.8
MW-20	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9

The migration of petroleum through the vadose zone appears to have limited lateral extent prior to reaching the water table. The analytical data shows soil impacts are defined to the north by MW-4, to the east by borings MW-5 and MW-8, to the south by MW-10 and MW-11, and to the west by MW-15. Away from the release area, the zone of hydrocarbon impact is isolated to the water table interface. The soil analytical data was submitted with the Comprehensive Report.

1.4.2 Liquid Phase Hydrocarbons

On August 1, 2000 liquid phase hydrocarbons (LPH) were detected in wells MW-1, MW-2, MW-3, MW-6, MW-7, MW-9, and SP-1. The LPH thickness ranged from 0.12 feet in MW-6 to 3.06 feet in MW-9.

1.4.3 Dissolved Phase Hydrocarbons

Four groundwater sampling events have been conducted at the site. The first sampling event occurred on January 13, 2000 and consisted of wells MW-4 through MW-6, MW-8, and MW-10. The second sampling event was conducted on April 6, 2000 and consisted of the above wells plus MW-11 and MW-12. The third sampling event occurred on June 2, 2000 and consisted of wells MW-13 through MW-20 and SP-1. The most recent sampling event occurred on August 2, 2000 and consisted of monitoring wells MW-4, MW-5, MW-8 and MW-10 through MW-20. The following table summarizes the groundwater analytical data for BTEX and TPH during the assessment activities.

Table 2
Groundwater Analytical Results for East Hobbs Junction
Hobbs, New Mexico

All results reported in ug/L.

Well ID	Date	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH
NM Action Levels		**10**	**750**	**750**	**620**	
MW-4	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-4	04/06/00	**19**	0.83	1.2	3.2	<1,000
MW-4	08/02/00	2	<0.5	<0.5	<2	<980
MW-5	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-5	04/06/00	<0.5	<0.5	<0.5	<2	<1,000
MW-5	08/02/00	<0.5	<0.5	<0.5	<2	<990
MW-6	01/13/00	**3,300**	**2,000**	240	580	<2,000
MW-6	04/06/00	**3,900**	**1,100**	270	540	<1,000
MW-8	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-8	04/06/00	<0.5	<0.5	<0.5	<2	<1,000
MW-8	08/02/00	<0.5	<0.5	<0.5	<2	<940
MW-10	01/13/00	**4,100**	490	440	**720**	<2,000
MW-10	04/06/00	**400**	53	66	98	<1,000
MW-10	08/02/00	220	12	27	55	<1,100
MW-11	04/06/00	**4,100**	**2,400**	290	420	1,600
MW-11	08/02/00	**3,900**	**2,100**	260	510	2,500
MW-12	04/06/00	**2,000**	200	110	200	<1,200
MW-12	08/02/00	**2,900**	22	97	160	<970
MW-13	06/02/00	<0.5	<0.5	<0.5	<2	<1,000
MW-13	08/02/00	<0.5	<0.5	<0.5	<2	<990
MW-14	06/02/00	**370**	5.3	1.7	11	<1,000
MW-14	08/02/00	**760**	1.9	2.9	13	<1,000
MW-15	06/02/00	**830**	**770**	130	170	2,100
MW-15	08/02/00	**330**	250	42	52	2,800
MW-16	06/02/00	0.94	0.96	21	6.9	<1,000

Well ID	Date	Benzene	Toluene	Ethyl benzene	Total Xylenes	TPH
NM Action Levels		**10**	**750**	**750**	**620**	
MW-16	08/02/00	<0.5	<0.5	13	<2	<1,000
MW-17	06/02/00	<0.5	<0.5	<0.5	<2.0	<1,000
MW-17	08/02/00	6	<0.5	9.3	<2	<970
MW-18	06/02/00	**600**	0.66	120	45	<1,000
MW-18	08/02/00	**780**	<0.5	150	46	<990
MW-19	06/02/00	<0.5	<0.5	<0.5	<2.0	<1,000
MW-19	08/02/00	1.8	6.3	<0.5	11.2	<1,000
MW-20	06/02/00	<0.5	<0.5	<0.5	<2.0	<1,000
MW-20	08/02/00	4	3.8	4.1	12.7	<1,000
SP-1	06/02/00	9.4	7.4	2.5	7	<1,000

As summarized in the above table, wells MW-6, MW-10 through MW-12, MW-14, MW-15, and MW-18 contain dissolved phase benzene above the New Mexico action level of 10 ug/l. Figure 2 (Appendix A) illustrates the lateral distribution of BTEX and TPH beneath the site. As illustrated by Figure 2, the lateral extent of petroleum hydrocarbon impacts associated with the Phillips release have been defined. The dissolved phase impacts are defined to the north by MW-4, to the west/southwest by MW-16, MW-17, and MW-20, to the south by MW-19 and to the east/southeast by MW-8 and MW-13. Dissolved phase benzene and toluene above state groundwater standards were also detected in well MW-15. Monitoring well MW-15 is located approximately 500 feet cross gradient of the release point near a GPM pipeline and a production well. Shallow petroleum impacts to soil were noted during the drilling of this well. The shallow impacts combined with the direction of groundwater flow in this area indicate that the petroleum impacts in this area are not associated with the release from the Phillips pipeline. The groundwater analytical data for the August 2000 sampling event is included in Appendix C.

1.4.4 Dissolved Phase Polynuclear Aromatic Hydrocarbons

Groundwater samples collected from wells MW-4, MW-5, MW-6, MW-8, and MW-10 were analyzed for polynuclear aromatic hydrocarbons (PAHs). PAHs were not detected in the above referenced wells. The analytical data is included in Appendix C.

1.4.5 Other Groundwater Analytical Data

Inorganic groundwater analytical data is summarized on the Inorganic Data Table in Appendix C. The analytical data presented on the table includes the major anion and cations, total dissolved solids (TDS), and the New Mexico Water Quality Control Commission (NMWQCC) metals. Included on the table are

field measurements of pH and conductivity.

Total dissolved solids ranged from 560 mg/L to 750 mg/L. Chloride ranged from 130 mg/L to 310 mg/L. The NMWQCC standard for Chloride in groundwater with less than 10,000 mg/L TDS is 250 mg/L. Barium was detected above the State Groundwater Standard of 1 mg/L in well MW-4 (2.89 mg/L) and MW-10 (5.48 mg/L). Well MW-4 is located upgradient of the release point and contains low levels of hydrocarbon impacts. Chromium was detected above the State Groundwater Standard of 0.05 mg/L in well MW-4 (0.13 mg/L). Fluoride was detected above the State Groundwater Standard of 1.6 mg/L for wells MW-4 (2.3 mg/L), MW-5 (2.6 mg/L), and MW-8 (2.4 mg/L). Monitoring wells MW-5 and MW-8 are located outside of the area of petroleum impact and may represent background concentrations for these analytes. No other analyte was detected above the NMWQCC standards for groundwater with TDS <10,000 mg/L.

1.5 Summary of Geology and Hydrogeology

1.5.1 Regional Setting

The regional geology surrounding the site is alluvium (unconsolidated) overlaying the Ogalalla Formation. The Ogalalla is also known as the High Plains aquifer which extends north to south from South Dakota to New Mexico and Texas. The Ogalalla was formed during the formation of the Rocky Mountains (Larimide orogeny - late Cretaceous to end of Paleocene). The Ogalalla Formation primarily consists of outwash alluvium deposited by the streams draining the newly formed Rocky Mountains. Caliche deposits are encountered in semiarid to arid conditions. The caliche was (and continues to be) formed as a result of the vertical movement of water through the unconsolidated alluvium from rainfall recharge (downward) and evaporation (upward). The calcium carbonate and/or calcium sulfate forms out of solution and creates a cementation effect. The origin of the calcareous material is either eolian (wind blown dust) or eroded limestone within the alluvium of the Ogalalla.

The hydrogeology of the Ogalalla aquifer can vary tremendously on a relatively small scale due to the wide grain-size distribution of the alluvial sediments. The regional water table slopes from west to east. The saturated thickness of the Ogalalla ranges from 0 feet to the west to upwards of 1,000 feet to the east. In the area of Hobbs, New Mexico, the saturated thickness may be 10 to 150 feet. Depth to groundwater is shallower to the west and gradually gets deeper to the east. Aquifer recharge is primarily rainfall; aquifer discharge is a combination of streams or springs and evapotranspiration.

1.5.2 Local Setting

Based on information obtained from the drilling activities, the site specific geology consists primarily of caliche mixed with sands, limestone and some gravel. The caliche was encountered from ground surface to approximately 6 to 15 feet below ground surface. The sands and gravels were encountered below the caliche to total depth. The drilling logs for each well are presented in Appendix B.

The monitoring wells were gauged for depth to groundwater/depth to product on each of the four sampling events discussed in Section 1.4.3. Groundwater was encountered in the monitoring wells at approximately 20 to 26 feet below ground surface. The groundwater elevation and LPH thickness data for the gauging events are included in Appendix D. Figure 3 (Appendix A) depicts the groundwater potentiometric surface map for the August 1, 2000 data. The groundwater flow direction beneath the area is varied. The groundwater flow is predominantly to the south/southeast which is consistent with the regional groundwater flow direction. However in the northeastern portion of the site a southwest component of groundwater flow exists. In the western portion of the site a eastward component of flow exists. The groundwater gradient is approximately 0.002 ft/ft. Based on the rising head permeability test data from wells MW-4, MW-5, and MW-9, the site specific hydraulic conductivity ranges from 1.6×10^{-3} cm/sec to 4.2×10^{-3} cm/sec. Based on an estimated porosity of 30%, average hydraulic conductivity of 2.7×10^{-3} cm/sec, and a gradient of 0.002 ft/ft, the average groundwater velocity is approximately 18 feet per year. This data is consistent with the lithology encountered during the drilling activities. The test data is included in Appendix E.

1.5.3 Land Ownership and Well Records Search

A record search for area landownership and water wells within a minimum of 1 mile radius of the site was performed. The New Mexico registered wells are shown in the Baker Water Well record search.

There are 18 New Mexico registered wells within the search area. The installation dates are unknown. Some of the wells are designated domestic/stock or unused. Most of the wells are located upgradient of the project site and all the wells listed are outside the immediate area of the dissolved hydrocarbon plume. The Baker record search with associated maps are in Appendix F.

2.0 Development and Assessment of Abatement Options

The Stage II Abatement Plan for the East Hobbs Junction site is based on experience with various remedial technologies, experience with projects associated with the Ogalalla Aquifer, and knowledge of the regulatory compliance and cleanup goals of the OCD. The following conclusions were also incorporated during the development of the abatement options under consideration.

- The lateral extent of petroleum impacts in the caliche appears to be limited. The analytical data shows soil impacts are defined to the north by borings MW-4 and MW-5, to the south and east by borings MW-8 and MW-13, and to the south and west by borings MW-16, MW-19, and MW-20.
- On August 1, 2000, liquid phase hydrocarbons (LPH) were detected in wells MW-1, MW-2, MW-3, MW-7, MW-9 and SP-1. The LPH plume has been defined.
- The crude oil associated with the release appears to be a mixture of condensate and crude oil.
- The lateral extent of the dissolved phase hydrocarbons has been defined to the north (MW-4 and MW-5), to the east (MW-8), to the south/southeast (MW-13 and MW-19), and to the west/southwest (MW-16 and MW-20).

2.1 Technical Feasibility of Remediation Technologies

2.1.1 Soil and Groundwater Remediation Goals

The remedial approach is designed to address the adsorbed phase, liquid phase and dissolved phase petroleum impacts. The petroleum hydrocarbons released at the site consist of both volatile light end and semi volatile heavy end hydrocarbons. The remedial approach is being designed to reduce benzene concentrations in the soil to the OCD Guidance Document remedial goals of 10 mg/kg benzene. The system is also being designed to treat groundwater to the State Groundwater Standards of 10 ug/L benzene, 750 ug/L toluene, 750 ug/L ethylbenzene, and 620 ug/L xylenes. Residual hydrocarbons which may remain in the soils at the completion of remedial activities may consist of heavy end non-mobile hydrocarbons. The residual hydrocarbons may result in a TPH concentration of higher than 100 mg/kg but would represent low risk to human health or the environment.

2.1.2 Evaluation of Remediation Techniques

Many technologies are available to facilitate the remediation of petroleum hydrocarbon-affected soils and groundwater. These range from traditional excavation and hauling of affected soils to aquifer air sparging and aerobic/anaerobic bioremediation. Most technologies are well suited to high permeability conditions, and only a few work well in low permeability conditions. The following technologies, alone or in combination, were considered for incorporation in the Stage II Abatement Plan for this site:

- Excavation,
- Soil vapor extraction,
- Aerobic and anaerobic bioremediation,
- Aquifer sparging, and
- Groundwater pumping.

2.1.3 Excavation

Excavation is typically considered in three general circumstances: 1) when there are relatively small volumes of affected soils, 2) when the affected soils have a very low permeability, 3) if removal of relatively small quantities of soil will facilitate other remediation technologies by eliminating the concentrated source of petroleum hydrocarbons.

Excavation is not a practical solution at present due to the depth of the petroleum impacted soil combined with the presence of LPH and dissolved phase hydrocarbons.

2.1.4 Soil Vapor Extraction/Biovent System

Soil vapor extraction is a good mechanism for *in situ* reduction of petroleum hydrocarbon concentrations in the unsaturated zone through volatilization of petroleum hydrocarbon constituents and by increasing the oxygen content within the soil, thereby facilitating the natural biodegradation of petroleum hydrocarbons.

Advantages for incorporation of a soil vapor extraction system at this site are:

- Disruption to the current use of the property as grazing land would be minimal. Excavation activities will be limited to trenches for installation of system piping from the vapor recovery wells to the equipment compound.

- Excavation of contaminated soil will be minimal, reducing potential exposure to the petroleum hydrocarbons. Remediation of contaminated soils will be accomplished *in situ*, reducing long term liabilities associated with off-site treatment and disposal of contaminated soil.

- The consistency of the LPH, being a mixture of crude oil and condensate is conducive to mass removal by soil vapor extraction.

- The biodegradability of the petroleum hydrocarbon components are also conducive to mass removal by soil vapor extraction.

Disadvantages of soil vapor extraction are:

- Off gas treatment cost, if required.

- This technology primarily addresses the vadose zone.

Soil vapor extraction has practical applications at this site.

2.1.5 Aerobic and Anaerobic Bioremediation

In situ bioremediation is effective for saturated and unsaturated zone soils affected by petroleum hydrocarbons. Bioremediation technologies considered for this site enhance the populations of naturally occurring hydrocarbon utilizing bacteria. This process can be accomplished by simply increasing the oxygen content in the vadose zone by soil vapor extraction or by inducing nutrients and/or alternative electron acceptors into the subsurface to facilitate anaerobic bioremediation. If anaerobic bioremediation were implemented to address dissolved phase hydrocarbons, the process would consist of the addition of nitrate, sulfate, and/or other electron acceptors and nutrients to the subsurface through injection wells.

Advantages for bioremediation are:

- Bioremediation is an effective technology for addressing crude oil impacts and is a byproduct of soil vapor extraction.
- If necessary, nutrient addition may enhance biodegradation reducing remediation time frames.

Disadvantages to bioremediation are as follows:

- Permitting and additional monitoring requirements if injection of nutrients or electron acceptors is required.

Bioremediation has practical application at this site. The *in situ* bioremediation can be applied through the use of the soil vapor extraction system.

2.1.6 Aquifer Sparging

Aquifer sparging is a technology used to reduce concentrations of petroleum hydrocarbons in the saturated zone. Aquifer sparging is the injection of air, under pressure, at a point beneath the contamination within the saturated zone. This removes petroleum hydrocarbons directly from the saturated zone soils through volatilization and enhanced bioremediation. The air rises to the vadose zone, where it is collected and removed by a soil vapor extraction system.

Advantages of aquifer sparging are:

- Removal rates of dissolved and adsorbed hydrocarbons are rapid.
- Operation and maintenance of the remediation equipment is low.

- Removal efficiencies of volatile hydrocarbons from the saturated zone are high, resulting in reduced residual hydrocarbon concentrations at closure.

Disadvantages of aquifer sparging are:

- Improper application of an aquifer sparge system can result in spreading of the contaminant (especially with the presence of LPH) instead of removal.

Aquifer sparging has practical application at this site.

