

1R - 2498

WORKPLANS

Date:

10-11-11

Rice Environmental Consulting & Safety

P.O. Box 5630 Hobbs, NM 88241
Phone 575.393.4411 Fax 575.393.0293

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RETURN RECEIPT NO. 7008 1140 0001 3070 5856

October 11th, 2011

Mr. Edward Hansen

New Mexico Energy, Minerals, & Natural Resources
Oil Conservation Division, Environmental Bureau
1220 S. St. Francis Drive
Santa Fe, New Mexico 87505

RE: Corrective Action Plan

Apache Corporation

Walter Lynch Tank Battery (1R-2498): UL/F sec. 1 T22S R37E

Mr. Hansen:

Apache Corporation, Inc. (Apache) has retained Rice Environmental Consulting and Safety (RECS) to address potential environmental concerns at the above-referenced site.

Background and Previous Work

This site is located approximately 2.5 miles south-east of Eunice, New Mexico at UL/F sec. 1 T22S R37E as shown on the Site Location Map (Figure 1 and 2). Monitor wells at the site indicate groundwater will be encountered at 54 +/- feet.

On August 26th, 2009, four soil bores were advanced at the site. Each soil bore was sampled every five feet and all samples were taken to a commercial laboratory for field test confirmation. SB-1 was drilled to a depth of 65 ft bgs and had laboratory chloride readings ranging from a high of 1,424 mg/kg at 35 ft bgs to a low of 96 mg/kg at 30 ft bgs. SB-2 was drilled to 65 ft bgs and had laboratory chloride readings ranging from a high of 1,860 mg/kg at 40 ft bgs to a low of 96 mg/kg at 55 ft bgs. SB-3 was drilled to a depth of 56 ft bgs and had laboratory chloride readings ranging from a high of 1,230 mg/kg at 25 ft bgs to a low of non-detect at 5 ft bgs. Finally, SB-4 was drilled to 56 ft bgs and had laboratory chloride readings ranging from a high of 672 mg/kg at 55 ft bgs to a low of 16 mg/kg at 5 ft bgs. BTEX, GRO, and DRO were all non-detect throughout all the bores and at all depths. All four soil bores were plugged and abandoned (P&A) on August 27th, 2009 in conformance with NMOCD Rules and Regulations.

On December 8-9th, 2009, three monitor wells were installed at the site. Two soil samples from each monitor well installation were sent to a commercial laboratory for verification of field numbers. From MW-1, samples from 10 ft bgs and 60 ft bgs were taken. The laboratory chloride reading from the 10 ft bgs sample was non-detect and from 60 ft bgs sample was 64 mg/kg. From MW-2, the 10 ft bgs and 60 ft bgs samples were taken for laboratory analysis. The chloride

reading for 10 ft bgs sample was non-detect and the reading from 60 ft bgs sample was 96 mg/kg. From MW-3, the 10 ft bgs and 57 ft bgs samples were taken for laboratory analysis. The chloride reading for the 10 ft bgs sample was 16 mg/kg and the chloride reading for 57 ft bgs sample was 96 mg/kg. BTEX, GRO, and DRO were non-detect in the soil samples for all the wells.

On December 11th, 2009, the three monitor wells were sampled for BTEX, sulfates, chloride, TDS and metals. MW-1 had laboratory readings of non-detect for BTEX and metals. The well had a TDS laboratory reading was 1,720 mg/L, a sulfate reading of 283 mg/L and a chloride reading of 680 mg/L. MW-2 had laboratory readings of non-detect for BTEX and all metals except mercury which had a reading of 0.002 mg/L. The TDS reading for MW-2 was 3,680 mg/L, with a sulfate reading of 310 mg/L, and a chloride reading of 1,980 mg/L. Finally MW-3 showed BTEX readings of non-detect. The well showed non-detect for all metals except mercury which showed a reading of 0.003 mg/L. The well showed a TDS reading of 1,400 mg/L, a sulfate reading of 190 mg/L, and a chloride reading of 610 mg/L.

On January 20th, 2010, Apache submitted a Notice of Groundwater Impact to the NMOCD District 1 office.

On February 10th, 2010, Apache submitted a Remediation Proposal to the NMOCD District 1 office. In that report, Apache agreed that it would excavate the entire area to 4 ft bgs. The sidewalls would be excavated to whatever distance necessary to achieve chloride numbers at or below 250 mg/kg. Once the site was excavated, a 20 mil-polyethylene liner would be installed along the bottom and up the sidewalls to inhibit chloride migration through the vadose zone to groundwater. The site would then be backfilled to bring the excavation to surface level and seeded. The remediation proposal was approved by NMOCD and the soil work was subsequently completed.

