AE Order Number Banner

Report Description

This report shows an AE Order Number in Barcode format for purposes of scanning. The Barcode format is Code 39.

App Number: pGRL0902035612

1RP - 2053

CML EXPLORATION, LLC

7/26/2016

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

April 18, 2011

Larry Johnson
Oil Conservation Division
1625 N. French Drive
Hobbs, NM 88240
Via Email and FedEx

RE: CML Exploration, Paddy 19 State #3, Unit F, Section 19, T17S, R33E
API #:30-025-38591
Ground Water Monitoring Report and Request for Closure

Dear Larry,

In January 2009, CML closed the drilling pit associated with the above-referenced well by excavation and removal. Confirmation sampling beneath the pit liner identified a release of pit fluids to the vadose zone (see January 23 Notice of Release). The February 2009 Investigation and Characterization Plan described proposed sampling of the vadose zone. In July 2009, a Corrective Action Plan (CAP) presented a remedy to abate the vadose zone so that water contaminants in the vadose zone will not with reasonable probability contaminate ground water or surface water. The CAP also called for the installation of a monitoring well down gradient from the former drilling pit. Appendix A presents the 2009 CAP text that described the proposed remedy as well as results of soil samples at the site.

In December 2009, we submitted a letter presenting ground water quality data collected at that time and describing a plan to extract water from the well on site to remove chloride mass from ground water.

This report:

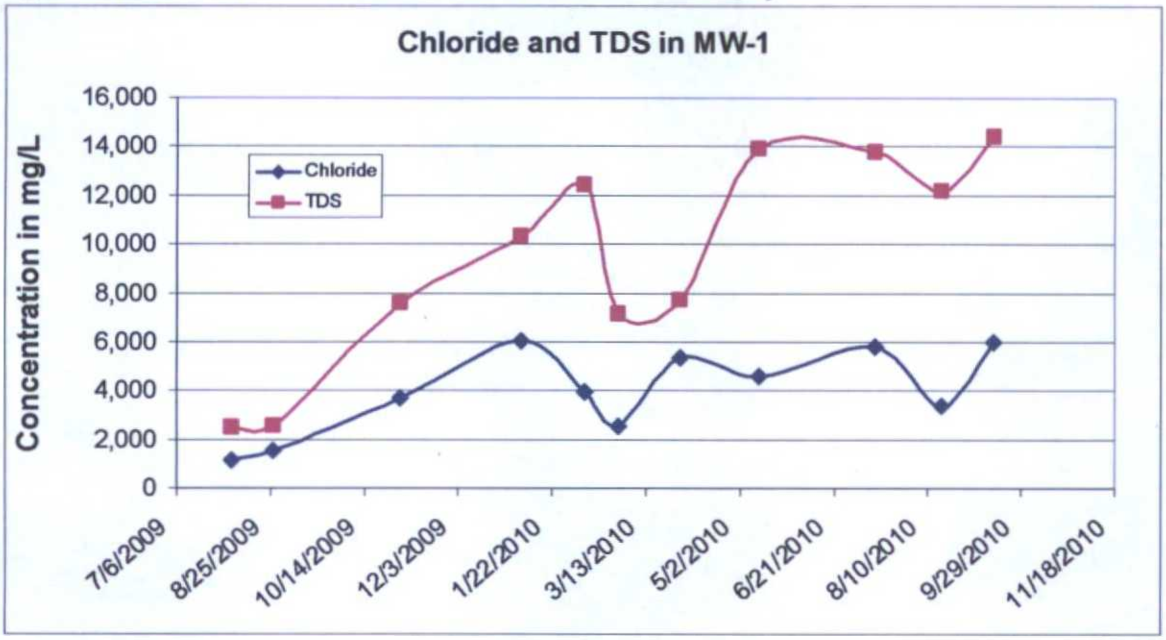
1. Summarizes ground water (and chloride) removal,
2. Presents findings of further investigations which include the installation of three monitoring wells as well as routine sampling of MW-1
3. Provides a discussion of the results and
4. Requests closure of the regulatory file.

MW-1 Ground Water Monitoring Data

MW-1 was installed in July 2009. Ground water sampling data for chloride and TDS concentrations are summarized in Figure 1 below and Table 1.

2053

Figure 1. Concentrations of Chloride and TDS at Paddy 19 #3



Installation of and Data from Three Additional Monitoring Wells

In September 2010, three additional wells were installed at the site to investigate background concentrations, determine the extent of ground water impact and better establish the ground water gradient at the site. A Water Easement Amendment was obtained from the NM State Land Office for these wells. Well logs for monitoring wells at the site are presented in Appendix B.

Plate 1 presents the locations of the four wells at the site, located to the south, east, and north of the former pit, as well as a gradient map based on observed ground water elevations. Plate 2 and Table 1 present the chloride and TDS concentrations from recent samples. The highest observed chloride in ground water at this site is in MW-4, located roughly north of the former pit with a concentration of 13,600 mg/L. MW-3, located southeast of the former pit, has a chloride concentration of 9,820 mg/L and MW-1, just south of the former pit, shows a chloride concentration of 6,020. MW-2, located south of MW-1 shows a chloride concentration of 12.3 mg/L.

As shown in well logs in Appendix B, the saturated thickness of the ground water zone in the area of Paddy 19 #3 ranges from 5-feet (MW-1) to 11 feet (MW-4).