2.1.7 Groundwater Pumping

Groundwater pumping is the removal of groundwater from the subsurface with either surface mounted or submersible electric pumps, or total fluid pneumatic pumps. Groundwater pumping provides hydraulic control of dissolved phase and liquid phase petroleum hydrocarbons, but often does not efficiently remove petroleum contamination when employed as the only remedial technology.

Advantages for groundwater pumping are:

- Migration of dissolved phase and liquid phase hydrocarbons are controlled.

Disadvantages to groundwater pumping are as follows:

- Groundwater removed from the subsurface will require treatment prior to disposal.
- Groundwater from the pumping system would be re-injected following treatment. The time period for obtaining the reinjection permit can be long, delaying implementation of remedial measures.
- Remediation rates of groundwater by pump and treat technologies are slow.

Due to the physical properties of the petroleum hydrocarbons released to the subsurface, and the anticipated effectiveness of the soil vapor extraction system in removing the hydrocarbons, groundwater pumping is not considered necessary for control of LPH migration.

3.0 Preferred Abatement Options

The following remedial technologies were selected to address the adsorbed phase, dissolved phase, and liquid phase petroleum hydrocarbons. The remedial technologies proposed are a soil vapor extraction system, a product skimming system for wells with LPH, and an air sparge system to address the areal extent of the dissolved hydrocarbon plume.

3.1 Soil Vapor Extraction Pilot Testing at Site NM-1-1

Phillips Pipe Line site NM-1-1 is located approximately 3/4 of a mile south of the East Hobbs Junction site. The two sites have similar geology and hydrogeology. The conceptual soil vapor extraction system for East Hobbs Junction is based on the pilot testing conducted at the NM-1-1 site on October 20, 1999 through October 25, 1999. The following section summarizes the results of the pilot tests.

3.1.1 Soil Vapor Extraction Pilot Test Results

On October 20, 1999, a soil vapor extraction pilot test was performed on well SVE-1 (completed in the caliche). On October 23, 1999, a second soil vapor extraction pilot test was conducted on well SVE-2 (completed in both the caliche and the sand). A 4.5 hp regenerative blower was utilized to apply vacuum to each SVE well. Influent and effluent measurements of air flow, VOCs, and vacuum were obtained. Surrounding wells were measured for induced vacuum. The results of the tests are summarized in the following tables.

Table 3
SVE Pilot Test at SVE-1
Applied Vacuum @ SVE-1 = 66 inches H2O

Time (min.)	Effluent Air Flow (cfm)	Effluent PID (ppm)	Vacuum @ SVE-2 (50 ft)*	Vacuum @ MP-1 (23 ft)	Vacuum @ MP-2 (35 ft)	Vacuum @ MW-4 (95 ft)	Vacuum @ MW-5 (60 ft)	Vacuum @ MW-6 (160 ft)
5	85	145	0.4	1	0.03	0.28	0.01	0
15	85	885	0.4	1	0.03	0.28	0.01	0
30	88	888	0.4	1	0.04	0.28	0.01	0

*Distance from SVE-1.

Table 4
SVE Pilot Test at SVE-2
Applied Vacuum @ SVE-2 = 68 inches H2O

Time (min.)	Effluent Air Flow (cfm)	Effluent PID (ppm)	Vac. @ SVE-1 (50 ft)*	Vac. @ MP-1 (45 ft)	Vac. @ MP-2 (30 ft)	Vac. @ MW-4 (95 ft)	Vac. @ MW-5 (30 ft)	Vac. @ MW-6 (120 ft)	Vac. @ MW-11 (200 ft)
5	83	844	0.5	0.8	1.5	0.32	1	0.18	0.1
30	80	747	0.5	0.76	1.4	0.32	1.2	0.18	0.1
60	82	595	0.6	0.78	1.4	0.32	1.2	0.18	0.1

* Distance from SVE-2.

Based on the results of the pilot tests, the vacuum and flow from the caliche and sand are similar. The sand unit exhibited a more uniform and larger radius of influence than the caliche unit, which is most likely due to the fractured nature of the caliche. The radius of influence of an individual SVE well completed in the sand unit is up to approximately 200 feet at an applied vacuum of 68 inches of water and a flow of 80 cfm.

A biovent test was also conducted at the NM1-1 project site. Due to the volatile nature of the condensate, a biovent program is currently not proposed for the East Hobbs Junction project. If bioventing is determined to be necessary to address residual heavy end hydrocarbons, then the NM1-1 system performance data will be used to modify the East Hobbs system.

3.1.2 Air Sparge Pilot Testing

On September 6, 2000, an air sparge pilot test was performed at the East Hobbs Junction site. During the air sparge pilot test, an air compressor was used to inject air at well SP-1 into the saturated zone at specific flows and pressures. Changes in pressures were measured at wells MW-1 through MW-5, MW-8, and MW-9 utilizing magnehelic gauges. Dissolved oxygen was measured at wells MW-4, MW-5, and MW-9. Results of the air sparge pilot test are summarized in the following table:

Table 5
Air Sparge Pilot Test

Well ID	Feet from SP-1	Time (minutes)	Air Pressure at SP-1 (PSI)	Air Flow at SP-1 (cfm)	Dissolved Oxygen (ppm)	Positive Pressure (" H_2O)
MW-1	80	0	0	0	NM	0
MW-2	80	0	0	0	NM	0

Well ID	Feet from SP-1	Time (minutes)	Air Pressure at SP-1 (PSI)	Air Flow at SP-1 (cfm)	Dissolved Oxygen (ppm)	Positive Pressure (" H_2O)
MW-3	30	0	0	0	NM	0
MW-4	240	0	0	0	3.64	0
MW-5	120	0	0	0	5.02	0
MW-8	300	0	0	0	4.61	0
MW-9	75	0	0	0	NM	0
MW-1	80	15	16	4	NM	NM
MW-2	80	15	16	4	NM	NM
MW-3	30	15	16	4	NM	NM
MW-4	240	15	16	4	3.01	0.04
MW-5	120	15	16	4	5.52	0.04
MW-8	300	15	16	4	4.00	0
MW-9	75	15	16	4	NM	NM
MW-1	80	30	11	4	NM	0
MW-2	80	30	11	4	NM	0
MW-3	30	30	11	4	NM	0
MW-4	240	30	11	4	NM	NM
MW-5	120	30	11	4	NM	NM
MW-8	300	30	11	4	NM	NM
MW-9	75	30	11	4	NM	NM
MW-1	80	75	17	7	NM	0.04
MW-2	80	75	17	7	NM	0
MW-3	30	75	17	7	NM	0
MW-4	240	75	17	7	3.01	0.06
MW-5	120	75	17	7	5.60	0.04

Well ID	Feet from SP-1	Time (minutes)	Air Pressure at SP-1 (PSI)	Air Flow at SP-1 (cfm)	Dissolved Oxygen (ppm)	Positive Pressure (" H_2O)
MW-8	300	75	17	7	4.40	0
MW-9	75	75	17	7	NM	NM
MW-1	80	135	15	7	NM	0.02
MW-2	80	135	15	7	NM	0
MW-3	30	135	15	7	NM	0
MW-4	240	135	15	7	3.20	0.04
MW-5	120	135	15	7	5.14	0.02
MW-8	300	135	15	7	5.40	0
MW-9	75	135	15	7	NM	NM
MW-1	80	195	16.5	7.5	NM	0.02
MW-2	80	195	16.5	7.5	NM	0
MW-3	30	195	16.5	7.5	NM	0
MW-4	240	195	16.5	7.5	3.03	0.02
MW-5	120	195	16.5	7.5	5.85	0.02
MW-8	300	195	16.5	7.5	5.23	0
MW-9	75	195	16.5	7.5	NM	0.04
MW-1	80	255	16	8	NM	0.02
MW-2	80	255	16	8	NM	0
MW-3	30	255	16	8	NM	0
MW-4	240	255	16	8	3.12	0.02
MW-5	120	255	16	8	5.11	0.01
MW-8	300	255	16	8	NM	NM
MW-9	75	255	16	8	NM	0.04

During the test, slight increases in dissolved oxygen levels were noted in wells MW-4, MW-5, and MW-8. Dissolved oxygen was not measured in wells MW-1, MW-2, MW-3, and MW-9 due to the presence of LPH. Liquid level measurements were obtained from MW-1 through MW-3 and MW-9 during the pilot test. Groundwater mounding up to 0.10 feet was recorded indicating that this area was being influenced by the air sparge test. During the test, positive pressures were observed at MW-1, MW-4, MW-5, and MW-9. No pressures were observed in wells MW-2, MW-3, and MW-8 which may be due to the presence of LPH in MW-2 and MW-3. Based on the air sparge pilot test, air sparging is applicable for the site. Based on the results of the test, a conservative effective radius of influence of an air sparge point is approximately 100 feet at an injection pressure of 16 psi and an air flow rate of 7cfm.

3.2 Conceptual System Design

The conceptual system design will incorporate three major components: a soil vapor extraction system, an air sparging system, and a product recovery system. The overall proposed conceptual system layout is presented in Figure 4 (Appendix A). Included on the figure is the proposed trench locations (for manifolded piping) and equipment compound.

3.2.1 Soil Vapor Extraction/Air Sparging System Design

The remedial approach is designed to address the adsorbed phase, liquid phase and dissolved phase hydrocarbons. Based on the results of the pilot testing, the system is proposed to consist of 12 vapor extraction wells and 20 air sparge wells. The vapor extraction wells will be manifolded to a vacuum blower located in the equipment compound. The system will be sized based on the pilot test data to account for pressure loss from the system piping and equipment components. Each vapor extraction well will be individually valved to allow for balancing the system for optimum performance. The air sparge wells will be individually manifolded to a blower/air compressor located in the equipment compound. The blower will be sized to account for pressure loss from the system piping and components. Each well will be equipped with a pressure regulator and a flow meter to balance and optimize the system. Based on the results of the air sparge pilot test, the radius of influence of the air sparge point appeared to be slowly collapsing after two to three hours of operation. This is typical for air sparge systems due to preferential channeling of the air flow. Based on the results of the air sparge test, the system will be pulsed to maximize the radius of influence. The air sparge system wells will be divided into zones. Initially pressurized air will be injected into the first zone for a period of four hours, then the system will automatically switch to the next zone. The actual injection times for each zone will be modified based on site specific data collected during the monitoring events.

Air sparge wells SP-1 through SP-8 will not be operated at startup of the remedial system due to the presence of LPH. These wells will be brought on line following removal of the majority of the LPH by the skimmer and SVE systems.

3.2.2 Product Skimming System

Product recovery pumps will be deployed in wells MW-2, MW-3, MW-7 and MW-9. System piping will also be run to wells MW-1 and MW-6 to allow for future deployment of pumps if necessary. However, due to the close proximity of MW-1 to MW-9 and the small thickness of LPH in MW-6, product recovery pumps are not proposed to be deployed at this time. The equipment specifications are currently being obtained from the equipment manufactures and will be presented in the Stage 2 Implementation Report following system installation.

3.2.3 Permitting

All necessary permits for construction and operation of the system will be obtained as required by local state and federal requirements.

4.0 Monitoring Program

4.1 Groundwater Monitoring and Sampling

Groundwater samples will continue to be collected from all wells absent of LPH on a quarterly basis. The sampling scope of work will be as follows:

- All wells will be gauged for depth to water, depth to product (if any), and total depth.
- All wells absent of liquid phase hydrocarbons will be purged a minimum of three well volumes. Measurements of temperature, pH, and conductivity will be collected during well development to insure the water sampled is from the surrounding aquifer.
- Groundwater samples will be collected from all wells absent of liquid phase hydrocarbons. The groundwater samples will be analyzed for BTEX and TPH by EPA Method 8021/8015 Modified and chloride.

4.2 Quality Assurance Plan

Industry accepted standard operating practices will be followed for all field activities to insure the quality of the data obtained. These procedures are summarized as follows:

- Well development and purging activities for the monitoring wells will be conducted from the cleanest well (based on past data and field observations) to the most contaminated well to minimize potential cross contamination between wells.
- All reusable groundwater sampling equipment will be decontaminated utilizing a detergent wash and distilled water rinse prior to sampling activities and between each well.
- Groundwater samples will be collected utilizing new disposable bailers. One duplicate sample will be collected during the sampling activities.
- The groundwater samples will be collected in the appropriate sample containers, labeled, sealed with custody seals, and placed on ice. The samples will be logged on a chain-of-custody form and submitted to the laboratory for analysis.
- New disposable gloves will be utilized for all sampling activities and will be discarded between samples.

5.0 Site Maintenance Activities

5.1 Soil Vapor Extraction/Biovent and Air Sparging System Monitoring

Volatile organic compound emissions will be monitored using a PID at system activation. Air flow rates will be measured and used to calculate the mass of total hydrocarbons recovered and emitted. Once the remediation system is in place, monitoring will occur daily for one week and monthly thereafter. Oxygen and carbon dioxide will also be monitored to track hydrocarbon biodegradation processes. The data gathered from the air monitoring will help track the progress of the remediation system. During quarterly groundwater sampling events, dissolved oxygen measurements will be collected to evaluate the effectiveness of the air sparging system. Quarterly reports will present the remedial system performance data.

5.2 Product Skimming Monitoring

During each site visit, the product skimming system will be checked for proper operation. The product skimming system will be tracked for specific LPH volume. The above ground storage tank will be checked and emptied on an as needed basis. The recovered crude oil will be transported to the Phillips Pipe Line - Gaines Pump Station.

5.3 Equipment Maintenance

The remediation system will be monitored and maintained as per manufacture specifications. This will ensure that the system is operating as designed. Checking control panel operation, fail safe alarms, and equipment cleaning will be an integral part of the routine maintenance. Emergency contact list with phone numbers will be posted outside of the equipment compound.

5.4 Closure Plan

The system will be operated until the criteria for closure has been achieved or until asymptotic conditions are reached for dissolved hydrocarbon concentrations and the effluent from the soil vapor extraction system. At this point in the project, a petition for system shut down will be prepared and submitted to the OCD for approval. This petition will contain system performance data and hydrocarbon removal results, and will outline the closure monitoring plan.

Confirmatory soil borings will be completed within the historical plume to track the remedial progress. The soil samples collected will be analyzed for BTEX and TPH.

The anticipated closure monitoring program will include collecting groundwater samples quarterly from the monitoring wells, for a total of four quarters. The groundwater samples will be analyzed for concentrations of BTEX and TPH. If the concentrations of dissolved BTEX exceed New Mexico Water Quality Standards in any compliance well, recommendations will be prepared. The proposed compliance

wells are MW-4, MW-13, MW-19, and MW-20.

When closure monitoring has been successfully completed, the closure monitoring data will be submitted to OCD and a request for official closure will be made. At this time the remediation equipment will be dismantled and the site wells will be properly abandoned.

6.0 Schedule of Abatement Activities

Implementation of the Stage 2 Abatement Plan will commence within 30 to 60 days upon approval of the OCD. The remediation system installation is anticipated to take 3 to 4 weeks. Remediation equipment such as the SVE/air sparging and product recovery pumps will require 8 to 10 weeks for delivery.

Regular quarterly reports will be sent to the OCD. The first quarterly report will include a summary of the remediation system startup and list specific equipment specifications. The quarterly reports will include a summary of groundwater analytical data, remediation equipment efficiency, and LPH recovery to date. A map of the current groundwater potentiometric surface, LPH thickness, and dissolved hydrocarbon concentrations will be attached to the quarterly reports. Any changes to the scope of work or sampling schedule will be made in the quarterly reports as necessary. Additional reporting will be completed on an as needed or as requested basis. Routine database management will commence throughout the project.

7.0 Public Notification Proposal

The following public notification proposal is based on OCD requirements from 19 NMAC 15.A.19.