On April 25th, 2011, RECS sampled the three monitor wells at the site and sent the samples to a commercial laboratory for analysis of chloride and TDS (Figure 3). MW-1 had a laboratory chloride reading of 630 mg/L and a TDS reading of 1,700 mg/L. MW-2 had a laboratory chloride reading of 1,540 mg/L and a TDS reading of 3,000 mg/L. Finally, MW-3 had a laboratory chloride reading of 640 mg/L and a TDS reading of 1,530 mg/L (Appendix A).

On July 29th, 2011, Apache submitted an Update Report on the site to NMOCD District 1 office that described the activities conducted by Apache to remediate the site.

On September 2nd, 2011, MW-2 was plugged and abandoned per NMOCD requirements with a 1 – 3% bentonite slurry and a 3 foot concrete cap. It was replaced with a 4 inch recovery well (RW-1) located approximately 7 ft northwest of the former MW-2 (Figure 2 & Appendix B).

Recommendations

The Walter Lynch Tank Battery site is located within a regionally impacted groundwater area. The up gradient monitor well (MW-1) shows chloride impacted water (630 mg/L) coming onto the site. However, it is apparent that although the up gradient groundwater is impaired before it moves across the site, it has also been affected by prior downward migration of residual soil

chlorides from the vadose zone. The down gradient well (MW-2) showed evidence of these prior residual soil chlorides from the site with a laboratory chloride reading of 1,540 mg/L. However, since Apache installed a 20 mil-polyethylene liner, the subsequent effects to groundwater from the vadose zone will have become negligible. The liner will have virtually stopped the downward migration of water and thus the downward movement of chlorides. Therefore, only the chloride mass in the groundwater will be taken into account.

Groundwater Remedy:

Apache proposes to remove chloride impacted water from the location using RW-1, a 4 inch recovery well, and placing a groundwater recovery system at the site. Removed groundwater will be utilized in production operations (e.g. pipeline and well maintenance). Our estimate conservatively reflects the impact to groundwater at the site resulting from the tank battery. It does not take into account other sources or regional groundwater conditions that may exist up gradient of the site.

- **Estimated chloride mass in the groundwater**

The estimated impact area is again 13,000 square feet. The aquifer thickness is determined to be 15 ft thick. The porosity of the soil is estimated at 0.25. The volume of the impacted groundwater beneath the site is determined by multiplying the impact area by the aquifer thickness by the porosity. The volume of impacted groundwater beneath the site is then 48,750 cubic feet. The result is then converted to liters giving us 1,380,446.1 liters. The chloride concentration contributed from the source is the difference between the most recent concentrations observed in MW-2 and in MW-1 which is determined to be 910 mg/L. The total chloride mass in the groundwater is then determined by multiplying the volume of impacted groundwater beneath the site by the chloride concentration added to the soil from the site. This is then converted to kilograms. Thus, the total chloride mass beneath the site is 1,256 kg.

Estimate of Chloride Mass in Groundwater

Parameter	Unit	Value	Description
Impact area	ft ²	13,000	Estimated Area of Impact
Aquifer Thickness	ft	15	NMOCD Approved Estimation
Porosity	%	0.25	Professional Estimate for Water Saturated Pore Volume
Volume of Impacted Groundwater Below Site	ft ³	48,750	Impact Area x Aquifer Thickness x Porosity
Volume of Impacted Groundwater Below Site	L	1,380,446.1	Conversion from ft ³ to Liters
Chloride Concentration Contributed from Source	mg/L	910	Difference between Concentrations in Monitor Wells (MW-1 = 630 mg/L and MW-2 = 1,540 mg/L)
TOTAL CHLORIDE MASS	kg	1,256	Volume of Impacted Groundwater Below Site x Chloride Concentration Added to Groundwater from Source

- **Estimated groundwater recovery system removal at MW-2**

Groundwater recovery will extract water from RW-1, a 4 inch recovery well that replaced MW-2. The groundwater concentration of the water from MW-2 was 1,540 mg/L. Assuming a pumping rate of one gallon a minute for ten hours a day, we can expect an extraction rate of 3.5 kg/day. Since the total chloride mass is 1,256, it would take approximately 359 days to remove the chloride impact resulting from the leak. The volume of water that needs to be removed is determined by multiplying the pumping rate by the estimated removal time. This gives us a total of approximately 5,130 barrels that need to be removed from the site.