Table 1. Laboratory Results Summary – Ground Water

Monitor Well	Sample Date	Chloride (mg/L)	TDS (mg/L)
MW-1	8/5/2009	1,160	2,490
	8/27/2009	1,500	2,560
	11/2/2009	3,680	7,600
	1/5/2010	6,080	10,300
	2/8/2010	3,930	12,400
	2/26/2010	2,570	7,120
	3/31/2010	5,380	7,690
	5/12/2010	4,580	13,900
	7/13/2010	5,830	13,800
	8/17/2010	3,400	12,200
	9/14/2010	6,020	14,400
MW-2	9/14/2010	12.3	434
MW-3	9/14/2010	9,820	27,600
MW-4	9/14/2010	13,600	35,800

Well Recovery Tests

On August 5, 2009, we conducted a recovery test on MW-1 to provide an estimate of the hydraulic conductivity of the ground water zone. The calculated value is 11.2 feet/day. In September 2010 we conducted a recovery test on MW-2 that gave a calculated value of 11 feet/day. The observed draw down in MW-1 was 5.2 feet and MW-2 it was 5.3 feet. Results of recovery tests are given in Appendix C.

Chloride Mass Removal

Beginning in January of 2010, a pump was set in MW-1 that removed 0.5 gallon per minute (gpm) 24 hours a day. Pumped water was collected in an above ground tank and transported either for use as work over water at another site or properly disposed of at a disposal well. From January 5, 2010 to September 8, 2010 approximately 406,320 gallons were removed from the well. Water from the well was sampled to monitor chloride concentrations about every 20-60 days. Chloride concentrations during this time fluctuated from 6,080 mg/L to 2,560 mg/L with an average concentration (based on the seven sampling events from January to September 2010) of 4,282 mg/L. Using the average chloride concentration observed in MW-1 during this time, we estimate 15,367 lbs of chloride were removed from ground water at the site.

The table below presents results of ground water sampling during ground water removal as well as gallons purged between sampling dates and the total water removed.

Table 2. Chloride observed in ground water at MW-1, Gallons Removed

Monitor Well	Sample Date	Gallons Purged	Chloride (mg/L)
MW-1	7/30/2009	75	--
	8/5/2009	70	1,160
	8/27/2009	56	1,500
	11/2/2009	39	3,680
	1/5/2010	80	6,080
	2/8/2010	33,000	3,930
	2/26/2010	13,000	2,570
	3/31/2010	54,000	5,380
	5/12/2010	90,000	4,580
	7/13/2010	126,000	5,830
	8/17/2010	63,000	3,400
Turn off Pump	9/8/2010	27,000	--
Total gallons purged		406,320	

Land Use History

Aerial photography dated 1996-98, 2005-06 and 2008 are posted on the PRRC website (http://216.93.164.45/prrc_MF/) and are reproduced in Appendix D. Data on oil and gas wells are available through the NMOCD website.

Table 3. Historic Oil and Gas Activity Near the site

Date	Description	Comments
3/11/58	Spud 3002501484	Located about 200 feet east of Paddy 19 #3 drilling pit. The well was probably drilled using an unlined earthen drilling pit.
10/21/95	Spud 3002533083	Located about 1000 feet northwest of Paddy 19#3. Evidence of reserve pit reclamation in 1996-98 aerial photo on PRRC website.
1996-1998	3002533083	Evidence of reserve pit reclamation in 1996-98 aerial photo on PRRC website.
1996-1998	Pipeline	Pipeline located about 50 feet north of Paddy 19 #3 visible on air photograph. No evidence of salt scar.
1996-98	3002501484	Photograph shows evidence of what appears to be salt scars (lack of vegetation)
2005-06	3002533083	Photograph shows re-vegetation proceeding at site of probable reserve pit
2005-06	Pipeline	Photograph shows evidence of salt scar along pipeline north of location of Paddy 19 #3
2005-06	3002501484	Photograph shows re-vegetation along edges of salt scar
2008	3002533083	Photograph shows very minor changes in re-vegetation
2008	Pipeline	Photograph shows no change in salt scar geometry from 2005-06.
2008	3002501484	Photograph shows very minor changes in re-vegetation
2008	Paddy 19 #3	Location of reserve pit in photograph
2010	Pipeline	Field inspection (Figure 4) shows lack of re-vegetation north of former Paddy 19 #3 reserve pit

Figure 2: Vegetation scar along pipeline north of Paddy 19#3

Discussion

The data show the following:

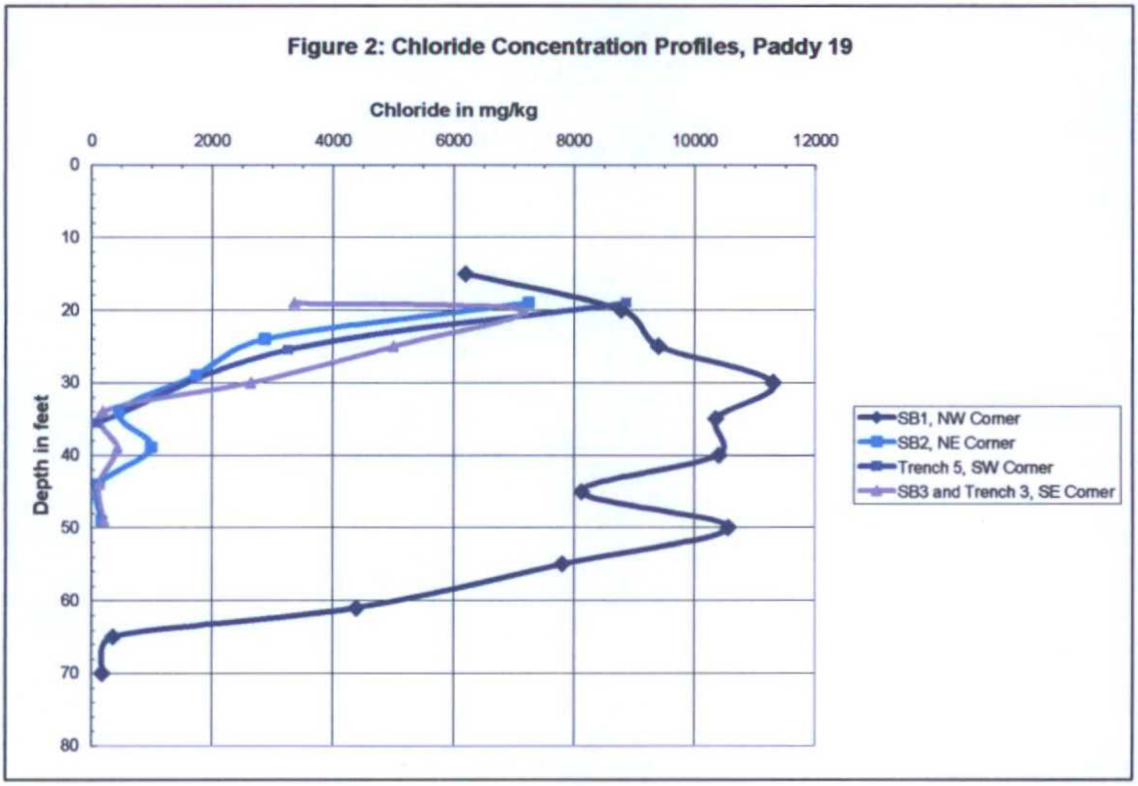
1. Ground water gradient in the area flows to the southeast at a gradient of 0.005 ft/ft as shown on Plate 2.
2. This direction of flow and gradient is consistent with regional data (see regional ground water flow map in Appendix A).
3. Background chloride concentrations in ground water are less than 50 mg/L (MW-2).
4. Ground water chloride concentration up-gradient from the former pit exceeds 10,000 mg/L.
5. Between 1996 and 2006, damage to vegetation occurred along the pipeline right-of-way north of the Paddy 19 #3 reserve pit area.

Plate 3 presents isoconcentration contours of chloride in ground water based upon the following interpretation of the data:

A. Well 3002501484 was drilled using an unlined drilling pit in 1958.
B. Surface spills of produced water at or near well 3002501484 caused damage to vegetation near the well prior to 1996.
C. The pipeline north of Paddy 19 #3 appears to have released produced water to the surface after 1996 and before 2006.
D. Releases from pressurized pipelines will not immediately present evidence at the surface.
E. Produced water releases to the ground surface do not typically cause significant impairment of ground water quality with respect to chloride.
F. Unlined drilling pits or production pits in this area would have released saline fluids to the vadose zone and could have caused impairment of ground water quality.

Figure 2 from the July 2009 Corrective Action Plan shows depth of the center of chloride mass beneath the former drilling pit is between 20 and 60 feet below grade. Samples from SB-1 show chloride concentrations from 170 to 352 mg/kg at 65-70 feet below grade. Chloride concentrations 5-10 feet above the water table obtained from the four monitoring wells range from 54 to 272 mg/kg.

Depth to water measured at MW-1 under non-pumping conditions is typically 75 feet below grade.



Conclusions

The data and interpretations presented above permit the following conclusions:

- A historic release from the pipeline north of the former Paddy 19 #3 reserve pit created saturated flow of produced water from the pipeline to ground water. This release caused chloride concentrations in ground water quality beneath the pipeline to exceed 10,000 mg/L.
- Over time, the area of ground water impairment caused by the release from the pipeline migrated south-southeast with ground water flow.
- Migration of chloride from the 1958 drilling pit associated with well 3002501484 may have caused impairment of ground water quality.
- The existing condition up gradient from the site (as shown in MW-4) is a chloride concentration of 13,600 mg/L and TDS of 35,800 mg/L.
- As identified in NMAC 20.6.2.3103, the chloride standard for ground water beneath the Paddy 19 #3 drilling pit is the existing condition at the site.
- Chloride released from the former Paddy 19 #3 drilling pit did not enter ground water via saturated flow as evidenced by chloride in soil boring data that show relatively low levels of chloride in soil in the 5-10 feet above ground water at the site.
- Soil boring data at the site indicate a very small mass of chloride released from the pit entered ground water near SB-1.
- When originally drilled in 2009, MW-1 was at the western edge of a ground water chloride plume caused by the release of produced water from the pipeline.
- Initial chloride concentrations in ground water observed in MW-1 were 1,160 and 1,500 mg/L in August 2009.
- Pumping of MW-1 caused significant drawdown in the well and localized westward

migration of chloride from the main portion of the ground water plume to the well. This migration is evidenced in the increasing chloride concentration observed in MW-1 during 2009 and 2010.

- No evidence shows that the release from the Paddy 19 #3 pit caused an elevation in chloride concentrations in ground water above the identified existing condition.
- Data and interpretations presented in the CAP show that the proposed remedy effectively caused abatement of the vadose zone so that water contaminants in the vadose zone will not with reasonable probability contaminate ground water or surface water, in excess of the standards in Subsections B and C of 19.15.30.9 NMAC, through leaching, percolation or other transport mechanisms, or as the water table elevation fluctuates.