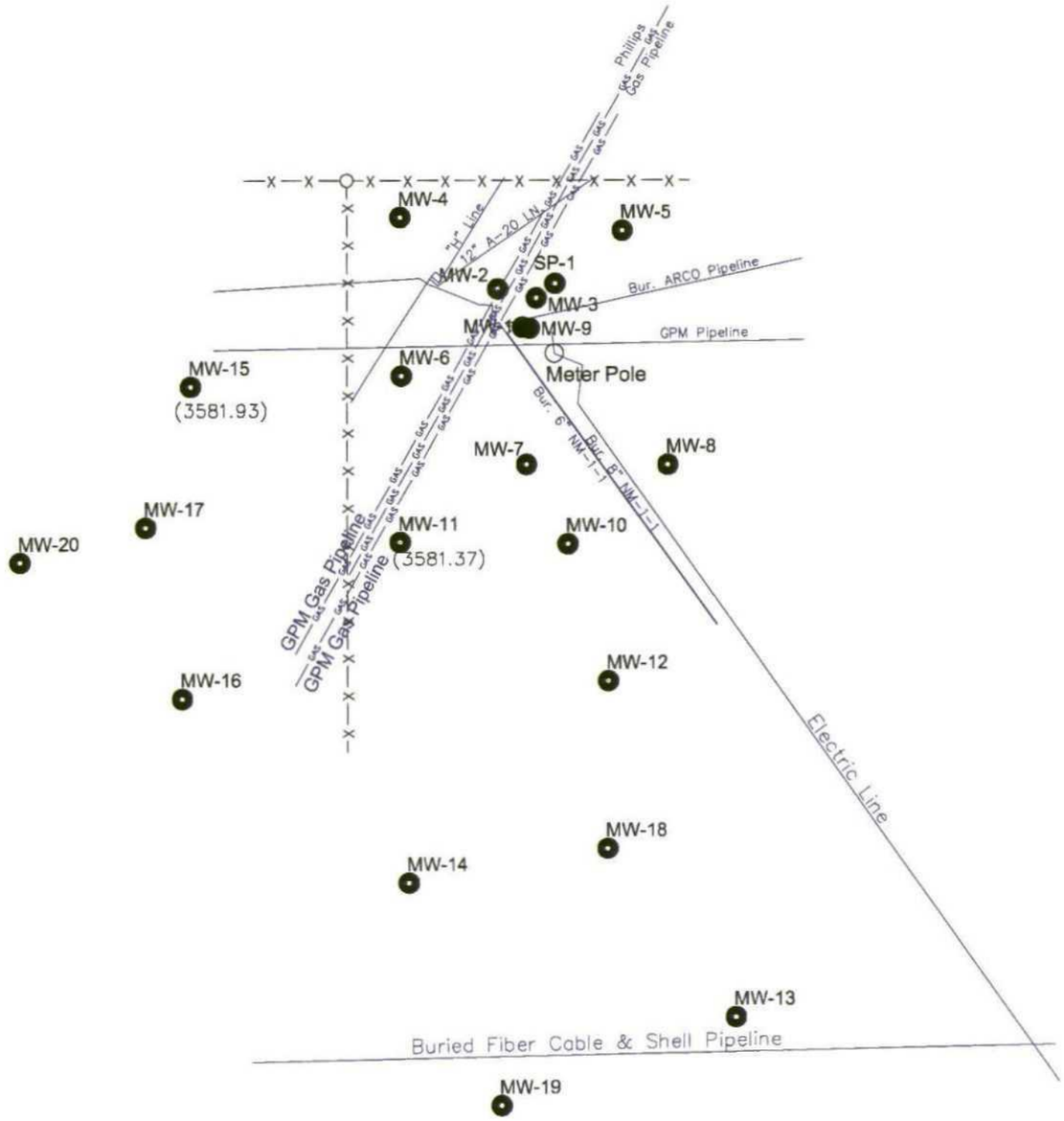
Phillips Pipe Line will distribute the Public Notice written and provided by the OCD to the following persons by certified mail prior to publishing the Public Notice:

- land owners of record within a one-mile radius,
- the Lea County commission,
- appropriate City of Hobbs officials,
- and the New Mexico Trustee for Natural Resources.

The Public Notice will be provided via the United States Postal Service to other persons identified by the OCD. After distributing the aforementioned Public Notice to the persons indicated, Phillips Pipe Line will publish the Notice in the following newspapers by the deadline indicated in the OCD's Stage 2 Abatement Plan approval letter: The Hobbs News-Sun, The Lovington Daily Leader, and The Albuquerque Journal.

Appendix A

Figures



LEGEND

MW-1 Monitor Well

N

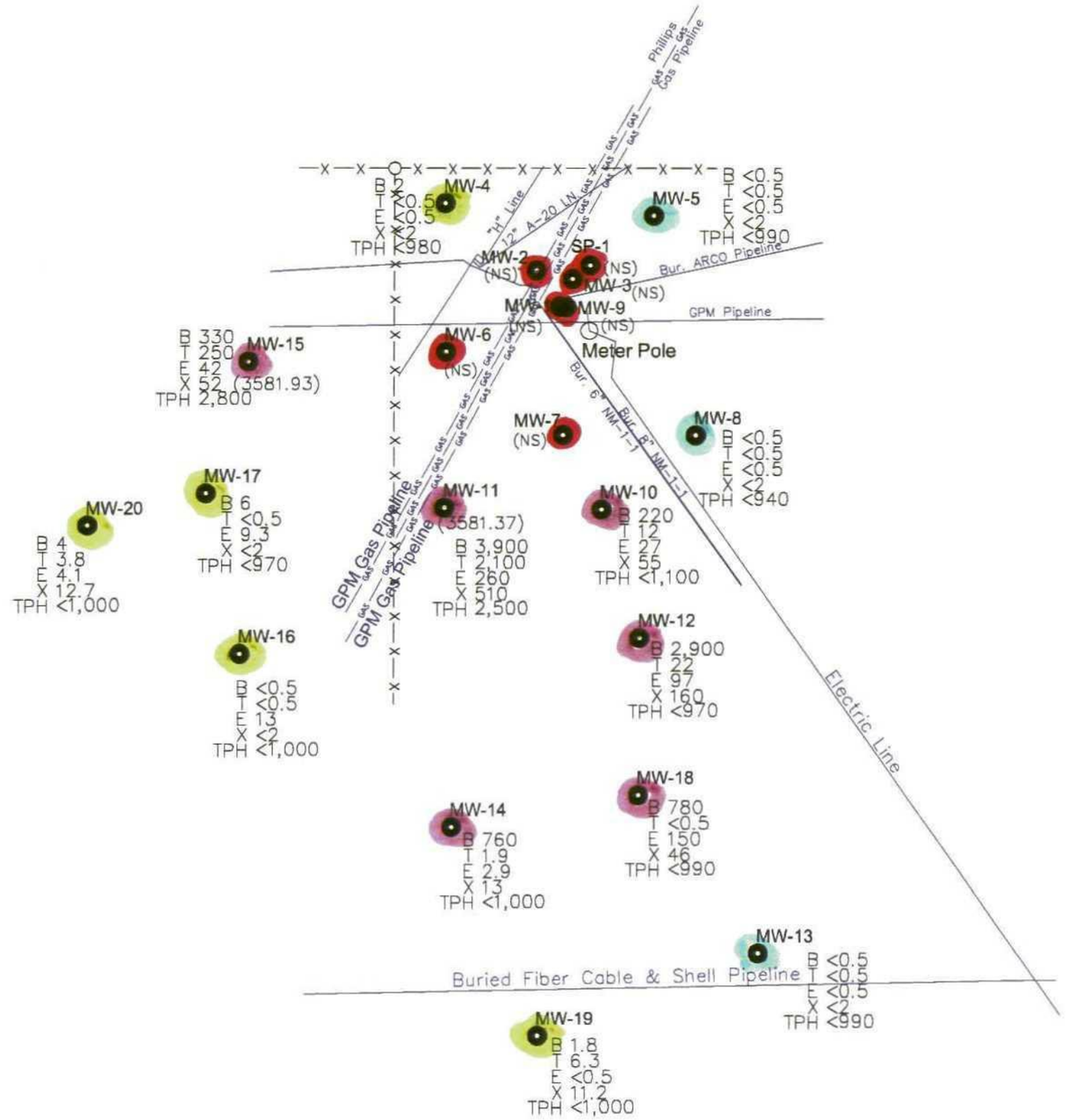
0 200 400

Scale (ft)

HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated: 11/1/00	Date Data Collected:	Figure No. 1

Authored: CH	Title: SITE MAP
Checked: CH	
Detailed: ML	Client: Phillips Pipe Line
	ACAD File: \571-17\Figure_SITE-PLAN_11-1-00.dwg
	Location: East Hobbs Junction New Mexico



LEGEND

MW-1 ● Monitor Well

B – Benzene
T – Tolvene
E – Ethylbenzene
X – Xylenes
TPH – Total Petroleum Hydrocarbons
(NS) – Not Sampled

All results reported in µg/l.

N

0 200 400
Scale (ft)

HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated: 10/19/00	Date Data Collected: 8/2/00	Figure No. 2

Authored: CJ
Checked: CH
Detailed: ML

Title: DISSOLVED PHASE HYDROCARBONS

Client: Phillips Pipe Line

Location: East Hobbs Junction New Mexico

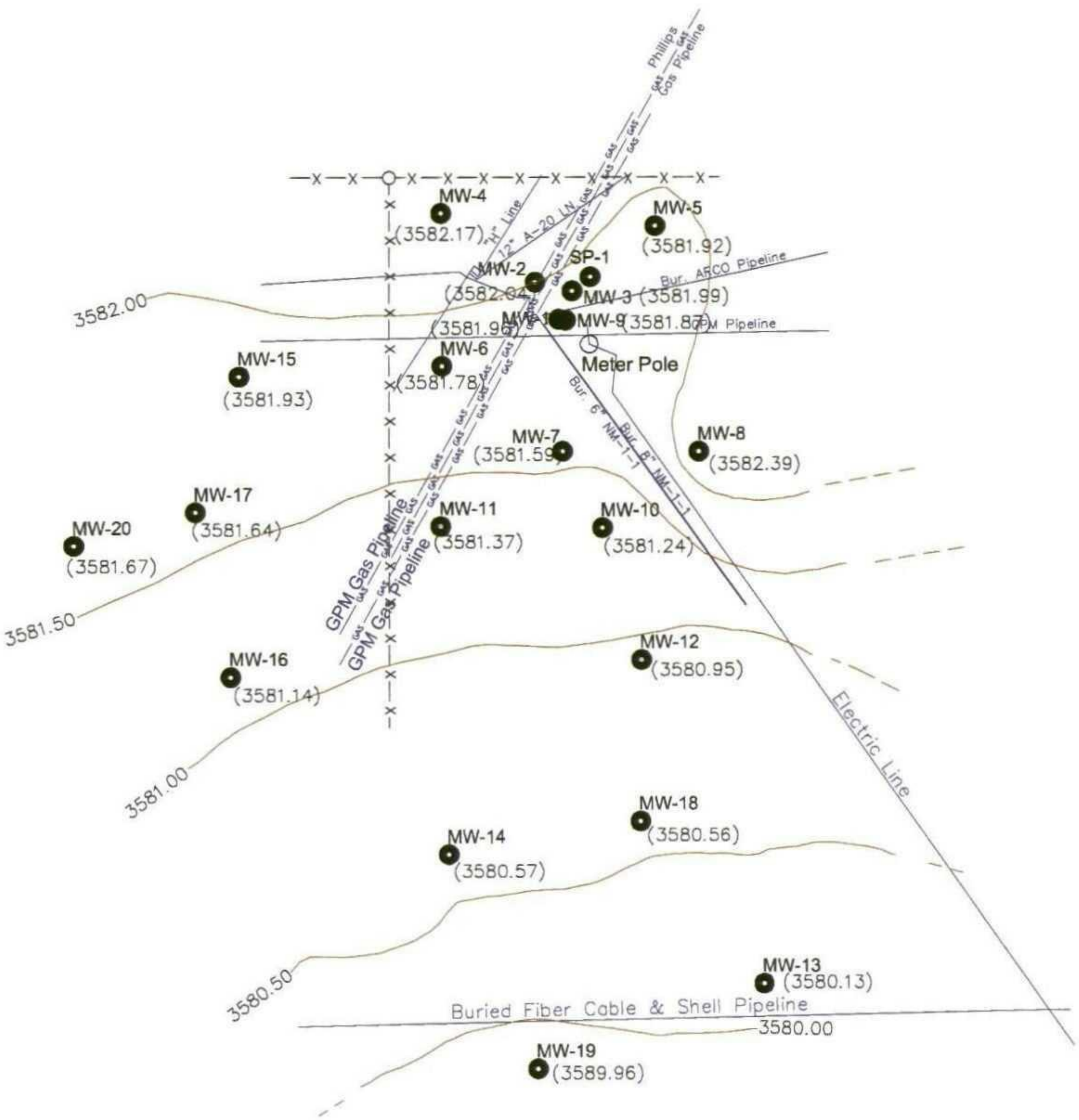
ACAD File: \571-17\Figure_HC_11-1-00.dwg

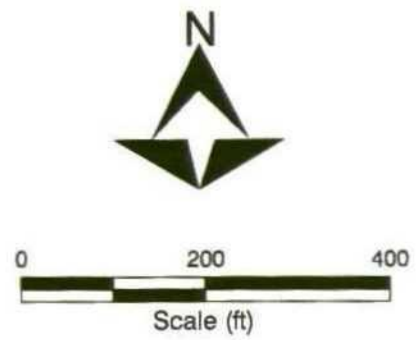
LEGEND

MW-1 ● Monitor Well

(3581.92) Groundwater Elevation (ft.)

Contour interval = 0.5 ft.





HIGGINS AND ASSOCIATES, L.L.C.

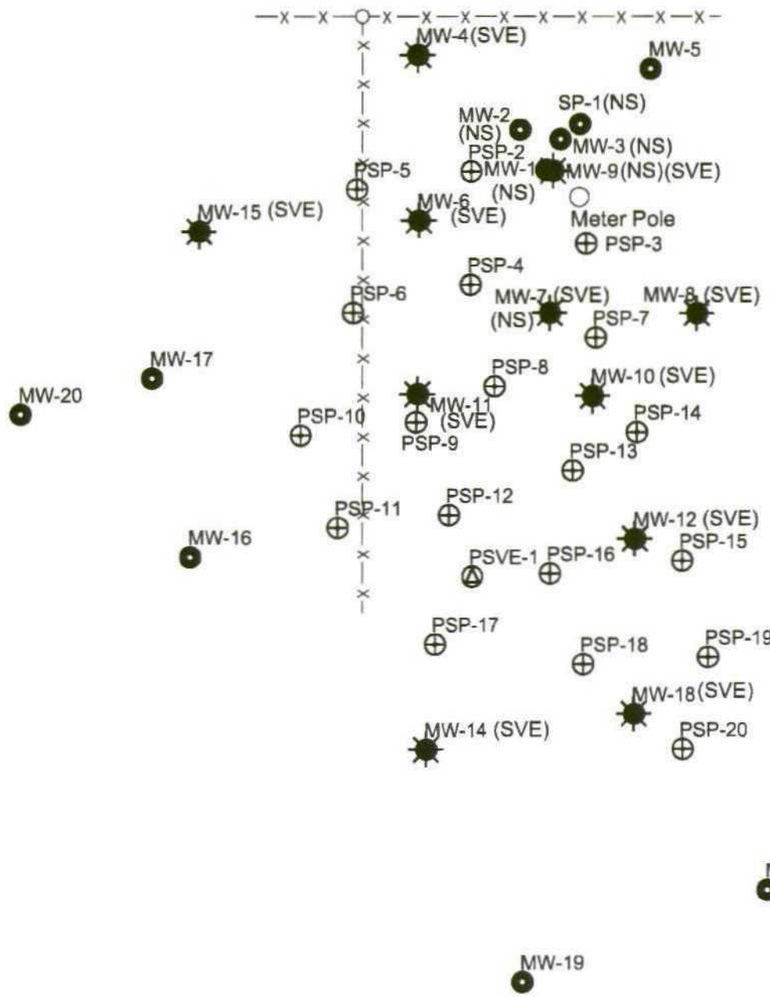
Project No.:	Date Map Generated: 10/19/00	Date Data Collected: 8/1/00	Figure No. 3
Authored: CJ	Title: Groundwater Potentiometric Surface Map		
Checked: CH			
Detailed: ML	Client: Phillips Pipe Line		Location: East Hobbs Junction New Mexico
	ACAD File: \571-17\Figure_GPSM_11-1-00.dwg		

LEGEND

MW-1 — Existing Monitor Well Converted to SVE Well

PSP-1 — Proposed Air Sparge Well

PSVE-1 — Proposed SVE Well



N

0 200 400

Scale (ft)

HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated: 11/1/00	Date Data Collected: -	Figure No. 4