Estimated Groundwater Recovery System Removal at the Walter Lynch Tank Battery MW-2			
Parameter	Unit	Value	Description
Groundwater Concentration	mg/L	1,540	Groundwater Concentration from MW-2
Groundwater Concentration	kg/gal	0.0058296	Conversion from mg/L to kg/gal
Pumping Rate	gals/min	1	Given
Extraction Rate	kg/min	0.0058296	Pumping rate x Groundwater Concentration (kg/gal)
Extraction Rate	kg/day	3.4977477	Conversion from kg/min to kg/day
Representative Total Chloride Mass	kg	1,256	From above
Volume Removal	gals	215,452	Pumping rate x Estimated Removal Time x 60 min/hour x 10 hr/day
Volume Removal	bbls	5,130	Conversion from gals to bbls
ESTIMATED REMOVAL TIME	day	359	Representative Total Chloride Mass/Extraction Rate

Upon completion of the CAP work elements, we anticipate Apache will submit a written report which will include a request for “remediation termination” and the closure of the regulation file.

RECS appreciates the opportunity to work with you on this project. Please call Hack Conder at (575) 393-9174 or Natalie Gladden (575) 390-4186 if you have any questions or wish to discuss the site.

Sincerely,

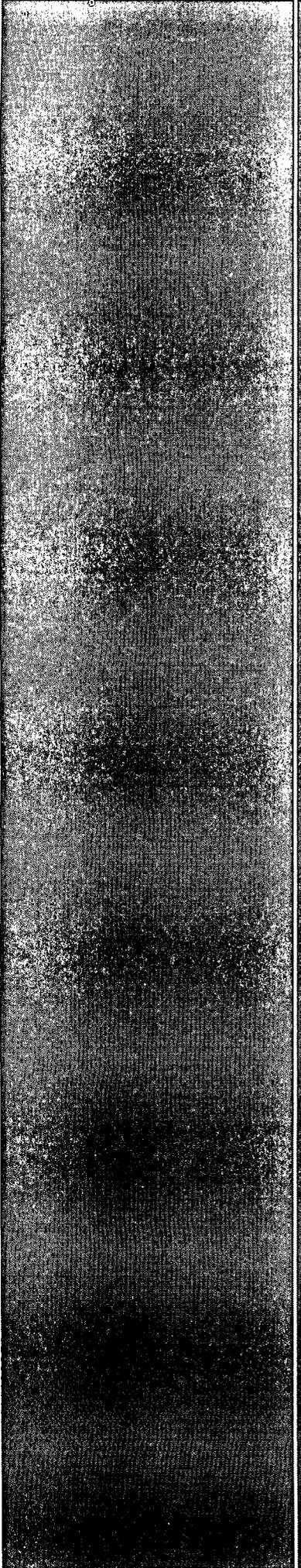


Lara Weinheimer
Project Scientist
RECS
(575) 441-0431

Attachments:

- Figure 1 – Site location map
- Figure 2 – Close up of site location map
- Figure 3 – Monitor well sampling map
- Appendix A – Monitor well sampling analysis April 25 & 26th, 2011
- Appendix B – Plug and abandon MW-2 and install RW-1