Recommendations

CML has now:

I. Met all regulatory obligations with respect to closure of the drilling pit
II. Implemented a remedy that prevents ground water impairment due to migration of chloride released from the drilling pit
III. Provided evidence that any release from the former drilling pit has not and will not cause ground water concentrations to exceed ground water standards

Therefore, we respectfully request termination of the regulatory file associated with this site.

We do not propose additional work for this site. Unless NMOCD instructs otherwise, we will *not* plug and abandon the monitoring well network at the site. If you have questions, please contact me at 505-266-5004 or Mr. Nolan von Roeder of CML Exploration, LLC.

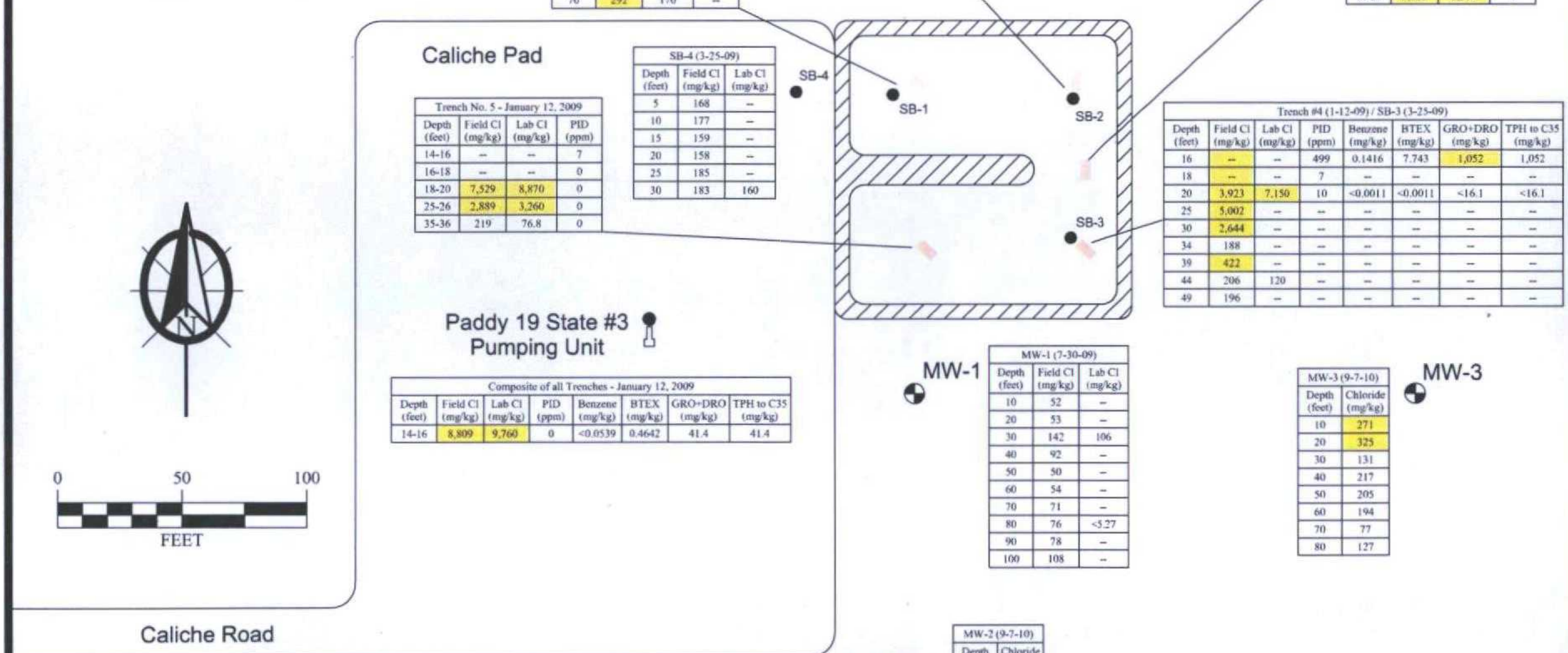
Sincerely,
R.T. Hicks Consultants, Ltd.

Randall T. Hicks
Principal

Copy: CML Exploration, Nolan von Roeder

CML Exploration
Paddy 19 State No. 3
Sec. 19, T-17-S, R-33-E
Lea County, New Mexico
API 30-25-38591

Lab Concentrations Exceeds Regulatory Protection Levels



Trench #1 (1-12-09) / SB-1 (3-25-09)			
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)
15	6,199	--	0
18	--	--	0
20	9,166	8,780	0
25	9,400	--	--
30	11,304	--	--
35	10,350	--	--
40	10,401	--	--
45	8,123	--	--
50	10,559	--	--
55	7,805	--	--
61	4,395	--	--
65	352	--	--
70	292	170	--

Trench #2 (1-12-09) / SB-2 (3-25-09)			
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)
16	--	--	10
18	--	--	0
19	6,665	7,250	0
24	2,875	--	--
29	1,744	--	--
34	454	--	--
39	993	--	--
44	242	110	--
49	159	--	--

MW-4 (9-7-10)	
Depth (feet)	Chloride (mg/kg)
10	286
20	319
30	308
40	255
50	225
60	272
70	54
80	256

Composite Walls - January 12, 2009			
Location	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)
North	4,760	5,050	14
South	3,404	4,630	0
East	714	618	0
West	10,318	13,800	138