Authored: CH

Checked: CH

Detailed: DG

Title: Remedial System Layout

Client: Phillips Pipe Line

Location: East Hobbs Junction New Mexico

ACAD File: \571-17\Figure_RSL_11-1-00.DWG

Appendix B

Well Logs

Lithologic/Drilling Log

Project Information		Well Information			
Project: Hobbs (3)	Borehole completed as well?	YES	(NO)	Well Casing Interval:	
Project Number:	Well Name: SB-1			Well Screen Interval:	
Location: E. Hobbs Jnct.	Total Depth:	28'		Sand Pack Interval:	
Date Drilled: 4/27/99	Borehole Diameter:	6"		Bentonite Interval:	
Client: PPL	Well Elevation:	—		Cement/Grout Interval:	
Rig/Core Type: air rotary	Water Level Initial:	26'			
Drilling Company: McDonald	Water Level Static:	—		Comments/Notes:	
Driller: T. McDonald	Well Type:	PVC Sch 40		Backfilled with sand and bentonite chips	
Drilling Method: Air rotary		PVC Sch 80			
Field Notes By: C. Jensen		Low Carbon Steel			
Time Start:	Well Diameter:	2 inch		Later re-drilled and Completed as MW-1	
Time Stop:		4 inch			
		Other:			

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
4-6'	Sand	Sandy	Tan-white	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
6	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
—	(Weathered?)	Caliche %	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	gravel %	poorly					damp
2.5		%	very poorly					moist
NOTES: 0-4 Topsoil, Silt.								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
10-12'	Sand	Sandy	Tan-white	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
—	(Weathered?)	%	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	%	poorly					damp
7.0		%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
14-16'	Sand	Sandy	Tan-white	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
—	(Weathered?)	%	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	%	poorly					damp
11.3		%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
20-22'	Sand	Sandy	Tan-white	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
—	(Weathered?)	%	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	%	poorly					damp
16.5		%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
24-26'	Sand	Sandy	Tan-white	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
—	(Weathered?)	%	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	%	poorly					damp
26.4		%	very poorly					moist
NOTES:								wet
								saturated

Lithologic/Drilling Log

Project Information		Well Information		
Project:	PPL / Hobbs (2)	Borehole completed as well?	YES NO	Well Casing Interval:
Project Number:		Well Name:	SB-1 continued.	Well Screen Interval:
Location:		Total Depth:		Sand Pack Interval:
Date Drilled:	4/27/99	Borehole Diameter:		Bentonite Interval:
Client:		Well Elevation:		Cement/Grout Interval:
Rig/Core Type:		Water Level Initial:		
Drilling Company:		Water Level Static:		Comments/Notes:
Driller:		Well Type:	PVC Sch 40	
Drilling Method:			PVC Sch 80	
Field Notes By:			Low Carbon Steel	
Time Start:		Well Diameter:	2 inch	
Time Stop:			4 inch	
			Other:	

	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly						
30-32	Sand	Sandy	TAN - White	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	w/ %	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	Caliche %	poorly	cobbles/boulders			hard (>30)	dry
47ppm		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly						
35-36'	Sand	Sandy	Tan - white	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	w/ Caliche %	poorly	cobbles/boulders			hard (>30)	dry
13		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly						
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly						
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly						
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Lithologic/Drilling Log

Project Information		Well Information			
Project: PPL/Hobbs	Borehole completed as well?	YES	(NO)	Well Casing Interval:	
Project Number:	Well Name:	SB-2		Well Screen Interval:	
Location: East Hobbs Junct.	Total Depth:	44'		Sand Pack Interval:	
Date Drilled: 4/27/99	Borehole Diameter:	6"		Bentonite Interval:	
Client: PPL	Well Elevation:	—		Cement/Grout Interval:	
Rig/Core Type: Air Rotary	Water Level Initial:	37'			
Drilling Company: MacDonald	Water Level Static:	—		Comments/Notes:	
Driller: T. MacDonald	Well Type:	PVC Sch 40		Backfilled w/sand	
Drilling Method: Air Rotary		PVC Sch 80		and bentonite chips.	
Field Notes By: C. Jensen		Low Carbon Steel			
Time Start:	Well Diameter:	2 inch		Later re-drilled and completed	
Time Stop:		4 inch		as MW-2	
		Other:			

Depth/Interval	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
4'-6'	(Gravel) Sand	Gravelly Sandy	Tan - white	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty Clayey	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS: w/caliche	%	poorly	cobbles/boulders			hard (>30)	dry
>2000		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Depth/Interval	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity silt/clay)
12 - 13	(Gravel) Sand	Sandy	Tan - White	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS: Weathered	%	poorly	cobbles/boulders			hard (>30)	dry
>2000		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Depth/Interval	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity silt/clay)
14 - 15	(Gravel) Sand	Sandy	Reddish - White	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS: Weather	%	poorly	cobbles/boulders			hard (>30)	dry
>2000		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Depth/Interval	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity silt/clay)
30-33'	(Gravel) Sand	Sandy	Some brown	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS: Weathered	%	poorly	cobbles/boulders			hard (>30)	dry
>2000		%	very poorly					damp
NOTES:	Some minor staining							moist
								wet
								saturated

Depth/Interval	Primary Lithology	Subordinate Lithology	Color	Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
34-36'	(Gravel) Sand	Sandy	Tan - white	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS: Weathered	%	poorly	cobbles/boulders			hard (>30)	dry
1645		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Lithologic/Drilling Log

Project Information		Well Information			
Project:	PPL/Hobbs	Borehole completed as well?	YES	NO	Well Casing Interval:
Project Number:		Well Name:	SB-2 continued.		Well Screen Interval:
Location:		Total Depth:			Sand Pack Interval:
Date Drilled:	4/27/99	Borehole Diameter:			Bentonite Interval:
Client:		Well Elevation:			Cement/Grout Interval:
Rig/Core Type:		Water Level Initial:			
Drilling Company:		Water Level Static:			Comments/Notes:
Driller:		Well Type:	PVC Sch 40		
Drilling Method:			PVC Sch 80		
Field Notes By:			Low Carbon Steel		
Time Start:		Well Diameter:	2 inch		
Time Stop:			4 inch		
			Other:		

	Primary Lithology	Subordinate Lithology		Grain Size	Angularity	Induration	Induration	Plasticity
Depth/Interval	Gravel	Gravelly	Color	(sand/gravel)	(sand/gravel)	(sand/gravel)	(silt/clay)	(silt/clay)
30-32'	Sand	Sandy	Red-Tan	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
24.1		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size	Angularity	Induration	Induration	Plasticity
Depth/Interval	Gravel	Gravelly	Color	(sand/gravel)	(sand/gravel)	(sand/gravel)	(silt/clay)	(silt/clay)
34-36'	Sand	Sandy	Red-Tan	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
11.3		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size	Angularity	Induration	Induration	Plasticity
Depth/Interval	Gravel	Gravelly	Color	(sand/gravel)	(sand/gravel)	(sand/gravel)	(silt/clay)	(silt/clay)
42-44'	Sand	Sandy	Red-Tan	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
21		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size	Angularity	Induration	Induration	Plasticity
Depth/Interval	Gravel	Gravelly	Color	(sand/gravel)	(sand/gravel)	(sand/gravel)	(silt/clay)	(silt/clay)
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size	Angularity	Induration	Induration	Plasticity
Depth/Interval	Gravel	Gravelly	Color	(sand/gravel)	(sand/gravel)	(sand/gravel)	(silt/clay)	(silt/clay)
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

Lithologic/Drilling Log

Project Information		Well Information			
Project: PPL/Hobbs(2)	Borehole completed as well?	YES	(NO)	Well Casing Interval:	
Project Number:	Well Name:	SB-3		Well Screen Interval:	
Location: East Hobbs Junction	Total Depth:	38'		Sand Pack Interval:	
Date Drilled: 4/27/99	Borehole Diameter:	6"		Bentonite Interval:	
Client: PPL	Well Elevation:	—		Cement/Grout Interval:	
Rig/Core Type: Air Rotary	Water Level Initial:	36'			
Drilling Company: McDonald	Water Level Static:	—		Comments/Notes:	
Driller: T. McDonald	Well Type:	PVC Sch 40		Backfilled with sand and bentonite chips.	
Drilling Method: Air Rotary		PVC Sch 80			
Field Notes By: C. Jensen		Low Carbon Steel			
Time Start:	Well Diameter:	2 inch			
Time Stop:		4 inch		Later redrilled and completed as MW-3	
		Other:			

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
4-6'	(Sand)	Sandy	White	fine	rounded	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
	(Weathered?)	%	moderately	cobbles/boulders			hard (>30)	dry
PID/FID	USCS:	%	(poorly)					damp
0	Caliche	%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
8-10'	(Sand)	Sandy	Tan-white	fine	(rounded)	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	(Silty)	Sorting (sand/gravel)	(medium)	(subrounded)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	(dense) (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
	(Weathered?)	%	(moderately)	cobbles/boulders			hard (>30)	(dry)
PID/FID	USCS: w/caliche	%	(poorly)					damp
0		%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
14-16	(Sand)	Sandy	Light brown-Tan	(fine)	(rounded)	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	(Silty)	Sorting (sand/gravel)	(medium)	(subrounded)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	(dense) (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
	(Weathered?)	%	(moderately)	cobbles/boulders			hard (>30)	(dry)
PID/FID	USCS: w/caliche	%	poorly					(damp)
5.6		%	very poorly					moist
NOTES:								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
8-30'	(Sand)	Sandy	Light Brown-Tan	(fine)	(rounded)	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	(Silty)	Sorting (sand/gravel)	(medium)	(subrounded)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	coarse	subangular	(dense) (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
	(Weathered?)	%	(moderately)	cobbles/boulders			hard (>30)	(dry)
PID/FID	USCS:	%	poorly					(damp)
>2000		%	very poorly					moist
NOTES:								wet
								saturated

30-37' = 535

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
34-36'	(Sand)	Sandy	Red-brown-Tan	(fine)	(rounded)	loose (4-10)	soft (2-4)	plastic
Sample ID	Silt	(Silty)	Sorting (sand/gravel)	(medium)	(rounded)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
	Clay	Clayey	very well	(coarse)	subangular	(dense) (30-50)	stiff (8-15)	nonplastic
Blow Counts	Bedrock	Pebbly	well	very coarse	angular	very dense (>50)	very stiff (15-30)	Moisture
	(Weathered?)	%	(moderately)	cobbles/boulders			hard (>30)	dry
PID/FID	USCS: w/caliche	%	poorly					(damp)
3100-311		%	very poorly					moist
NOTES:								wet
								saturated

Lithologic/Drilling Log

Project Information		**Well Information**			
Project:	PPL/Hobbs(2)	Borehole completed as well?	YES NO	Well Casing Interval:	
Project Number:		Well Name:	SB-3 continued	Well Screen Interval:	
Location:		Total Depth:		Sand Pack Interval:	
Date Drilled:	4/27/99	Borehole Diameter:		Bentonite Interval:	
Client:		Well Elevation:		Cement/Grout Interval:	
Rig/Core Type:		Water Level Initial:			
Drilling Company:		Water Level Static:		Comments/Notes:	
Driller:		Well Type:	PVC Sch 40		
Drilling Method:			PVC Sch 80		
Field Notes By:			Low Carbon Steel		
Time Start:		Well Diameter:	2 inch		
Time Stop:			4 inch		
			Other:		

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color					
30-32'	Sand (circled)	Sandy	Tan-white	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty (circled)	Sorting (sand/gravel)	fine (circled)	rounded (circled)	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium (circled)	subrounded (circled)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50) (circled)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately (circled)	very coarse	angular	very dense (>50) (circled)	very stiff (15-30)	**Moisture**
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry (circled)
27.2		%	very poorly					damp (circled)
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color					
34-36	Sand (circled)	Sandy	Tan-white	very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty (circled)	Sorting (sand/gravel)	fine (circled)	rounded (circled)	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium (circled)	subrounded (circled)	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
—	(Weathered?)	%	moderately (circled)	very coarse	angular	very dense (>50) (circled)	very stiff (15-30)	**Moisture**
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry (circled)
12		%	very poorly					damp (circled)
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color					
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	**Moisture**
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color					
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	**Moisture**
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

	Primary Lithology	Subordinate Lithology		Grain Size (sand/gravel)	Angularity (sand/gravel)	Induration (sand/gravel)	Induration (silt/clay)	Plasticity (silt/clay)
Depth/Interval	Gravel	Gravelly	Color					
	Sand	Sandy		very fine	well rounded	very loose (<4 blows/ft)	very soft (<2)	very plastic
Sample ID	Silt	Silty	Sorting (sand/gravel)	fine	rounded	loose (4-10)	soft (2-4)	plastic
	Clay	Clayey	very well	medium	subrounded	medium dense (10-30)	medium stiff (4-8)	slightly plastic
Blow Counts	Bedrock	Pebbly	well	coarse	subangular	dense (30-50)	stiff (8-15)	nonplastic
	(Weathered?)	%	moderately	very coarse	angular	very dense (>50)	very stiff (15-30)	**Moisture**
PID/FID	USCS:	%	poorly	cobbles/boulders			hard (>30)	dry
		%	very poorly					damp
NOTES:								moist
								wet
								saturated

DRILLING LOG

Well No. MW-4

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/11/00 Total Depth 33' Diameter 8"

Surface Elevation Water depth (init.) 24' 24-hrs. 24.35'

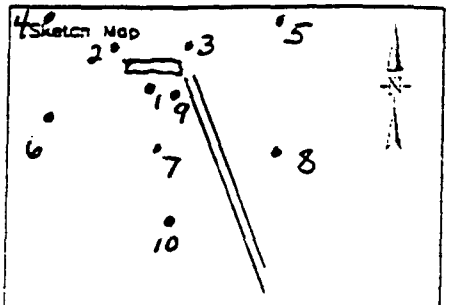
Screen: Dia. 2" Length 15' Slot Size 0.020"

Casing: Dia. 2" Length 20' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB

Sketch Map



Notes Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2–4	Concrete			grab	1.4	0		
6–8	Bentonite					0		Caliche, gray, tan to white, very dense, dry.
10–12			MW-4-14'-16'	grab	5	0		
14–16					2.8	0		
18–20	Silica Sand			grab	2	0		
22–24			MW-4-24'-26'	grab	2.8	0	SP	Sand, brown, moderately to well sorted, medium grained, subrounded, dense, moist to wet.
26–28								
30–32								
34–36								
38–40								
42–44								
46–48								
50								

DRILLING LOG

Well No. MW-5

Project: PPL/East Hobbs Client: Phillips Pipe Line

Location: Hobbs, NM Project Number:

Date Drilled: 1/11/00 Total Depth: 33' Diameter: 8"

Surface Elevation: Water depth (init.): 24' 24-hrs.: 23.62'

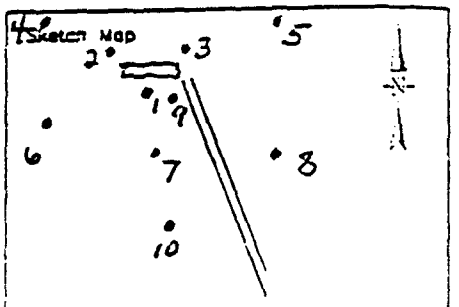
Screen: Dia. 2" Length: 15' Slot Size: 0.020"

Casing: Dia. 2" Length: 20' Type: Sch 40 PVC

Drilling Company: Scarborough Drilling Drilling Method: Air Rotary

Driller: L. Scarborough Log by: C. Jensen Sampling Method: GRAB

Sketch Map



Notes: Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No. / Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete		Grab	1.8	0.0		Silty, sandy CALICHE, tan to white, very dense, dry.
4							
6							
8	Bentonite						
10			MW-5-14'-16' Grab	4.6	0.0		
12							
14			Grab	0.8	0.0		
16							
18	Silica Sand						
20			Grab	1.1			
22							
24			MW-5-24'-26' Grab	1.6		SP	SAND, some silt and gravel, brown, fine to coarse grained, subrounded to rounded, dense to very dense, moist to wet.
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

DRILLING LOG

Well No. MW-6

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/11/00 Total Depth 33' Diameter 8"