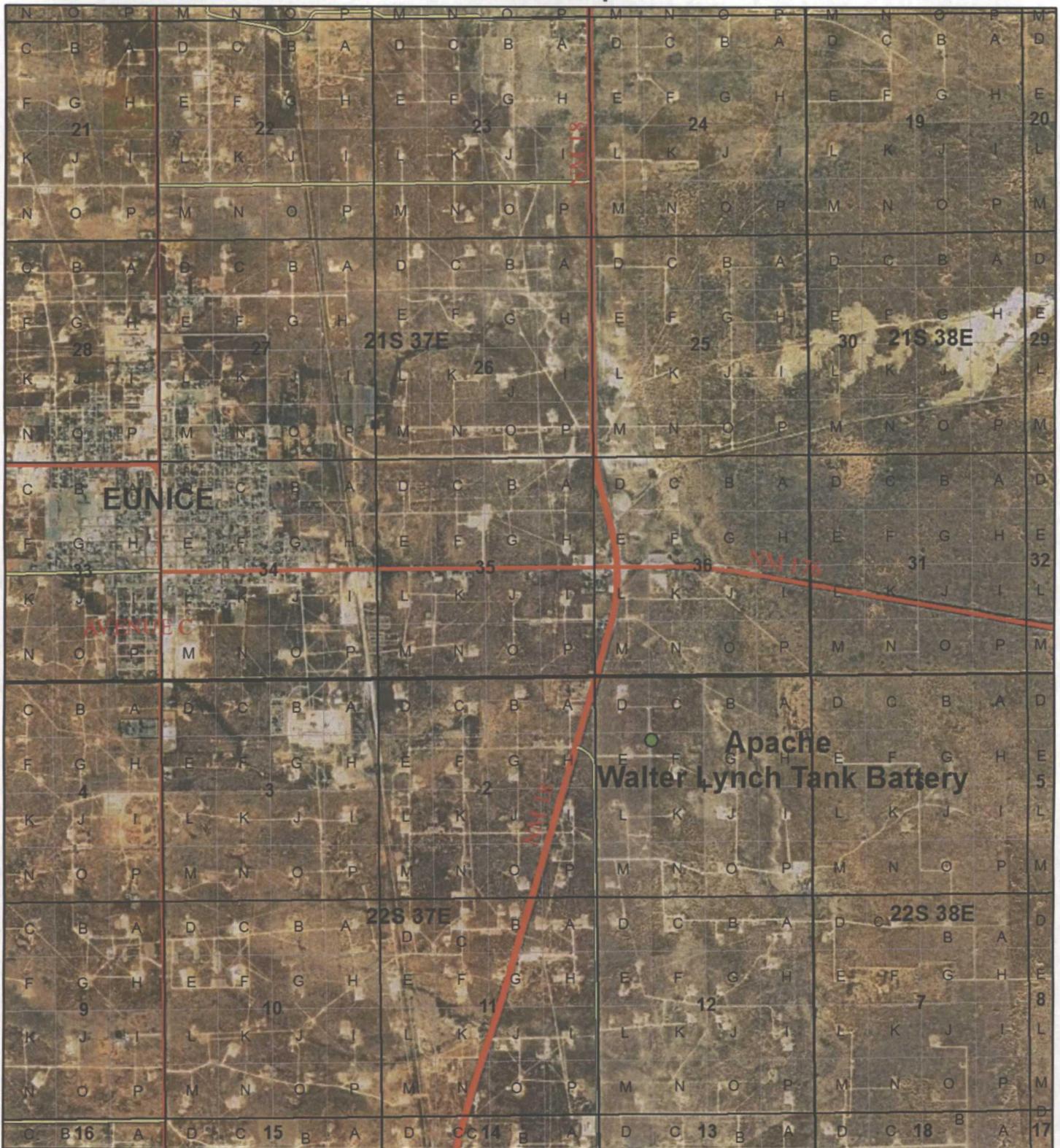
cc. Geoffrey Leking, NMOCD – District 1



Figures

RICE Environmental Consulting and Safety (RECS)
P.O. Box 5630 Hobbs, NM 88241
Phone 575.393.4411 Fax 575.393.0293