Trench No. 3 - January 12, 2009			
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)
14-16	--	--	36
16-18	--	--	21
18-20	5,618	3,360	0

SB-4 (3-25-09)		
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)
5	168	--
10	177	--
15	159	--
20	158	--
25	185	--
30	183	160

Trench No. 5 - January 12, 2009			
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)
14-16	--	--	7
16-18	--	--	0
18-20	7,529	8,870	0
25-26	2,889	3,260	0
35-36	219	76.8	0

Trench #4 (1-12-09) / SB-3 (3-25-09)							
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)	Benzene (mg/kg)	BTEX (mg/kg)	GRO+DRO (mg/kg)	TPH to C35 (mg/kg)
16	--	--	499	0.1416	7.743	1,052	1,052
18	--	--	7	--	--	--	--
20	3,923	7,150	10	<0.0011	<0.0011	<16.1	<16.1
25	5,002	--	--	--	--	--	--
30	2,644	--	--	--	--	--	--
34	188	--	--	--	--	--	--
39	422	--	--	--	--	--	--
44	206	120	--	--	--	--	--
49	196	--	--	--	--	--	--

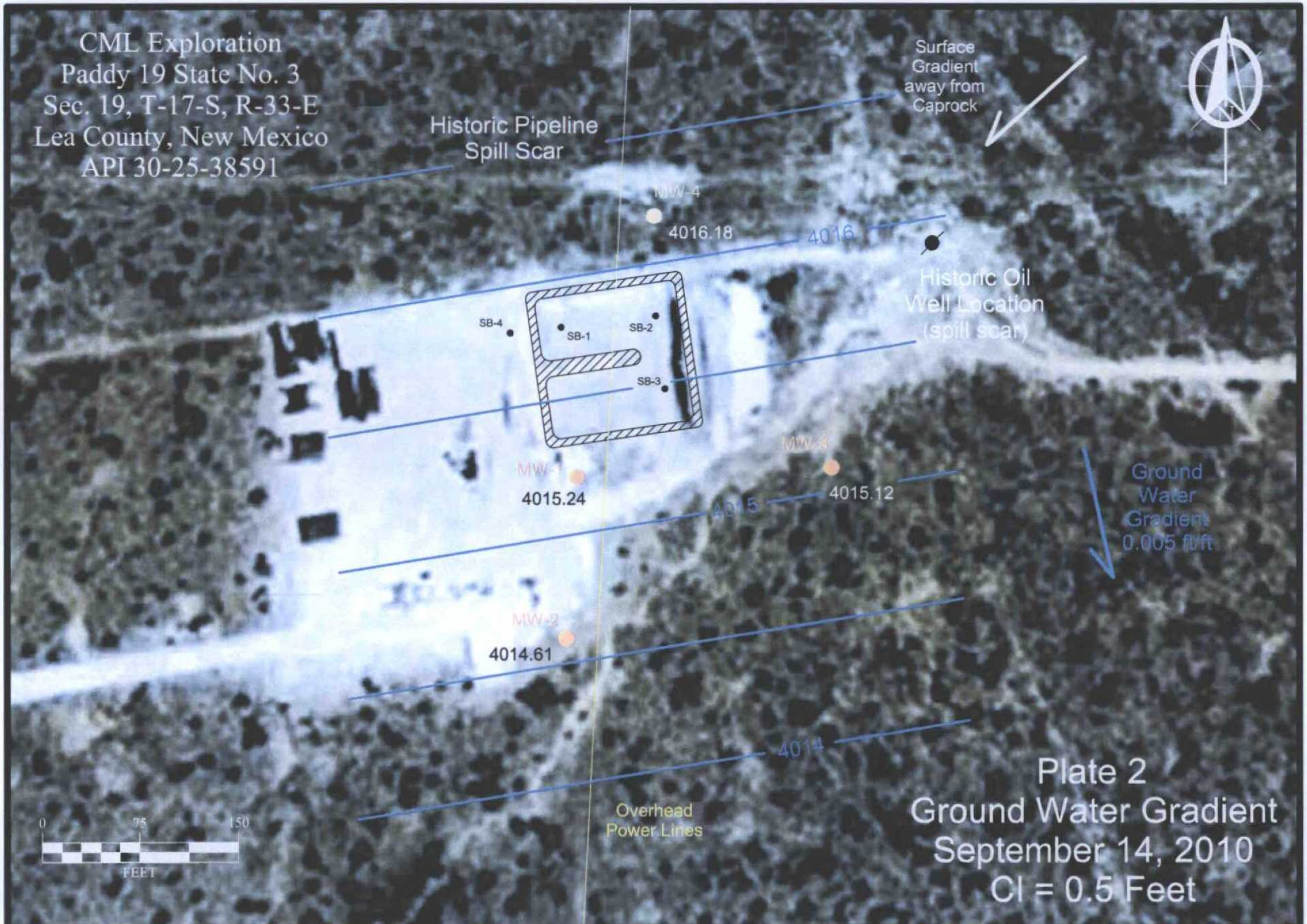
Composite of all Trenches - January 12, 2009							
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)	PID (ppm)	Benzene (mg/kg)	BTEX (mg/kg)	GRO+DRO (mg/kg)	TPH to C35 (mg/kg)
14-16	8,809	9,760	0	<0.0539	0.4642	41.4	41.4