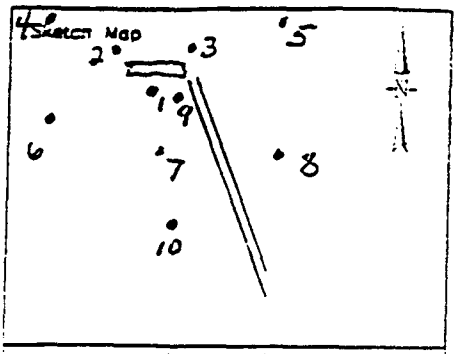
Surface Elevation Water depth (init.) 24' 24-hrs. 24.59'

Screen: Dia. 2" Length 15' Slot Size 0.020"

Casing: Dia. 2" Length 20' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB



Notes Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery (ft) (type)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete						
4							
6			Grab	3.2			Sandy Caliche, gray to tan, very dense, dry.
8	Bentonite						
10							
12				6.6	0.1		
14			MW-6-14'				
16			Grab	1.7			
18							
20	Silica Sand						
22			Grab	6		SP	SAND, red-brown to brown, medium to coarse grained, subrounded to rounded, dense, moist to wet.
24							
26			MW-6-24'				
28			Grab	30			
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

DRILLING LOG

Well No. MW-7

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/12/00 Total Depth 33' Diameter 8"

Surface Elevation Water depth (init.) 24' 24-hrs. 24.57'

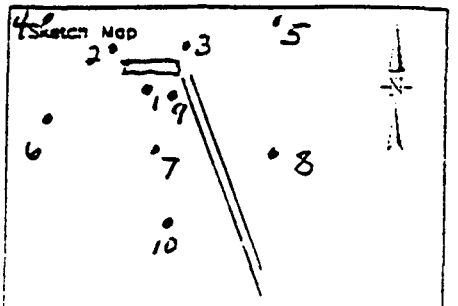
Screen: Dia. 2" Length 15' Slot Size 0.020"

Casing: Dia. 2" Length 20' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB

Sketch Map



Notes: Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete							
4								
6			grab		0	0		Caliche, tan to white, very dense, dry.
8	Bentonite					0		
10								
12								
14			MW-7-14'-16'	grab	0.8	0.8		
16				grab	1.1	1.1		
18								
20	Silica Sand							
22				grab	4.6	4.6	SP	SAND, some gravel, light brown to brown, moderately to well sorted, fine to medium grained, subrounded to rounded, very dense, moist to wet.
24								
26			MW-7-24'-26'	grab	177	177		
28								
30								
32								
34								
36								
38								
40								
42								
44								
46								
48								
50								

DRILLING LOG

Well No. MW-8

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/11/00 Total Depth 33' Diameter 8"

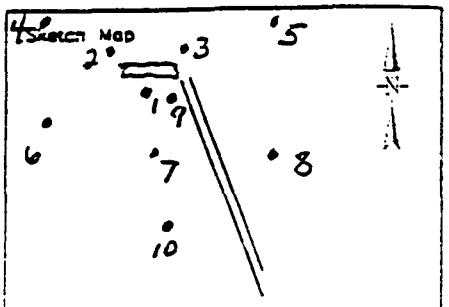
Surface Elevation Water depth (init.) 24' 24-hrs. 24.31'

Screen: Dia. 2" Length 15' Slot Size 0.020"

Casing: Dia. 2" Length 20' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB



Notes Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete							
4				grab	0.5			Sandy Caliche, tan to white, very dense, dry.
6								
8	Bentonite							
10			MW-8-14'-16'	grab	0.4			
12								
14				grab	0.8			
16								
18								
20	Silica Sand							
22				grab	1.8			
24			MW-8-24'-26'					SAND, some silt and gravel, light brown to brown, moderately sorted, fine to medium grained, subrounded, very dense, moist to wet.
26				grab	3.3		SP	
28								
30								
32								
34								
36								
38								
40								
42								
44								
46								
48								
50								

DRILLING LOG

Well No. MW-9

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/11/00 Total Depth 33' Diameter 8"

Surface Elevation Water depth (init.) 24' 24-hrs. 26.82'

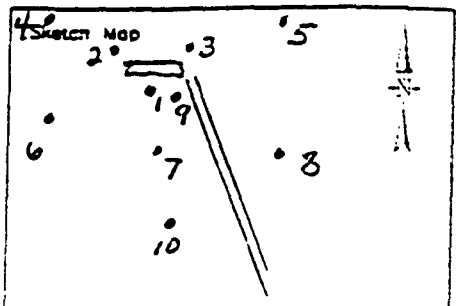
Screen: Dia. Length Slot Size 0.020"

Casing: Dia. Length Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB

Sketch Map



Notes Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete		GRAB	13		0		Silty, sandy CALICHE, light brown to white, very dense, dry
4								
6	Bentonite							
8								
10			GRAB	6		0		
12								
14			GRAB	66		0		
16								
18	Silica Sand							
20			GRAB	797		0		SAND, some silt and gravel, brown, moderately sorted, fine to coarse grained, subrounded to rounded, dense, moist to wet.
22								
24			GRAB	462		0	SP	
26								
28								
30								
32								
34								
36								
38								
40								
42								
44								
46								
48								
50								

DRILLING LOG

Well No. MW-10

Project PPL/East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 1/12/00 Total Depth 33' Diameter 8"

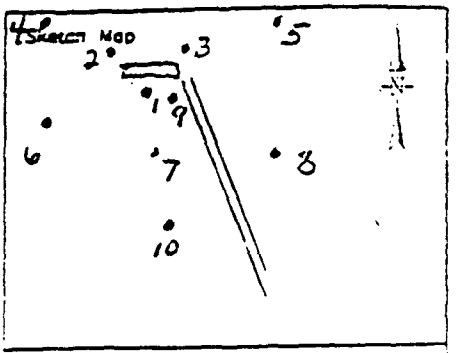
Surface Elevation Water depth (init.) 24' 24-hrs. 23.55'

Screen: Dia. 2" Length 15' Slot Size 0.020"

Casing: Dia. 2" Length 20' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method GRAB



Notes Well Locations are approximate.

Depth (ft)	Well Construction	Notes	Sample No. Blow Count	Recovery Hits (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
2	Concrete		Grab	5.2		Silty, sandy Caliche, white, very dense, dry.
8	Bentonite					
10			MW-10 14'-16' Grab	1.0		
14			Grab	1.3		
16						
18	Silica Sand					
30			Grab	42		SAND, some silt and gravel, light brown to brown, moderately sorted, fine to medium grained, subrounded, very dense, moist.
32			MW-10 32'-34'			
34			Grab	39		
36						
38						
40						
42						
44						
46						
48						
52						

DRILLING LOG

Well No. MW-11

Project PPL / East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 4/6/00 Total Depth 30' Diameter 5 1/8"

Surface Elevation Water depth (init.) — 24-hrs. 26.74'

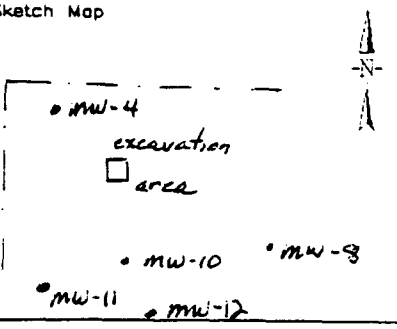
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 13' Type PVC sch 40

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method Grab

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0–8		Concrete; Bentonite						
0–4						0		Caliche, white to tan, very dense, dry.
8–30		Silica Sand	SS-11-24'-26', SS-11-28'-30'					
10–14						0		Silty, pebbly, SAND, moderately sorted, fine to medium grained, white to light brown, subangular to subrounded, loose, dry to damp.
14–16						0		
20–22						0.6	SW	
24–26						1.4		Silty, pebbly SAND, as above, moist.
28–30						0.3		

DRILLING LOG

Well No. MW-12

Project PPL / East Hobbs Client Phillips Pipe Line

Location Hobbs, NM Project Number

Date Drilled 4/6/00 Total Depth 35' Diameter 5 1/8"

Surface Elevation Water depth (init.) — 24-hrs. 33.58'

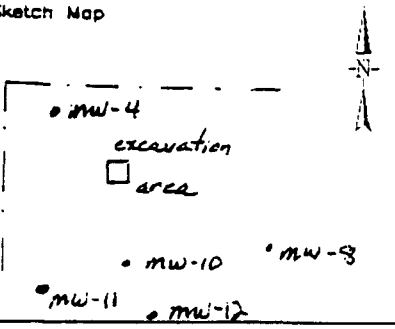
Screen: Dia. 2" Length 25' Slot Size 0.020"

Casing: Dia. 2" Length 13' Type PVC sch 40

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller L. Scarborough Log by C. Jensen Sampling Method Grab

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0–2		Concrete						
2–8		Bentonite						
0–10						0		Caliche, white to tan, very dense/dry - some interbedded limestone.
10–12						0		
12–14								
14–16		Silica Sand				0		
16–18								
18–20								Pebbly SAND, tan to light brown, moderately sorted, fine to medium grained, subangular to subrounded, loose, dry to damp.
20–22				SS-12-20'32' SS-13-14'/6'		1.1	SW	
22–24								
24–26						0.3		
26–28								
28–30						0		SAND, as above, moist.
30–32								
32–34						0		
34–36								
36–38								
38–40								
40–42								
42–44								
44–46								
46–48								
48–50								

DRILLING LOG

Well No. MW-13

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 5/31/00 Total Depth 34' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

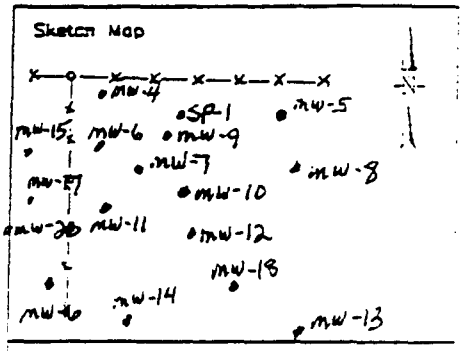
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 17' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. / Blow Count	Recovery / PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0–10		Concrete				
10–12		Bentonite				
12–34		Silica Sand				
0–2				0		Caliche, white to light gray, very dense, dry.
2–12				0		
12–14						SAND, pebbly, white to light gray, well sorted, fine grained, subrounded, loose, damp.
14–20				0		
20–22			SW	0		
22–34						SAND, as above, light brown, wet.
30–32				0		
32–34				0		

DRILLING LOG

Well No. MW-14

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 5/31/00 Total Depth 33' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

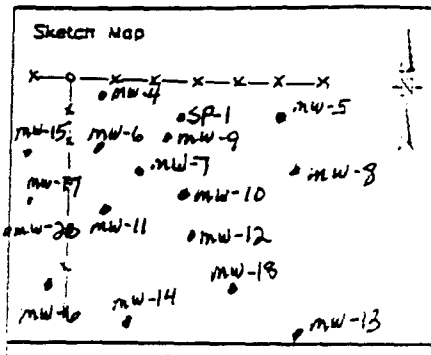
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 16' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. / Blow Count	Recovery / PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0 – 2 – 4 – 6 – 8 – 10 – 12 – 14 – 16 – 18 – 20 – 22 – 24 – 26 – 28 – 30 – 32 – 34 – 36 – 38 – 40 – 42 – 44 – 46 – 48 – 50		Concrete bentonite Silica Sand	0 0 0 0 0 0	SW		Caliche, and Limestone, some sand, dense, dry. Silty, pebbly, SAND, moderately to well sorted, fine to coarse grained, subangular to subrounded, loose, moist to wet. Silty, pebbly SAND, as above.

DRILLING LOG

Well No. MW-15

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 5/31/00 Total Depth 34' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

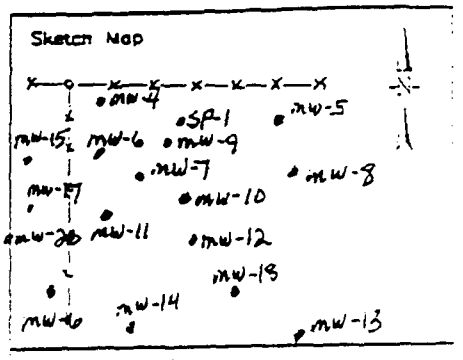
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 17' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. Blow Count	Recovery Hib (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0						Sand to limestone to Caliche, light gray to Tan, dense, dry. Poss. hydrocarbon odor noted in samples
2		Concrete				
4						
6				0		
8		bentonite				
10				0		Pebbly SAND, tan to light brown, moderately to well sorted, fine grained, subrounded, loose, dry to damp.
12						
14						
16		Silica Sand		0		
18						
20				0	SW	
22						
24						
26				57		Silty, pebbly SAND, brown, poorly sorted, medium to coarse grained, subrounded, loose, wet.
28						
30				68		
32						
34				0		
36						
38						
40						
42						
44						
46						
48						
50						

DRILLING LOG

Well No. MW-16

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 5/31/00 Total Depth 35' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

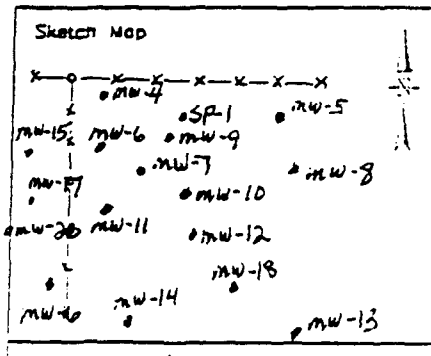
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 18' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. / Blow Count	Recovery / PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0						
2						
4		Concrete				Caliche, white to gray, very dense, dry.
6				0		
8						
10		bentonite				
12				0		
14						
16				0		
18						
20		Silica sand		0	SW	Silty, pebbly SAND, light gray to brown, fine to medium grained, subangular, loose, moist to wet.
22						
24						
26				0		
28						
30				0		
32						
34				0		
36						
38						
40						
42						
44						
46						
48						
50						

DRILLING LOG

Well No. MW-17

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 6/1/00 Total Depth 34' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

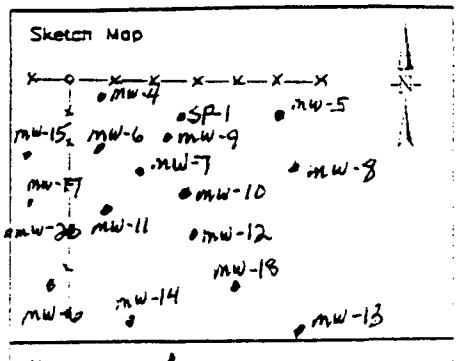
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 17' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery (ft) (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0							
2							Caliche, light gray, dense, dry.
4		Concrete					
6					0		
8							
10		bentonite			0		
12							
14							
16					0		
18							
20		Silica Sand			0	SW	Silty, pebbly, SAND, light brown to brown, moderately to poorly sorted, subangular to subrounded, loose, moist to wet.
22							
24							
26					0		
28							
30					0		
32							
34					0		
36							
38							
40							
42							
44							
46							
48							
50							

DRILLING LOG

Well No. MW-18

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 6/1/00 Total Depth 34' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

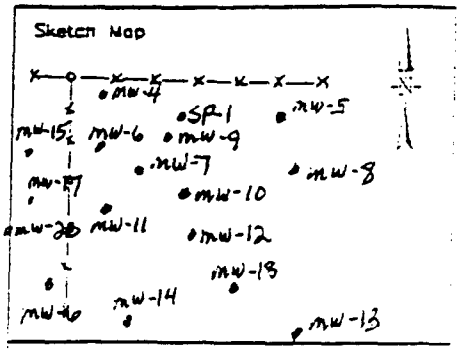
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 17' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. Blow Count	Recovery PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0						
2						
4		Concrete				Caliche, some limestone, light gray, very dense, dry.
6				0		
8						
10		bentonite		0		
12						
14						
16		Silica sand		0		
18						
20				0	SW	Silty, pebbly SAND, tan to brown, moderately to poorly sorted, fine to coarse grained, subangular to subrounded, medium dense, damp to wet.
22						
24						
26				0		
28						
30				0		
32						
34				0		
36						
38						
40						
42						
44						
46						
48						
50						

DRILLING LOG

Well No. MW-19

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 6/1/00 Total Depth 34' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

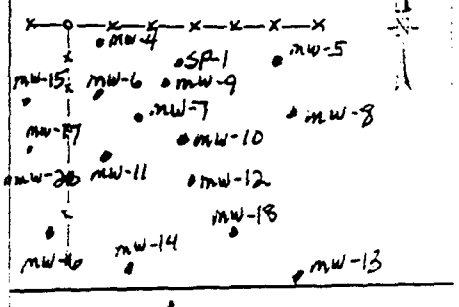
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 17' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No. Blow Count	Recovery (ft) (gpm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0						
2						
4		Concrete				Caliche, with limestone, light gray, dense, dry.
6				0		
8						
10		bentonite		0		
12						
14						
16				0		
18						
20		Silica Sand		0	SW	Silty, pebbly SAND, tan to brown, moderately sorted, fine - medium grained, subangular to subrounded, loose, damp to wet.
22						
24						
26				0		
28						
30				0		
32						
34				0		
36						
38						
40						
42						
44						
46						
48						
50						

DRILLING LOG

Well No. MW-20

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 6/1/00 Total Depth 35' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

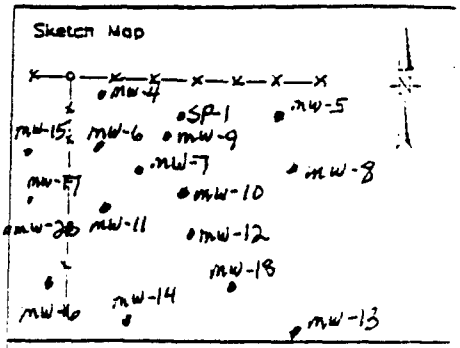
Screen: Dia. 2" Length 20' Slot Size 0.020"

Casing: Dia. 2" Length 18' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0–10		Concrete						Caliche w/limestone, light gray, dense, dry.
10–12		bentonite						
12–34		Silica sand					SW	Silty, pebbly SAND, tan to brown, moderately to poorly sorted, fine to medium grained, subangular to subrounded, loose to dense, moist to wet.