Site Map

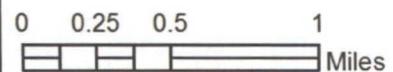


Apache Walter Lynch Tank Battery

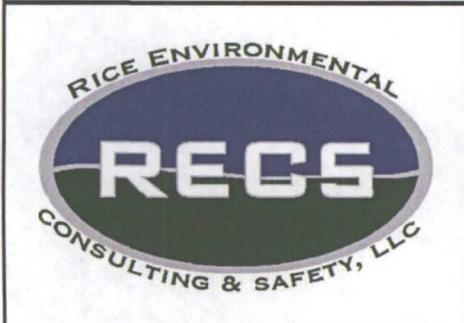
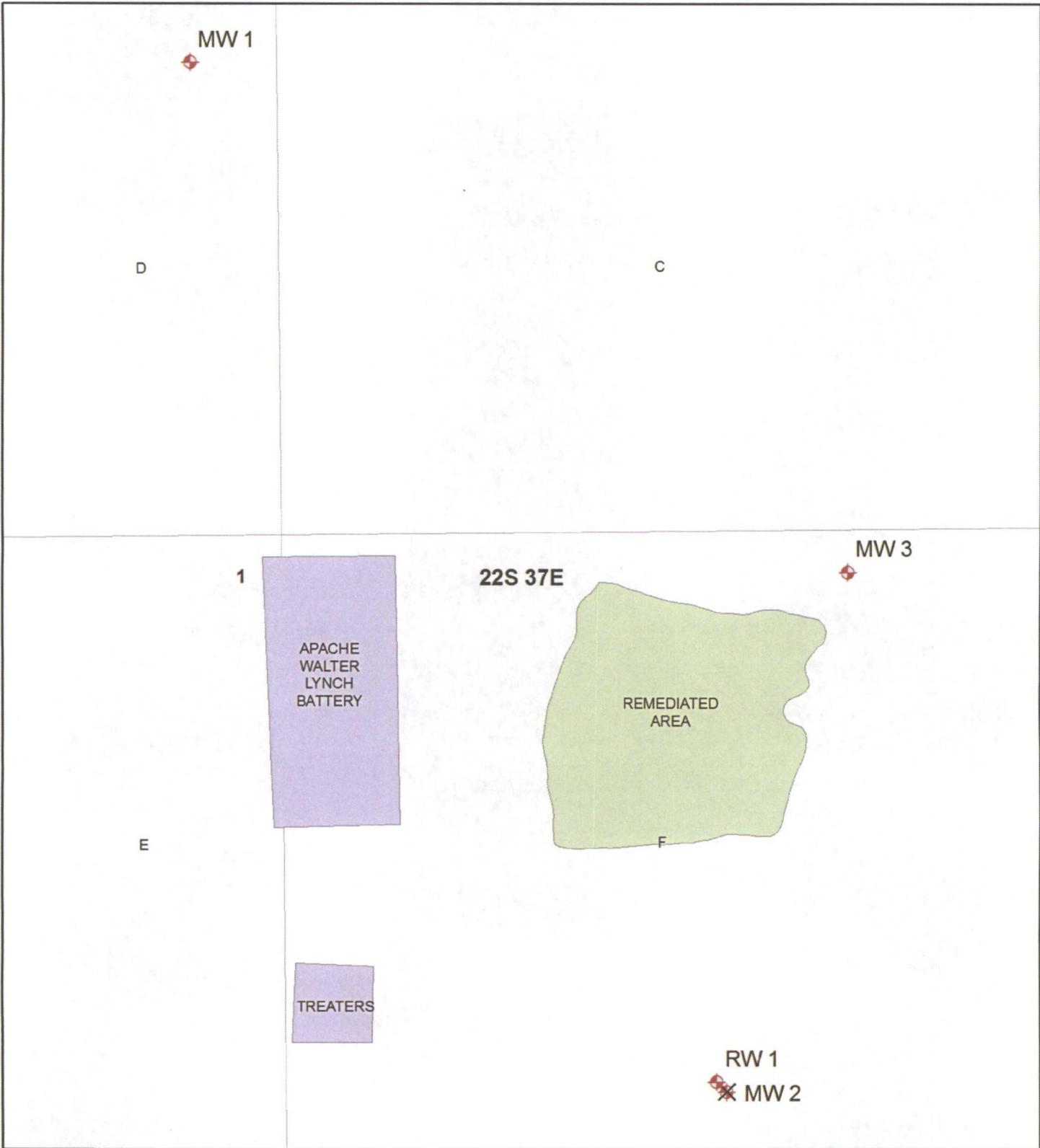
Legals: UL/F sec. 1
T22S R37E

NMOCD Case #: 1R-2498

Figure 1



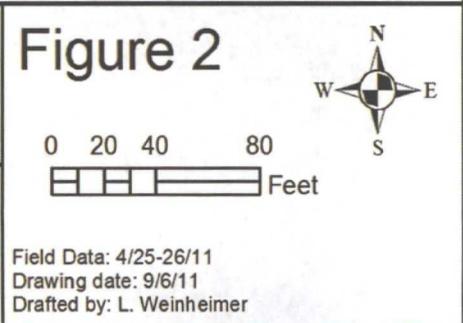
Drawing date: 2-9-10
Drafted by: L. Weinheimer