MW-1 (7-30-09)		
Depth (feet)	Field Cl (mg/kg)	Lab Cl (mg/kg)
10	52	--
20	53	--
30	142	106
40	92	--
50	50	--
60	54	--
70	71	--
80	76	<5.27
90	78	--
100	108	--

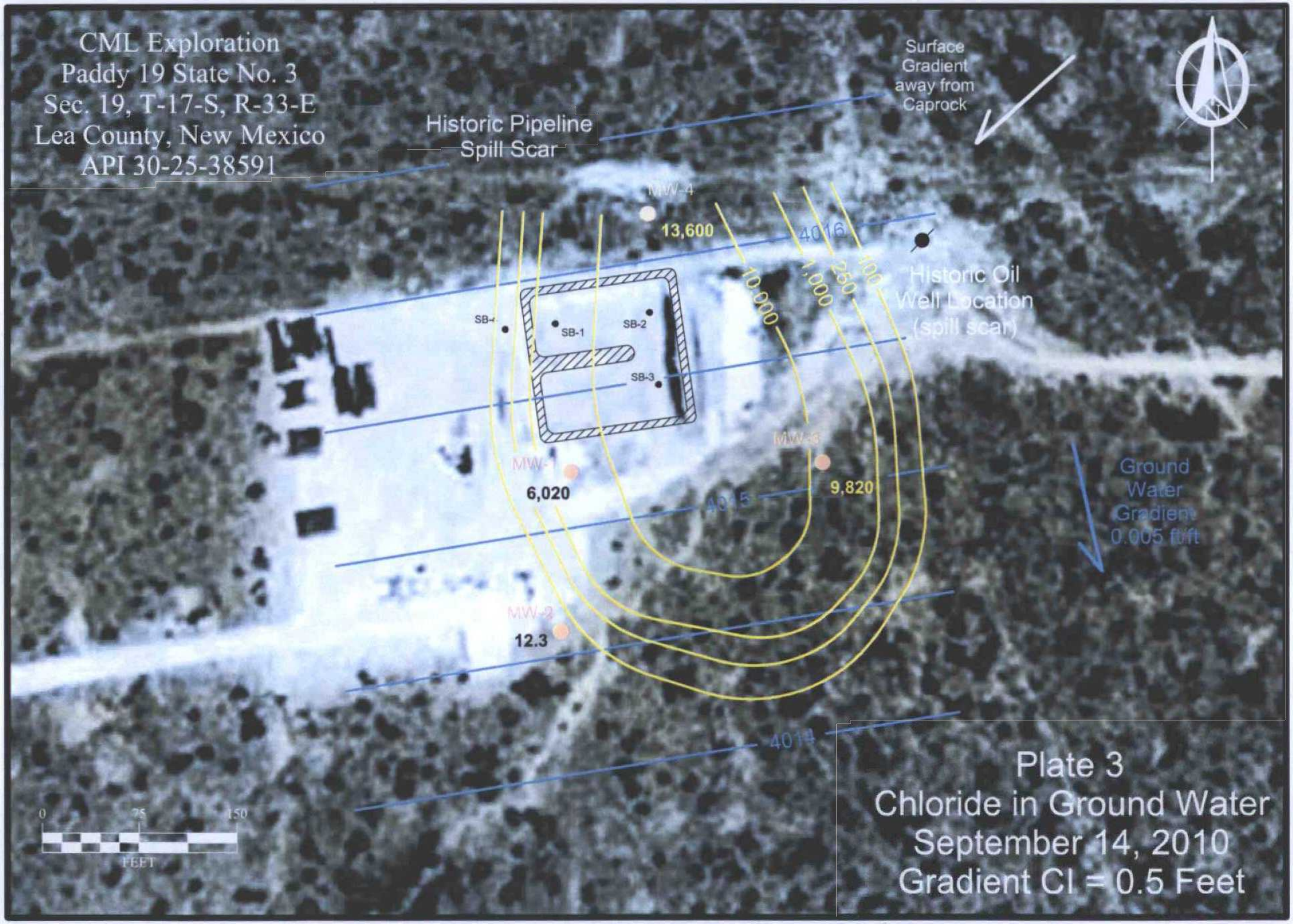
MW-3 (9-7-10)	
Depth (feet)	Chloride (mg/kg)
10	271
20	325
30	131
40	217
50	205
60	194
70	77
80	127

MW-2 (9-7-10)	
Depth (feet)	Chloride (mg/kg)
10	151
20	177
30	145
40	126
50	217
60	129
70	156
80	128

Plate 1
Soil Sample Results



CML Exploration
Paddy 19 State No. 3
Sec. 19, T-17-S, R-33-E
Lea County, New Mexico
API 30-25-38591
Historic Pipeline
Spill Scar
Surface
Gradient
away from
Caprock
MW-4
4016.18
4016
Historic Oil
Well Location
(spill scar)
SB-4
SB-1
SB-2
SB-3
MW-3
4015.12
MW-1
4015.24
4015
Ground
Water
Gradient
0.005 ft/ft
MW-2
4014.61
4014
0
75
150
FEET
Overhead
Power Lines
Plate 2
Ground Water Gradient
September 14, 2010
CI = 0.5 Feet



CML Exploration
Paddy 19 State No. 3
Sec. 19, T-17-S, R-33-E
Lea County, New Mexico
API 30-25-38591
Historic Pipeline Spill Scar
Surface Gradient away from Caprock
MW-4
13,600
4016
10,000
1,000
250
100
Historic Oil Well Location (spill scar)
SB-4
SB-1
SB-2
SB-3
MW-1
6,020
MW-3
9,820
4015
Ground Water Gradient 0.005 ft/ft
MW-2
12.3
4014
0
75
150
FEET
Plate 3
Chloride in Ground Water
September 14, 2010
Gradient CI = 0.5 Feet

Appendix A

Portions of July 2009 CAP

R.T. Hicks Consultants, Ltd.