DRILLING LOG

Well No. SP-1

Project PPL/East Hobbs Client Phillips Pipe Line

Location East Hobbs Junction Project Number

Date Drilled 5/31/00 Total Depth 33.5' Diameter 5"

Surface Elevation Water depth (init.) 24-hrs.

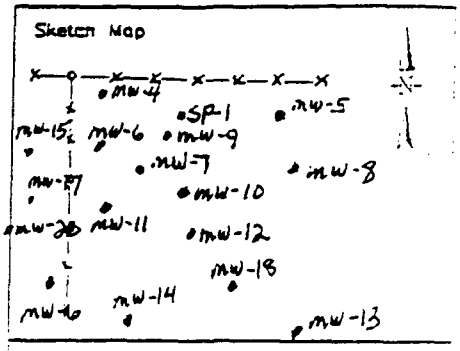
Screen: Dia. 2" Length 3' Slot Size 0.020"

Casing: Dia. 2" Length 33.5' Type Sch 40 PVC

Drilling Company Scarborough Drilling Drilling Method Air Rotary

Driller S. Scarborough Log by C. Higgins Sampling Method GRAB

Sketch Map



Notes

Depth (ft)	Well Construction	Notes	Sample No.	Blow Count	Recovery	PID (ppm)	Graphic Log	Description/Soil Classification (Color, Texture, Structure)
0								
2								
4								
6								
8								
10		concrete						
12								
14								
16								
18								
20								
22								
24		bentonite						
26								
28								
30								
32		Silica Sand						
34								
36								
38								
40								
42								
44								
46								
48								
50								
				2		0		Caliche, some limestone, light gray, dense, dry.
				0				
				4				
			SW	30				Pebbly SAND, tan to brown, fine to medium grained, well to poorly sorted, subangular to subrounded, loose, wet.
				290				
				23				
				16.1				

Appendix C

Analytical Data

Groundwater Analytical Data
PPL/East Hobbs
Hobbs, NM

Well	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	TPH (ug/L)
MW-4	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-4	04/06/00	19	0.83	1.2	3.2	<1,000
MW-4	08/02/00	2	<0.5	<0.5	<2	<980
MW-5	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-5	04/06/00	<0.5	<0.5	<0.5	<2	<1,000
MW-5	08/02/00	<0.5	<0.5	<0.5	<2	<990
MW-6	01/13/00	3,300	2,000	240	580	<2,000
MW-6	04/06/00	3,900	1,100	270	540	<1,000
MW-8	01/13/00	<0.5	<0.5	<0.5	<0.5	<2,000
MW-8	04/06/00	<0.5	<0.5	<0.5	<2	<1,000
MW-8	08/02/00	<0.5	<0.5	<0.5	<2	<940
MW-10	01/13/00	4,100	490	440	720	<2,000
MW-10	04/06/00	400	53	66	98	<1,000
MW-10	08/02/00	220	12	27	55	<1100
MW-11	04/06/00	4,100	2,400	290	420	1,600
MW-11	08/02/00	3,900	2,100	260	510	2,500
MW-12	04/06/00	2,000	200	110	200	<1,200
MW-12	08/02/00	2,900	22	97	160	<970
MW-13	6/2/00	<0.5	<0.5	<0.5	<2	<1000
MW-13	8/2/00	<0.5	<0.5	<0.5	<2	<990
MW-14	6/2/00	370	5.3	1.7	11	<1000
MW-14	8/2/00	760	1.9	2.9	13	<1000
MW-15	06/02/00	830	770	130	170	2,100
MW-15	08/02/00	330	250	42	52	2,800
MW-16	06/02/00	0.94	0.96	21	6.9	<1000
MW-16	08/02/00	<0.5	<0.5	13	<2	<1000
MW-17	06/02/00	<0.5	<0.5	<0.5	<2	<1000
MW-17	08/02/00	6	<0.5	9.3	<2	<970
MW-18	06/02/00	600	0.66	120	45	<1000
MW-18	08/02/00	780	<0.5	150	46	<990
MW-19	06/02/00	<0.5	<0.5	<0.5	<2	<1000
MW-19	08/02/00	1.8	6.3	<0.5	11.2	<1000

Groundwater Analytical Data
PPL/East Hobbs
Hobbs, NM

Well	Date	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	TPH (ug/L)
MW-20	06/02/00	<0.5	<0.5	<0.5	<2	<1000
MW-20	08/02/00	4	3.8	4.1	12.7	<1000
SP-1	06/02/00	9.4	7.4	2.5	7	<1000

Groundwater Analytical Data
PPL/East Hobbs
Hobbs, NM

Well	Date	Chloride (mg/L)
MW-4	01/13/00	210
MW-4	04/06/00	180
MW-4	08/02/00	140
MW-5	01/13/00	130
MW-5	04/06/00	130
MW-5	08/02/00	130
MW-6	01/13/00	230
MW-6	04/06/00	200
MW-8	01/13/00	160
MW-8	04/06/00	90
MW-8	08/02/00	84
MW-10	01/13/00	180
MW-10	04/06/00	180
MW-10	08/02/00	140
MW-11	04/06/00	310
MW-11	08/02/00	270
MW-12	04/06/00	190
MW-12	08/02/00	150
MW-13	6/2/00	91
MW-13	8/2/00	61
MW-14	6/2/00	180
MW-14	8/2/00	170
MW-15	06/02/00	170
MW-15	08/02/00	160
MW-16	06/02/00	220
MW-16	08/02/00	210
MW-17	06/02/00	140
MW-17	08/02/00	110
MW-18	06/02/00	190
MW-18	08/02/00	160
MW-19	06/02/00	140
MW-19	08/02/00	110

Groundwater Analytical Data
PPL/East Hobbs
Hobbs, NM

Well	Date	Chloride (mg/L)
MW-20	06/02/00	83
MW-20	08/02/00	66
SP-1	06/02/00	180

PPL/East Hobbs
Hobbs, NM
Inorganic Data

(Results in mg/L unless otherwise noted)

Analyte	NM Standards for Groundwater with <10,000 mg/L TDS	MW-4	MW-5	MW-6	MW-8	MW-10
Date		01/13/00	01/13/00	01/13/00	01/13/00	01/13/00
Lithium (ug/L)		<100	<100	<100	<100	<100
Silicon		103	44	34	32	80
Strontium		1.7	1.3	1.3	1.1	2.5
Uranium (ug/L)	**5,000 ug/L**	<20.0	<20.0	<20.0	<20.0	<20.0
Mercury	**0.002**	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic	**0.1**	0.016	0.01	0.0085	0.0085	0.015
Barium	**1**	2.89	0.185	0.841	0.119	5.48
Boron	**0.75**	0.18	0.15	0.14	0.16	0.19
Cadmium	**0.01**	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
Calcium		710	120	170	89	540
Chromium	**0.05**	0.13	<0.02	<0.02	<0.02	0.036
Lead	**0.05**	0.0099	<0.002	<0.002	<0.002	0.0065
Magnesium		44	23	28	22	54
Potassium		12	6.4	5.8	6.3	6.5
Selenium	**0.05**	<0.015	<0.003	<0.003	<0.003	<0.015
Silver	**0.05**	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium		170	43	93	58	62
Alkalinity		660	170	230	110	400
Bromide						
Chloride	**0.1**	210	130	230	160	180
Fluoride	**1.6**	2.3	2.6	1.5	2.40	1.3
Sulfate	**600**	140	82	<5.0	84	14
Total Dissolved Solids	**1,000**	750	560	730	570	750
pH	**Between 6 and 9**	7.70	7.70	7.60	7.90	7.40
Conductivity		1,090	840	1,160	980	1,040

PPL/East Hobbs
Hobbs, New Mexico

Soil Analytical Data

Well	Date	Depth (ft)	PID Reading (ppm)	Benzene (mg/Kg)	Toluene (mg/Kg)	Ethylbenzene (mg/Kg)	Xylenes (mg/Kg)	TPH (mg/Kg)
MW-1	04/27/99	22 - 24	264	0.071	1.202	1.014	3.487	5420
MW-1	04/27/99	35 - 36	13	<0.002	0.008	0.007	0.024	372
MW-2	04/27/99	20 - 22	>2,000	0.082	1.589	1.369	5.002	7930
MW-2	04/27/99	36 - 40	21	0.002	0.023	0.018	0.061	801
MW-3	07/15/99	18 - 20	>2,000	0.448	4.767	2.338	7.485	5790
MW-3	07/15/99	36 - 38	12	<0.002	0.002	<0.002	0.006	293
MW-4	01/11/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-4	01/11/00	24 - 26	2.8	<0.025	<0.025	<0.025	<0.025	<10
MW-5	01/11/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-5	01/11/00	24 - 26	1.6	<0.025	<0.025	<0.025	<0.025	<10
MW-6	01/11/00	14 - 16	1.7	<0.025	<0.025	<0.025	<0.025	<10
MW-6	01/11/00	24 - 26	20	<0.025	<0.025	<0.025	<0.025	12
MW-7	01/12/00	14 - 16	1.1	<0.025	<0.025	<0.025	<0.025	<10
MW-7	01/12/00	24 - 26	177	<0.025	<0.025	<0.025	<0.025	32.7
MW-8	01/11/00	14 - 16	0.8	<0.025	<0.025	<0.025	<0.025	<10
MW-8	01/11/00	24 - 26	3.3	<0.025	<0.025	<0.025	<0.025	<10
MW-10	01/12/00	14 - 16	13	<0.025	<0.025	<0.025	<0.025	<10
MW-10	01/12/00	24 - 26	39	<0.025	<0.025	<0.025	<0.025	<10
MW-11	04/06/00	22	1	<0.002	<0.002	<0.002	<0.002	<9.8
MW-11	04/06/00	24 - 26	1.4	<0.002	<0.002	<0.002	<0.002	<9.8
MW-12	04/06/00	14 - 16	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-12	04/06/00	20 - 22	1.1	<0.002	<0.002	<0.002	<0.002	<9.7
MW-13	05/31/00	20-22		<0.002	<0.002	<0.002	<0.002	<9.9
MW-14	05/31/00	20-22		<0.002	<0.002	<0.002	<0.002	<9.8
MW-15	05/31/00	5		<0.002	<0.002	<0.002	<0.002	<9.8
MW-15	05/31/00	24-26		<0.002	<0.002	<0.002	<0.002	<9.7
MW-15	05/31/00	28-30		<0.002	<0.002	<0.002	<0.002	<9.8
MW-16	05/31/00	20-22		<0.002	<0.002	<0.002	<0.002	<9.7
MW-17	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9

PPL/East Hobbs
Hobbs, New Mexico

Soil Analytical Data

MW-18	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9
MW-19	06/01/00	20-22	0	<0.002	<0.002	<0.002	<0.002	<9.8
MW-20	06/01/00	22-24	0	<0.002	<0.002	<0.002	<0.002	<9.9

Appendix D

Groundwater Elevation Data

GROUNDWATER ELEVATION DATA

CLIENT: Phillips Pipe Line
FACILITY: East Hobbs Junction, NM
LOCATION: Section 8, Township 19 S, Range 38 E
Hobbs, New Mexico
DATE: January 12, 2000

WELL ID	ETC	DTW	DTP	PT	PT X.8	ADJ DTW	WTE	COMMENTS
MW-1	3606.28	27.15	23.48	3.67	2.94	24.21	3582.07	
MW-2	3606.45	26.73	23.61	3.12	2.50	24.23	3582.22	
MW-3	3606.33	26.85	23.49	3.36	2.69	24.16	3582.17	
MW-4	3606.69	24.35		0.00	0.00	24.35	3582.34	
MW-5	3605.52	23.46		0.00	0.00	23.46	3582.06	
MW-6	3606.14	24.17		0.00	0.00	24.17	3581.97	
MW-7	3605.50	23.87	23.85	0.02	0.02	23.85	3581.65	
MW-8	3606.25	23.72		0.00	0.00	23.72	3582.53	
MW-9	3605.75	26.82	22.94	3.88	3.10	23.72	3582.03	
MW-10	3604.94	23.55		0.00	0.00	23.55	3581.39	

ETC = Elevation Top of Casing
DTW = Depth to water
DTP = Depth to Petroleum Hydrocarbons
PT = Measured Petroleum Thickness
ADJ. DTW = Adjusted Depth to Water
WTE = Water Table Elevation
PTE = Elevation Top of Petroleum
N.A. = Not Applicable
All measurements in linear feet

Higgins and Associates, LLC

GROUNDWATER ELEVATION DATA

CLIENT: Phillips Pipe Line
FACILITY: East Hobbs Junction, NM
LOCATION: Section 8, Township 19 S, Range 38 E
Hobbs, New Mexico
DATE: April 6, 2000

WELL ID	ETC	DTW	DTP	PT	PT X.8	ADJ DTW	WTE	COMMENTS
MW-1	3606.28	27.14	23.73	3.41	2.73	24.41	3581.87	
MW-2	3606.45	26.83	23.84	2.99	2.39	24.44	3582.01	
MW-3	3606.33	26.90	23.73	3.17	2.54	24.36	3581.97	
MW-4	3606.69	24.53		0.00	0.00	24.53	3582.16	
MW-5	3605.52	23.67		0.00	0.00	23.67	3581.85	
MW-6	3606.14	24.42		0.00	0.00	24.42	3581.72	
MW-7	3605.50	26.08	23.46	2.62	2.10	23.98	3581.52	
MW-8	3606.25	24.01		0.00	0.00	24.01	3582.24	
MW-9	3605.75	26.72	23.19	3.53	2.82	23.90	3581.85	
MW-10	3604.94	23.78		0.00	0.00	23.78	3581.16	
MW-11	3608.06	26.74		0.00	0.00	26.74	3581.32	
MW-12	3604.40	23.58		0.00	0.00	23.58	3580.82	

ETC = Elevation Top of Casing
DTW = Depth to water
DTP = Depth to Petroleum Hydrocarbons
PT = Measured Petroleum Thickness
ADJ. DTW = Adjusted Depth to Water
WTE = Water Table Elevation
PTE = Elevation Top of Petroleum
N.A. = Not Applicable
All measurements in linear feet

Higgins and Associates, LLC

GROUNDWATER ELEVATION DATA

CLIENT: Phillips Pipe Line
FACILITY: East Hobbs Junction, NM
LOCATION: Section 8, Township 19 S, Range 38 E
Hobbs, New Mexico
DATE: June 1, 2000