**APACHE
WALTER LYNCH
TANK BATTERY AREA**

Legals: UL's C,D,E,F sec. 1
T-22-S R-37-E

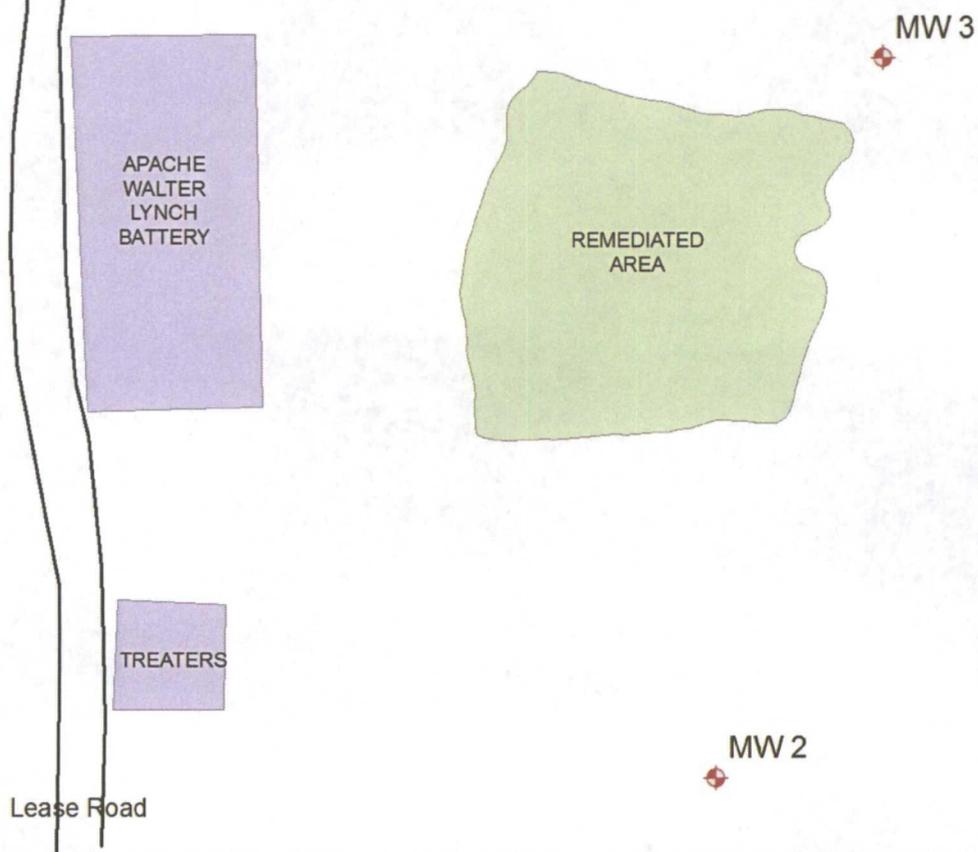
NMOCD Case #: 1R-2498



MW Sampling Data

MW 1

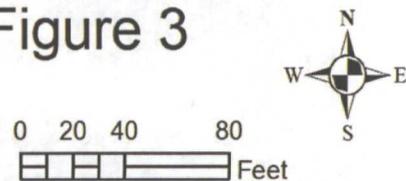
MW	Depth to Water	Total Depth	Well Volume	Volume Purged	Sample Date	Cl	TDS	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Sulfate	Comments
1	XXX	XXX	XXX	XXX	12/11/2009	680	1720	<0.001	<0.001	<0.001	<0.003	283	XXX
1	51.95	65.85	2.267	7	4/25/2011	630	1700	XXX	XXX	XXX	XXX	XXX	Red silty sand to clean
2	XXX	XXX	XXX	XXX	12/11/2009	1980	3680	<0.001	<0.001	<0.001	<0.003	310	XXX
2	54.31	70.81	2.69	8.5	4/26/2011	1540	3000	XXX	XXX	XXX	XXX	XXX	Red silty sand to clean
3	XXX	XXX	XXX	XXX	12/11/2009	610	1400	<0.001	<0.001	<0.001	<0.003	190	XXX
3	51.4	66.36	2.44	7.5	4/26/2011	640	1530	XXX	XXX	XXX	XXX	XXX	Red silty sand to clean