901 Rio Grande Blvd. NW, Suite F-142

The proposed well completion is presented in Plate 4 as field conditions permit. To collect a composite sample of the entire aquifer, a submersible pump will withdraw at least 3 casing volumes of ground water prior to obtaining a sample from the pump outlet. Sampling protocols will conform to ASTM methods.

To collect a discrete sample of the upper 15-feet of the aquifer, we will lower a discrete water sampler into the well during the last stages of purge pumping. When the sampler reaches the pumping water level, we will collect the sample, which will isolate the water flowing into the upper screen and down the casing toward the pump. To collect a discrete sample from the lower part of the aquifer, we will lower the sampler below the purge pump, purge the well again, and collect a sample of water entering the bottom portion of the screen.

Vadose Zone Remedy – Evaluation of Alternatives

We considered a remedy that called for removal of the chloride mass from the bottom of the pit to a depth of 34-feet below grade (20-feet below the base of the pit excavation). Given that the size of the existing excavation is about 120 feet by 120 feet, the volume of material removed for this remedy was about 10,700 cubic yards. We believe that this remedy removes as much chloride as feasible. Despite being very expensive and requiring the environmental costs associated with removal, hauling and disposal of over 10,000 cubic yards of soil, this remedy would not protect ground water from chloride impact because the chloride mass between 35 and 50 feet below grade would remain in place. Our work shows that this deep chloride mass is likely to cause adverse impact to ground water at the site.

We used Hydrus-1D and Hydrus-2D to simulate a number of alternatives involving the installation of various infiltration barriers without excavation and removal of the residual chloride. The most effective design calls for:

1. Expanding the size of the excavation and placing the removed material (with entrained chloride) into the pit excavation to form a prepared surface for liner placement,
2. Placing a cushioning layer of felt or other material over the bottom of the northern half of the pit,
3. Placing 20-mil smooth linear low density polyethylene (LLDPE) liner over the northern half of the pit according to manufacturer's specifications with felt above and below it to protect against punctures,
4. Placing 2 layers of 40 mil LLDPE with felt between them and felt on top of the top liner over the felt and light liner in more than half of the northwest quadrant ($1/7^{th}$ of the pit),
5. Placing a layer of sand over the liners in accordance with liner manufacturer specifications for cover,
6. Placing an evapotranspiration barrier over the entire pit consisting of:
    a. Coarser-grained caliche gravel obtained from the production pad,
    b. Coarser-grained fractions of the spoil pile (as practicable)
    c. The remainder of the spoil pile over the coarser-grained material

   d. A 2-foot layer of imported fine grained material mixed with the spoil pile and organic material (straw)
   e. A top layer of the original top soil that we believe lies beneath the spoil pile
7. Sloping the entire surface of the pit to shed precipitation away from the NW corner.
8. Placement of a low berm around the perimeter of the pit to infiltrate runoff at the edges of the former pit
9. Seeding the site to establish vegetation over the former pit.