WELL ID	ETC	DTW	DTP	PT	PT X.8	ADJ DTW	WTE	COMMENTS
MW-1	3606.28	27.16	23.85	3.31	2.65	24.51	3581.77	
MW-2	3606.45	26.85	23.95	2.90	2.32	24.53	3581.92	
MW-3	3606.33	26.90	23.85	3.05	2.44	24.46	3581.87	
MW-4	3606.69	24.63		0.00	0.00	24.63	3582.06	
MW-5	3605.52	23.76		0.00	0.00	23.76	3581.76	
MW-6	3606.14	24.47		0.00	0.00	24.47	3581.67	
MW-7	3605.50	26.25	23.49	2.76	2.21	24.04	3581.46	
MW-8	3606.25	24.06		0.00	0.00	24.06	3582.19	
MW-9	3605.75	26.68	23.32	3.36	2.69	23.99	3581.76	
MW-10	3604.94	23.84		0.00	0.00	23.84	3581.10	
MW-11	3608.06	26.82		0.00	0.00	26.82	3581.24	
MW-12	3604.40	23.63		0.00	0.00	23.63	3580.77	
MW-13	3604.31	24.45		0.00	0.00	24.45	3579.86	
MW-14	3604.11	23.71		0.00	0.00	23.71	3580.40	
MW-15	3609.78	27.91		0.00	0.00	27.91	3581.87	
MW-16	3606.31	25.28		0.00	0.00	25.28	3581.03	
MW-17	3609.03	27.48		0.00	0.00	27.48	3581.55	
MW-18	3605.71	25.34		0.00	0.00	25.34	3580.37	
MW-19	3606.69	26.93		0.00	0.00	26.93	3579.76	
MW-20	3611.50	29.30		0.00	0.00	29.30	3582.20	
SP-1	3606.21			0.00	0.00	0.00		

ETC = Elevation Top of Casing
DTW = Depth to water
DTP = Depth to Petroleum Hydrocarbons
PT = Measured Petroleum Thickness
ADJ. DTW = Adjusted Depth to Water
WTE = Water Table Elevation
PTE = Elevation Top of Petroleum
N.A. = Not Applicable
All measurements in linear feet

Higgins and Associates, LLC

GROUNDWATER ELEVATION DATA

CLIENT: Phillips Pipe Line
FACILITY: East Hobbs Junction, NM
LOCATION: Section 8, Township 19 S, Range 38 E
Hobbs, New Mexico
DATE: August 2, 2000

WELL ID	ETC	DTW	DTP	PT	PT X.8	ADJ DTW	WTE	COMMENTS
MW-1	3606.28	26.81	23.77	3.04	2.43	24.38	3581.90	
MW-2	3606.45	26.54	23.88	2.66	2.13	24.41	3582.04	
MW-3	3606.33	26.54	23.79	2.75	2.20	24.34	3581.99	
MW-4	3606.69	24.52		0.00	0.00	24.52	3582.17	
MW-5	3605.52	23.60		0.00	0.00	23.60	3581.92	
MW-6	3606.14	24.46	24.34	0.12	0.10	24.36	3581.78	
MW-7	3605.50	26.23	23.33	2.90	2.32	23.91	3581.59	
MW-8	3606.25	23.88		0.00	0.00	23.88	3582.37	
MW-9	3605.75	26.33	23.27	3.06	2.45	23.88	3581.87	
MW-10	3604.94	23.70		0.00	0.00	23.70	3581.24	
MW-11	3608.06	26.69		0.00	0.00	26.69	3581.37	
MW-12	3604.40	23.45		0.00	0.00	23.45	3580.95	
MW-13	3604.31	24.18		0.00	0.00	24.18	3580.13	
MW-14	3604.11	23.54		0.00	0.00	23.54	3580.57	
MW-15	3609.78	27.85		0.00	0.00	27.85	3581.93	
MW-16	3606.31	25.17		0.00	0.00	25.17	3581.14	
MW-17	3609.03	27.39		0.00	0.00	27.39	3581.64	
MW-18	3605.71	25.15		0.00	0.00	25.15	3580.56	
MW-19	3606.69	26.73		0.00	0.00	26.73	3579.96	
MW-20	3611.50	29.83		0.00	0.00	29.83	3581.67	
SP-1	3606.21	26.15		0.00	0.00	26.15	3580.06	

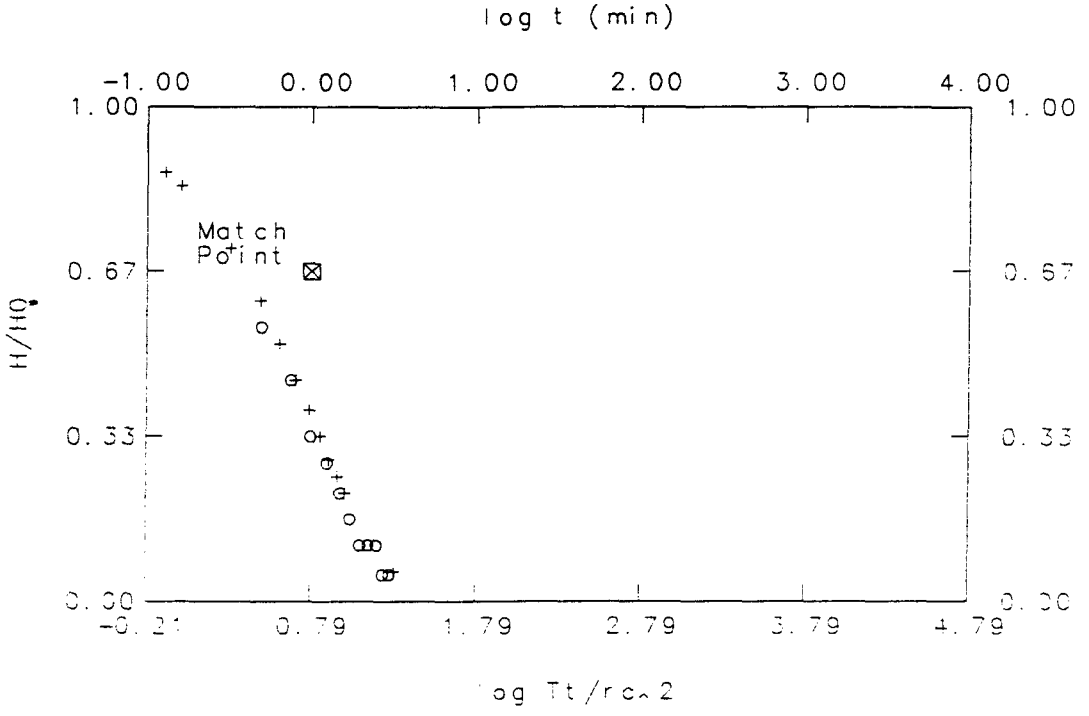
ETC = Elevation Top of Casing
DTW = Depth to water
DTP = Depth to Petroleum Hydrocarbons
PT = Measured Petroleum Thickness

ADJ. DTW = Adjusted Depth to Water
WTE = Water Table Elevation
PTE = Elevation Top of Petroleum
N.A. = Not Applicable
All measurements in linear feet

Appendix E

Aquifer Test Data

East Hobbs/MW-4



o - Data
- - Type Curve
Slug Test: alpha =-10.0

MATCH POINT			SOLUTION		
t	=	1.000E+0000	Transmissivity	=	4.612E+0002 gpd/ft
			Hydraulic. Cond.	=	5.124E+0001 gpd/sq ft
Tt/rc^2	=	6.166E+0000	Storativity	=	1.000E-0010

WELL INFORMATION	
WELL IDENTIFICATION	MW-4
DATE OF AQUIFER TEST	1/13/00
AQUIFER THICKNESS (b)	9.000E+0000 ft
VOLUME OF SLUG (V)	3.531E-0002 cu ft
EFFECTIVE RADIUS	8.333E-0002 cu ft
WELL RADIUS AT MEASURED WATER LEVELS (rc)	8.333E-0002 ft

Data for Slug Injection/Withdrawal Test

Well Name: MW-4 Date of Test: 1/13/00

Aquifer Thickness (b): 9.000 ft

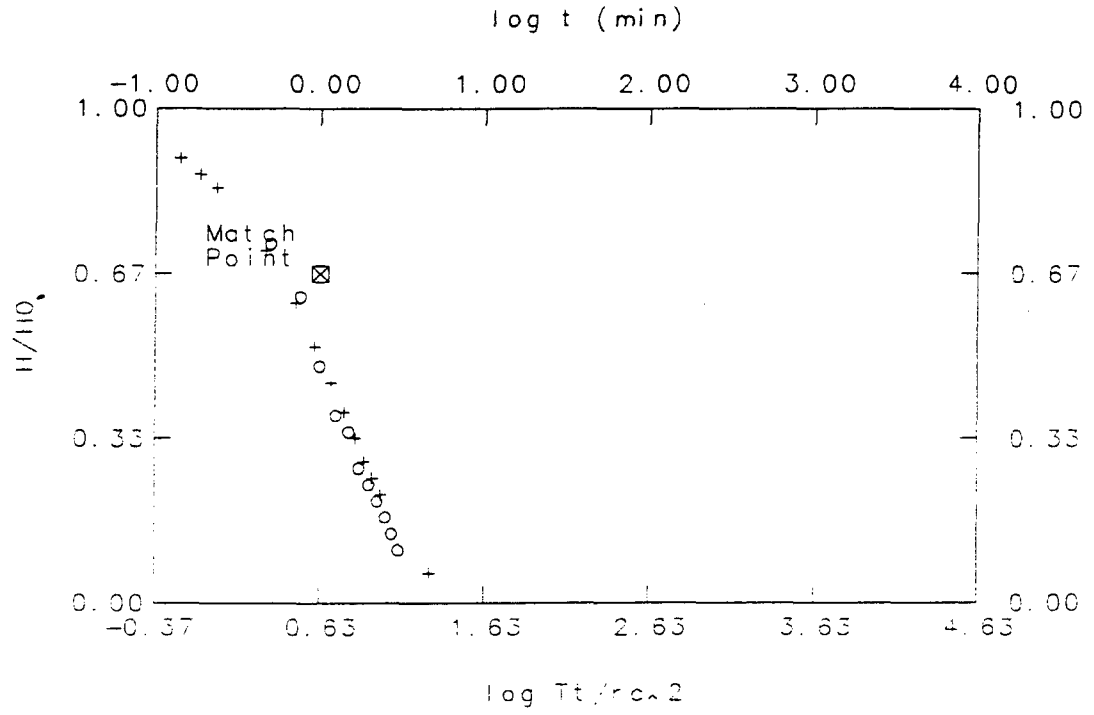
Change in Vol.of Water = 0.035 cu ft

Effective Radius of Well = 0.083 ft

Radius of Casing(rc) over Water Level Decline = 0.083 ft

Entry No.	Time(t) (min)	Head (ft)	H (ft)	H/H0
1	0.000	24.370		
2	0.250	24.550	0.180	1.000
3	0.500	24.470	0.100	0.556
4	0.750	24.450	0.080	0.444
5	1.000	24.430	0.060	0.333
6	1.250	24.420	0.050	0.278
7	1.500	24.410	0.040	0.222
8	1.750	24.400	0.030	0.167
9	2.000	24.390	0.020	0.111
10	2.250	24.390	0.020	0.111
11	2.500	24.390	0.020	0.111
12	2.750	24.380	0.010	0.056
13	3.000	24.380	0.010	0.056

East Hobbs/MW-5



o – Data
+ – Type Curve
Slug Test: alpha =-10.0

MATCH POINT			SOLUTION		
t	=	1.000E+0000	Transmissivity	=	3.190E+0002 gpd/ft
			Hydraulic. Cond.	=	3.545E+0001 gpd/sq ft
Tt/rc^2	=	4.266E+0000	Storativity	=	1.000E-0010

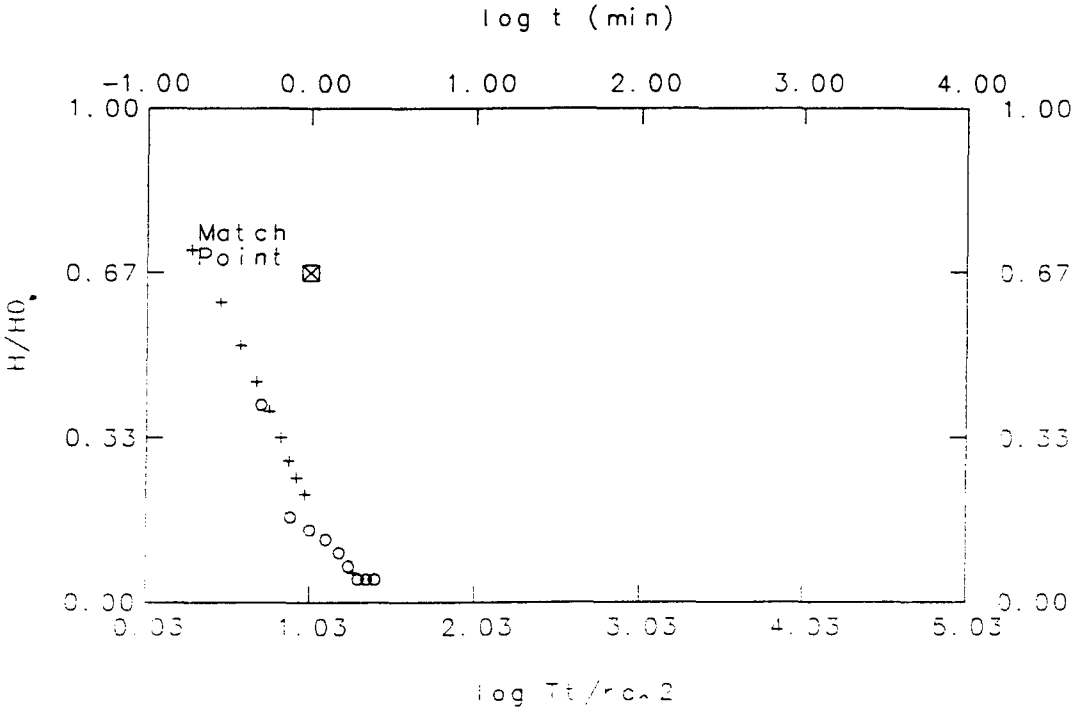
WELL INFORMATION	
WELL IDENTIFICATION	: MW-5
DATE OF AQUIFER TEST	: 1/13/00
AQUIFER THICKNESS (b)	: 9.000E+0000 ft
VOLUME OF SLUG (V)	: 3.500E-0002 cu ft
EFFECTIVE RADIUS	: 8.333E-0002 cu ft
WELL RADIUS AT MEASURED WATER LEVELS (rc)	: 8.333E-0002 ft

Data for Slug Injection/Withdrawal Test

Well Name: MW-5 Date of Test: 1/13/00
Aquifer Thickness (b): 9.000 ft
Change in Vol.of Water = 0.035 cu ft
Effective Radius of Well = 0.083 ft
Radius of Casing(rc) over Water Level Decline = 0.083 ft

Entry No.	Time(t) (min)	Head (ft)	H (ft)	H/H0
1	0.000	23.420		
2	0.250	23.710	0.290	1.000
3	0.500	23.630	0.210	0.724
4	0.750	23.600	0.180	0.621
5	1.000	23.560	0.140	0.483
6	1.250	23.530	0.110	0.379
7	1.500	23.520	0.100	0.345
8	1.750	23.500	0.080	0.276
9	2.000	23.490	0.070	0.241
10	2.250	23.480	0.060	0.207
11	2.500	23.470	0.050	0.172
12	2.750	23.460	0.040	0.138
13	3.000	23.450	0.030	0.103

East Hobbs/MW-6



o – Data
+ – Type Curve
Slug Test: alpha =10.0

MATCH POINT		SOLUTION		
t	= 1.000E+0000	Transmissivity	=	3.014E+0002 gpd/ft
		Hydraulic. Cond.	=	3.904E+0001 gpd/sq ft
Tt/rc^2	= 1.072E+0001	Storativity	=	1.003E-0010

WELL INFORMATION	
WELL IDENTIFICATION	: MW-6
DATE OF AQUIFER TEST	: 1/13/00
AQUIFER THICKNESS (b)	: 9.000E+0000 ft
VOLUME OF SLUG (V)	: 3.500E-0002 cu ft
EFFECTIVE RADIUS	: 8.333E-0002 cu ft
WELL RADIUS AT MEASURED WATER LEVELS (rc)	: 8.333E-0002 ft