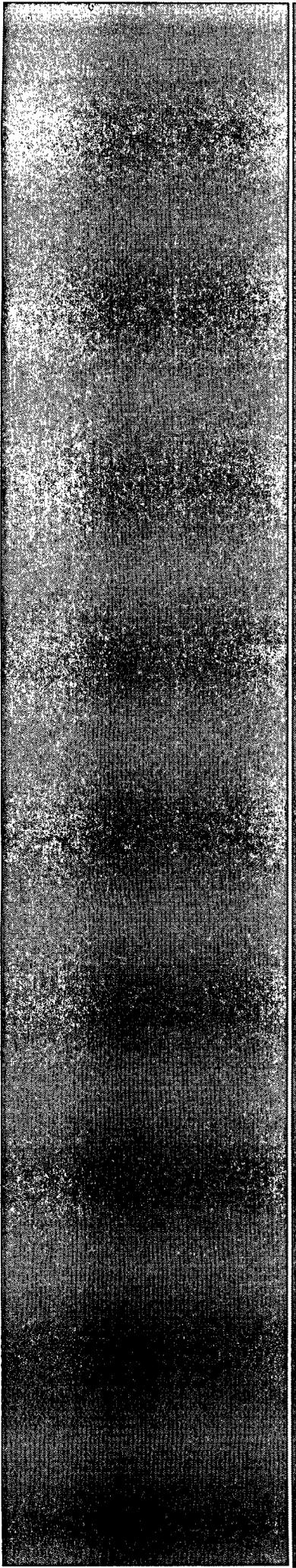
APACHE WALTER LYNCH TANK BATTERY AREA

Legals: UL's C,D,E,F sec. 1
T-22-S R-37-E
NMOCD Case #: 1R-2498

Figure 3



Field Data: 4/25-26/11
Drawing date: 8/8/11
Drafted by: L. Weinheimer



Appendix A

Monitor well sampling analysis April 25 & 26th, 2011

RICE Environmental Consulting and Safety (RECS)

P.O. Box 5630 Hobbs, NM 88241
Phone 575.393.4411 Fax 575.393.0293

April 29, 2011

NATALIE GLADDEN

APACHE - EUNICE

P. O. BOX 1849

EUNICE, NM 88231

RE: APACHE WALTER LYNCH TANK BATTERY

Enclosed are the results of analyses for samples received by the laboratory on 04/27/11 8:05.

Cardinal Laboratories is accredited through Texas NELAP for:

Method SW-846 8021	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method SW-846 8260	Benzene, Toluene, Ethyl Benzene, and Total Xylenes
Method TX 1005	Total Petroleum Hydrocarbons

Certificate number T104704398-08-TX. Accreditation applies to solid and chemical materials and non-potable water matrices.

Cardinal Laboratories is accredited through the State of Colorado Department of Public Health and Environment for:

Method EPA 552.2	Haloacetic Acids (HAA-5)
Method EPA 524.2	Total Trihalomethanes (TTHM)
Method EPA 524.4	Regulated VOCs (V2, V3)

Accreditation applies to public drinking water matrices.

This report meets NELAP requirements and is made up of a cover page, analytical results, and a copy of the original chain-of-custody. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Celey D. Keene

Lab Director/Quality Manager

Analytical Results For:

 APACHE - EUNICE
 NATALIE GLADDEN
 P. O. BOX 1849
 EUNICE NM, 88231
 Fax To: 394-2425

Received:	04/27/2011	Sampling Date:	04/25/2011
Reported:	04/29/2011	Sampling Type:	Water
Project Name:	APACHE WALTER LYNCH TANK BATTERY	Sampling Condition:	Cool & Intact
Project Number:	NONE GIVEN	Sample Received By:	Jodi Henson
Project Location:	NOT GIVEN		

Sample ID: MW - 1 (H100865-01)

Chloride, SM4500CI-B		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	630	4.00	04/27/2011	ND	112	112	100	3.64		
TDS 160.1		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
TDS	1700	5.00	04/27/2011	ND				1.28		

Sample ID: MW - 2 (H100865-02)

Chloride, SM4500CI-B		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	1540	4.00	04/27/2011	ND	112	112	100	3.64		
TDS 160.1		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
TDS	3000	5.00	04/27/2011	ND				1.28		

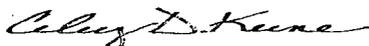
Sample ID: MW - 3 (H100865-03)

Chloride, SM4500CI-B		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
Chloride	640	4.00	04/27/2011	ND	112	112	100	3.64		
TDS 160.1		mg/L		Analyzed By: HM						
Analyte	Result	Reporting Limit	Analyzed	Method Blank	BS	% Recovery	True Value QC	RPD	Qualifier	
TDS	1530	5.00	04/27/2011	ND				1.28		

Cardinal Laboratories

*=Accredited Analyte

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising, whether based in contract or tort, shall be limited to the amount paid by client for analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within thirty (30) days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including, without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of the services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise. Results relate only to the samples identified above. This report shall not be reproduced except in full with written approval of Cardinal Laboratories.