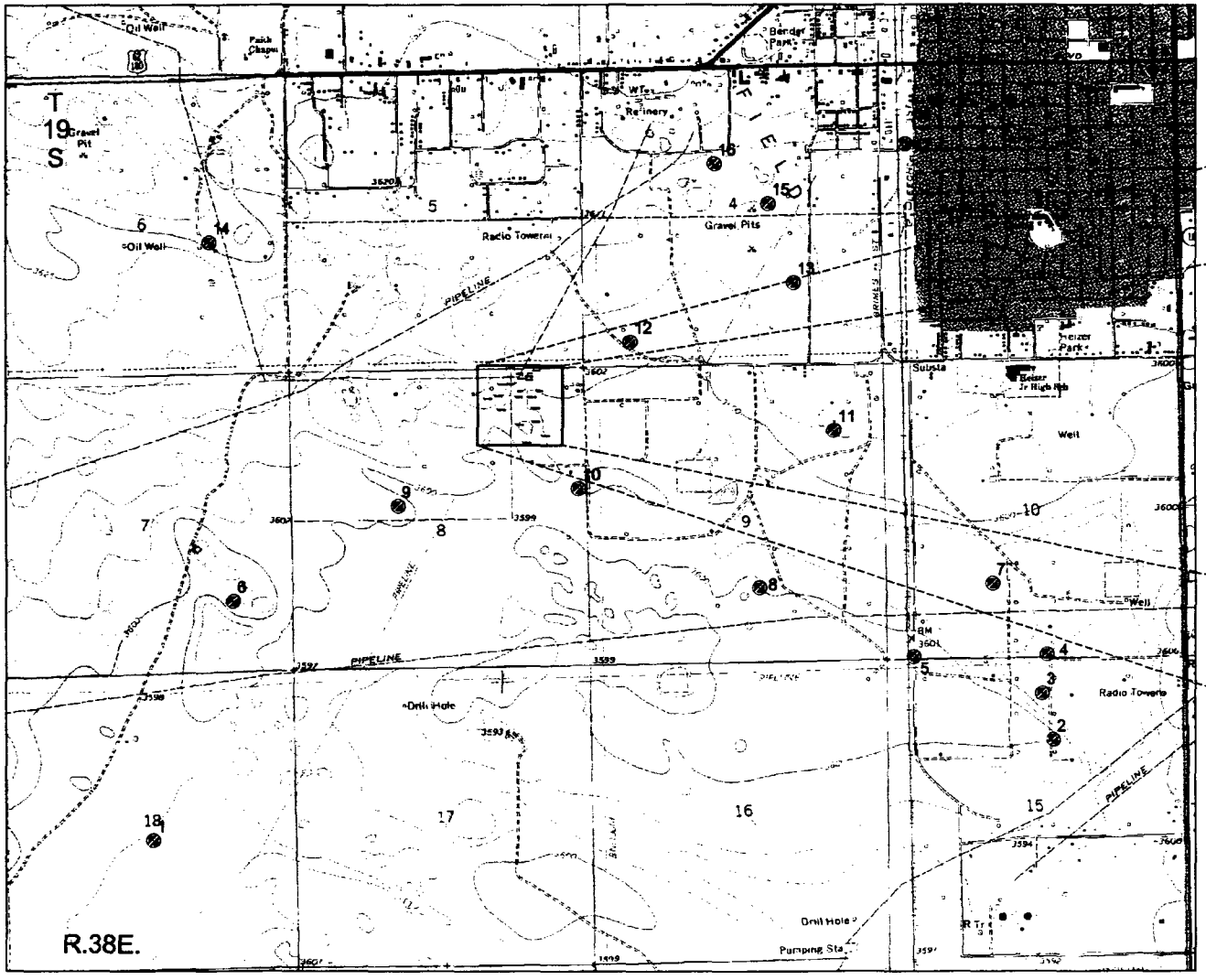
Data for Slug Injection/Withdrawal Test

Well Name: MW-6 Date of Test: 1/13/00
Aquifer Thickness (b): 9.000 ft
Change in Vol.of Water = 0.035 cu ft
Effective Radius of Well = 0.083 ft
Radius of Casing(rc) over Water Level Decline = 0.083 ft

Entry No.	Time(t) (min)	Head (ft)	H (ft)	H/H0
1	0.000	24.200		
2	0.250	24.600	0.400	1.000
3	0.500	24.360	0.160	0.400
4	0.750	24.270	0.070	0.175
5	1.000	24.260	0.060	0.150
6	1.250	24.250	0.050	0.125
7	1.500	24.240	0.040	0.100
8	1.750	24.230	0.030	0.075
9	2.000	24.220	0.020	0.050
10	2.250	24.220	0.020	0.050
11	2.500	24.220	0.020	0.050
12	2.750	24.210	0.010	0.025
13	3.000	24.210	0.010	0.025

Appendix F

Well Records

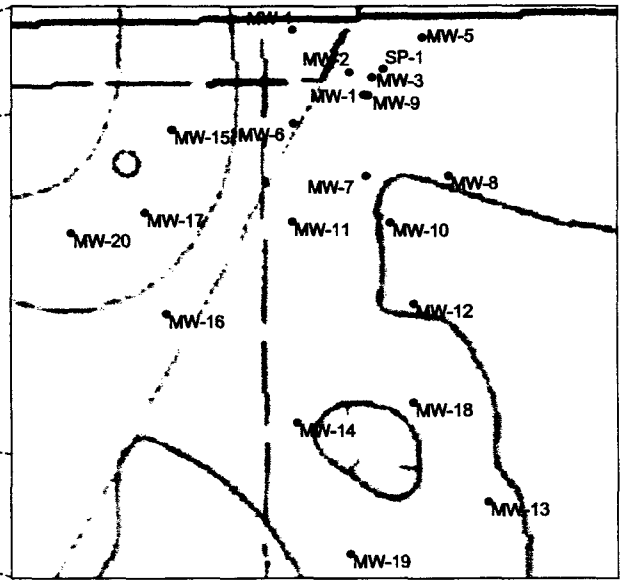


Topographics Source: USGS 7.5' Quad.;Hobbs West, NM

LEGEND

- Ground Water Well
- Monitor Well

Note: ground water well label refers to Water Well Report 10/1/1999



HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated:	Date Data Collected:	Figure No.
571-17	7/5/00	6/1/00	-

Authored	Title:
CH	PPL Line East Hobbs Junction Water Well Locations
Checked: CJ	
Detailed: ML	

Client:	Location:
Phillips Pipe Line Company	Hobbs New Mexico

ACAD File: 571-17waterwells-utm.dwg

Banks Information Solutions, Inc.

Water Well Report™

October 1, 1999

CLIENT

Higgins and Associates

9940 East Costilla Avenue, Suite B

Englewood, CO 80112

SITE

Hobbs and East Hobbs

Sections 8 & 9

Hobbs, New Mexico

100199-044

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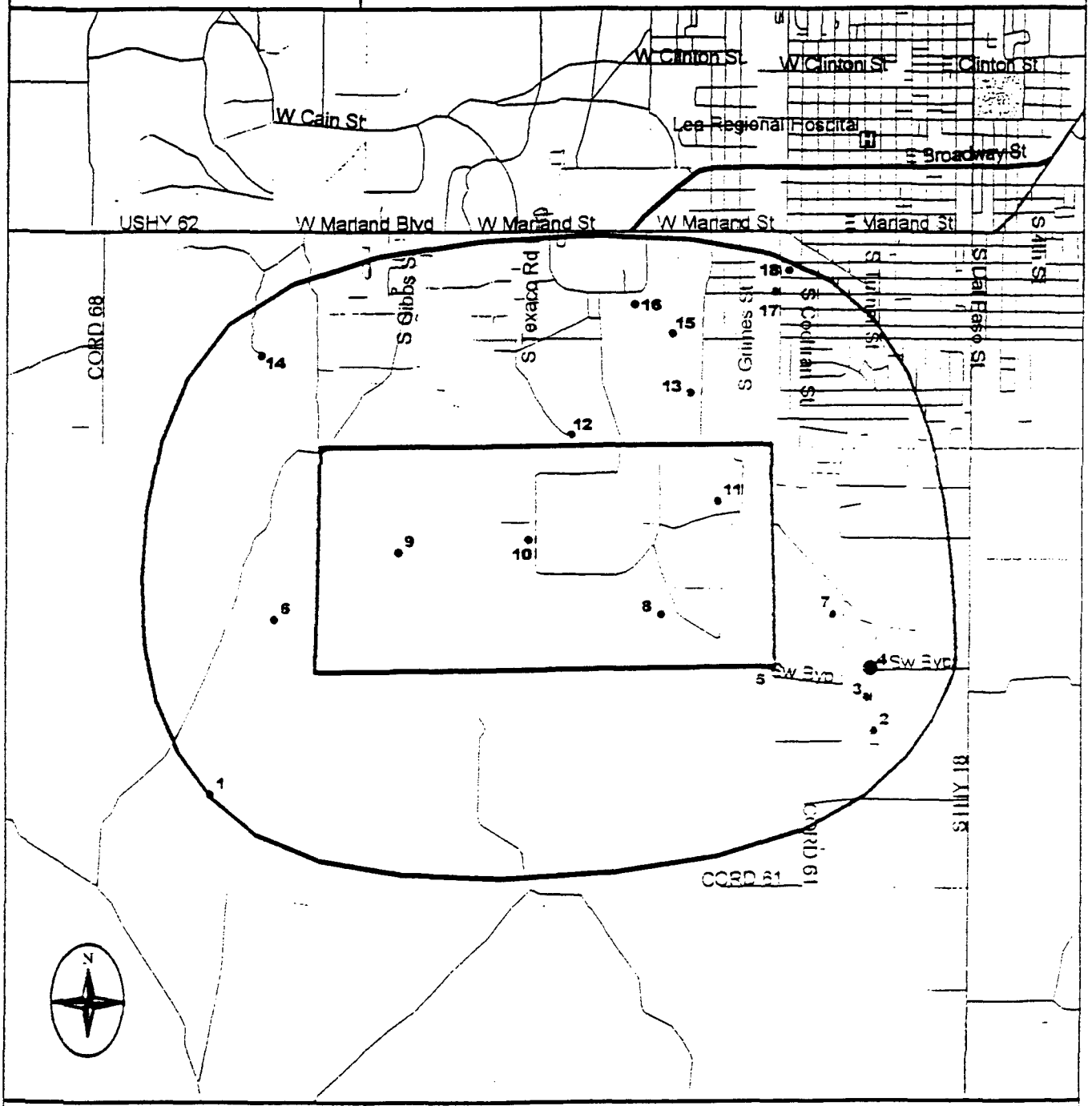
Map of Wells within Defined Polygon



Subject Site
Ground Water Wells (Cluster)
Ground Water Well
Airport
Hospital
Highway
Primary road
Secondary and connecting road
Local road
Access road
Water body
Park
State

0 0.464787 Miles

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512-478-0059 FAX 512-478-1433 E Mail: BANKS@BANKSINFO.COM

October 1, 1999

Banks Information Solutions, Inc.

Water Well Report™

DETAILS

State ID	323933103111401	MAP ID
Banks ID	3502501220	1
Owner Of Well	COCHRAN, C.B.	
Type Of Well	Domestic	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.18722222	
Latitude	32.6591666667	

State ID	323948103080501	MAP ID
Banks ID	3502501233	2
Owner Of Well	WALKER OIL CORP.	
Type Of Well	Unused	
Depth Drilled	58 '	
Completion Date	N/A	
Longitude	-103.13472222	
Latitude	32.6633333333	

State ID	323956103080701	MAP ID
Banks ID	3502501238	3
Owner Of Well	MIDWEST OIL CO.	
Type Of Well	Unused	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.13527778	
Latitude	32.6655555556	

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DETAILS

State ID	324003103080601	MAP ID
Banks ID	3502501242	4
Owner Of Well	SHELL OIL CO.	
Type Of Well	Unused	
Depth Drilled	37 '	
Completion Date	N/A	
Longitude	-103.135	
Latitude	32.6675	

State ID	324003103080602	MAP ID
Banks ID	3502501243	4
Owner Of Well	SHELL OIL CO.	
Type Of Well	Unused	
Depth Drilled	49 '	
Completion Date	N/A	
Longitude	-103.135	
Latitude	32.6675	

State ID	324003103083401	MAP ID
Banks ID	3502501244	5
Owner Of Well	PAN AMERICAN PET.	
Type Of Well	Unused	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.14277778	
Latitude	32.6675	

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DETAILS

State ID	324015103105601	MAP ID
Banks ID	3502501249	6
Owner Of Well	COCHRAN,	
Type Of Well	Stock	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.18222222	
Latitude	32.6708333333	

State ID	324016103081701	MAP ID
Banks ID	3502501252	7
Owner Of Well	THORP, D.C.	
Type Of Well	Irrigation	
Depth Drilled	125 '	
Completion Date	N/A	
Longitude	-103.13805556	
Latitude	32.6711111111	

State ID	324016103090601	MAP ID
Banks ID	3502501253	8
Owner Of Well	TERRY, WILL	
Type Of Well	Stock	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.15166667	
Latitude	32.6711111111	

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DETAILS

State ID	324031103102101
Banks ID	3502501263
Owner Of Well	BYROM, W.K.
Type Of Well	Unused
Depth Drilled	N/A '
Completion Date	N/A
Longitude	-103.1725
Latitude	32.6752777778

MAP ID
9

State ID	324034103094401
Banks ID	3502501265
Owner Of Well	GACKLE, ALBERT
Type Of Well	Unused
Depth Drilled	N/A '
Completion Date	N/A
Longitude	-103.16222222
Latitude	32.6761111111

MAP ID
10

State ID	324043103085001
Banks ID	3502501273
Owner Of Well	AMOCO PRODUCTION CO.
Type Of Well	Unused
Depth Drilled	N/A '
Completion Date	N/A
Longitude	-103.14722222
Latitude	32.6786111111

MAP ID
11

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DETAILS

State ID	324059103093201
Banks ID	3502501282
Owner Of Well	TEXACO
Type Of Well	Unused
Depth Drilled	35 '
Completion Date	N/A
Longitude	-103.15888889
Latitude	32.6830555556

MAP ID: 12

State ID	324109103085801
Banks ID	3502501297
Owner Of Well	LAMBERT
Type Of Well	Unused
Depth Drilled	N/A '
Completion Date	N/A
Longitude	-103.14944444
Latitude	32.6858333333

MAP ID: 13

State ID	324118103110001
Banks ID	3502501303
Owner Of Well	FOWLER, CLARA
Type Of Well	Stock
Depth Drilled	N/A '
Completion Date	N/A
Longitude	-103.18333333
Latitude	32.6883333333

MAP ID: 14

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Water Well Report™

DETAILS

State ID	324123103090301	MAP ID
Banks ID	3502501309	15
Owner Of Well	STANOLIND OIL	
Type Of Well	Unused	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.15083333	
Latitude	32.6897222222	

State ID	324130103091401	MAP ID
Banks ID	3502501319	16
Owner Of Well	PECOS VALLEY OIL CO.	
Type Of Well	Domestic	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.15388889	
Latitude	32.6916666667	

State ID	324133103083401	MAP ID
Banks ID	3502501324	17
Owner Of Well	N/A	
Type Of Well	N/A	
Depth Drilled	N/A '	
Completion Date	N/A	
Longitude	-103.14277778	
Latitude	32.6925	

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Water Well Report™

DETAILS

State ID	324138103083001
Banks ID	3502501332
Owner Of Well	MR. PROLLACK
Type Of Well	Unused
Depth Drilled	70'
Completion Date	N/A
Longitude	-103.14166667
Latitude	32.6938888889

MAP ID
18

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Banks Information Solutions, Inc.

Water Well Report™

SUMMARY

Water Well Report™ Research Mapping Protocol

Banks Information Solutions, Inc. Water Well Report™ is prepared from existing state water well databases and additional file data/records research conducted at the State Engineers Office located in Roswell, New Mexico. In New Mexico, water wells are located within a grid system using section, township, and range. The locations of these wells on the enclosed map were plotted using a GIS program, ArcView 3.0a, with the aid of the section, township, and range of the wells provided by the drillers logs.

Banks Information Solutions, Inc. has performed a thorough and diligent search of all groundwater well information provided and recorded with the New Mexico State Engineers Office. All mapped locations are based on information obtained from the NMSEO. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Information Solutions, Inc. cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the New Mexico State Engineer regulatory authorities.

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