Celey D. Keene, Lab Director/Quality Manager

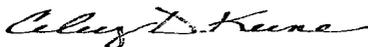
Notes and Definitions

ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
**	Samples not received at proper temperature of 6°C or below.
***	Insufficient time to reach temperature.
-	Chloride by SM4500Cl-B does not require samples be received at or below 6°C Samples reported on an as received basis (wet) unless otherwise noted on report

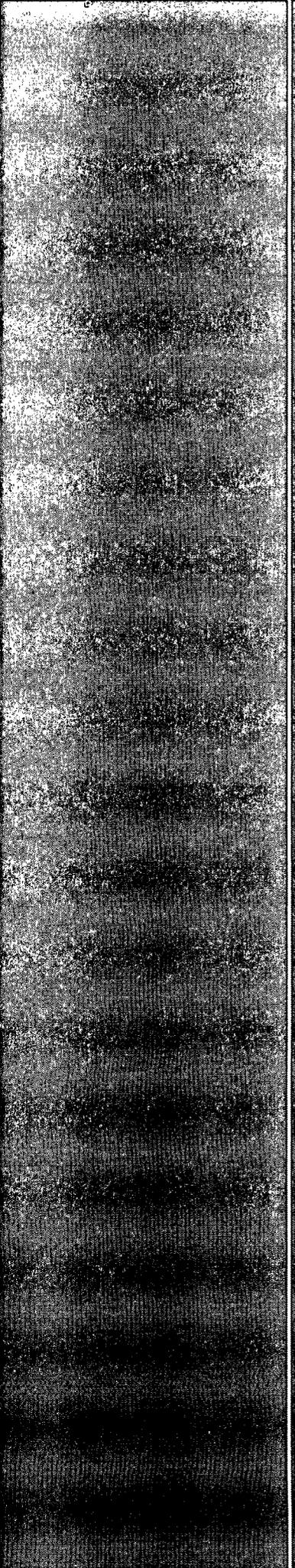
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*=Accredited Analyte

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Celest D. Keene, Lab Director/Quality Manager

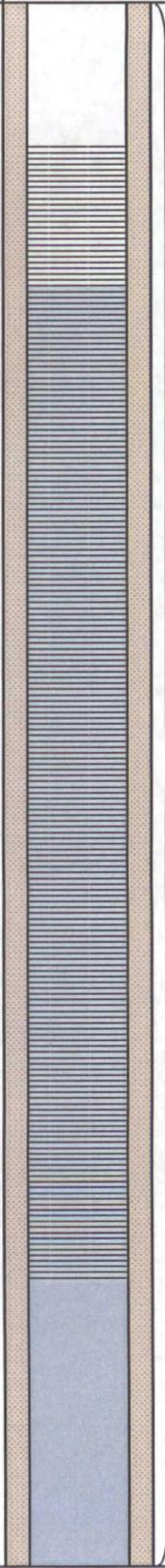


Appendix B

Plug and abandon MW-2 and install RW-1

RICE Environmental Consulting and Safety (RECS)

P.O. Box 5630 Hobbs, NM 88241
Phone 575.393.4411 Fax 575.393.0293

Depth (feet)	chloride field tests	LAB	PID	Description	Lithology	Well Construction																																																			
				Tan sand																																																					
50 ft											Red sandy clay			55 ft				60 ft								NO SAMPLES TAKEN			65 ft				70 ft				75 ft				80 ft				85 ft				90 ft				95 ft				99 ft
				Red sandy clay																																																					
55 ft																																																									
60 ft																																																									
				NO SAMPLES TAKEN																																																					
65 ft																																																									
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85 ft																																																									
90 ft																																																									
95 ft																																																									
99 ft																																																									

sand pack

**Apache Walter Lynch Tank Battery
Plug and abandon MW-2 and install RW-1
Unit F, Section 1, T-22-S, R-37-E**



Plugging MW-2, facing south 9/2/11



Drilling RW-1, facing north 9/2/11



Plugging MW-2 with a 1-3% bentonite slurry, facing north 9/2/11



Using mud rotary to complete drill, facing north 9/2/11



MW-2 plugged, facing north 9/2/11



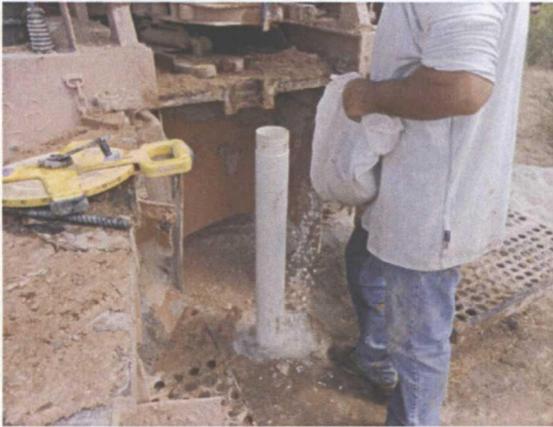
Installing the casing, facing north 9/2/11



Installing the sand pack, facing north 9/2/11



Completed RW-1, facing north 9/2/11



Installing the bentonite seal, facing north



Concreting the well in, facing NW 9/2/11