Figure 3. Plan view of remedy design

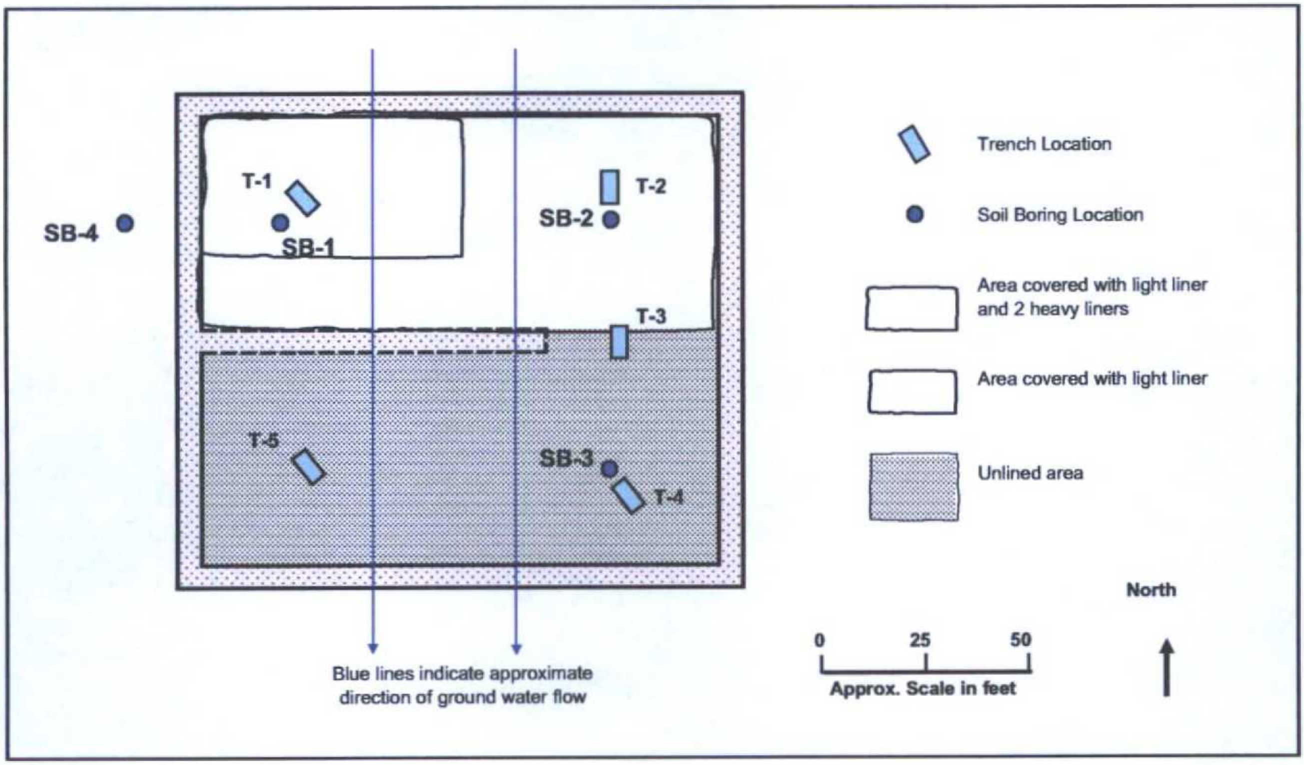


Plate 5 shows the predicted chloride concentrations in ground water down gradient of the eastern and western edges of the pit with the remedy described above, including installation of liners and an ET barrier. Attachment C describes the modeling protocol.

Remedy Efficacy

The remedy design involves various elements designed to significantly slow chloride migration through the vadose zone to ground water and to stagger the time frames that chloride reaches ground water. These design elements include, in summary:

1. An evapotransporation (ET) infiltration barrier using the known physical properties of moisture movement in unsaturated conditions, this barrier

will minimize the downward and upward migration of soluble salts. This barrier includes:

   a. Surface contouring – a slope at the site will encourage the shedding of excess precipitation away from the areas of highest chloride impact,
   b. A 2-foot thick layer of fine grained material mixed with an organic material such as hay to create loam, a suitable soil for plants at the surface,
   c. Re-vegetation – plants decrease the amount of precipitation that infiltrates to ground water by removal of vadose zone pore water from the root zone through root uptake and transpiration (lowering soil moisture content lowers hydraulic conductivity in unsaturated flow).
   d. A layer of coarse grained material placed on the current excavation floor to act as a capillary barrier to upward movement of water and chloride in the future.

2. Placement of 20 mil linear low density polyethylene (LLDPE) over the northern half of the pit with felt above and below it,
3. Placement of two 40 mil LLDPE liners in more than half of the NW corner of the pit with felt above and below each liner.

With respect to the performance of ET infiltration barriers, we researched the performance criteria of numerous landfill closure designs included examination of the following documents, all of which are available through the Internet. Research by Sandia National Laboratories concluded that this system can work very well in arid and semi-arid environments such as New Mexico. A list of web addresses for supporting information on this topic is included in Attachment D.

With respect to the predicted performance of the LLDPE, we found geomembrane lifetime predictions consider a number of factors that could influence liner failure either through chemical degradation or physical stresses on the tensile strength of the liner. Chemical degradation may be encouraged through liner exposure to: ultraviolet light, oxidation, ozone, hydrolysis, harsh chemicals, radioactive materials, biological factors, and extreme temperature. Physical stresses that may impact the liner's tensile strength include stress states, exposure to tears, stretching and the like. Through white papers on this topic and personal communication with Robert Koerner of the Geosynthetic Institute, we understand that a buried LLDPE that is not exposed to harsh chemicals or radioactive material may not chemically degrade for 400-1,000 years or more. Factors impacting the tensile strength of the liner (causing stress cracks, punctures, or tears) will likely occur many years before the liners begin to chemically degrade. While the combinations of circumstances that generate stress cracking are not well established, the industry rates liners based on tensile strength a number of ways including: break strength, break elongation, tear resistance, and puncture resistance.

The selected remedy design is based on a model that makes conservative assumptions about the possible life of the liner (that is, a liner life much shorter than industry predictions), and relies on a difference in liner life spans between the heavy and light liners of 150 years. Thus, our main concern in choosing light and heavy liner weights was the difference in tensile strengths. We selected two 40 mil LLDPE liners with felt between them and above and below them for the heavy liner and a 20 mil LLDPE for the light liner. Of note is that the light liner extends beneath the heavy liner.

A single 40 mil LLDPE is about twice as strong as a 20 mil LLDPE on at least four tests related to tensile properties. Table 2, below, compares tensile properties of 20 and 40 mil smooth LLDPE as given in a Geosynthetic Research Institute document presented in Attachment D. As punctures and tears are considered the earliest likely threat to liner integrity, the addition of felt between liners and the use of two 40 mil liners plus the underlying 20 mil liner and felt for the "heavy" liner element should increase the time to liner break-down due to mechanical forces.

Table 2. Selected Properties of Linear Low Density Polyethylene Geomembrane (Smooth)

Excerpted from Table 1a, *Test Properties, Testing Frequency and Recommended Warranty for LLDPE Smooth and Textured Geomembranes*, Geosynthetic Research Institute, June 2003.

Properties	Test Method	Test Value		% Difference
		20 mil	40 mil	
Break Strength (lb/in)	D 6693	76	152	50%
Break elongation (%)	Type IV	800	800	none
2% Modulus (lb/in) max	D 5323	1200	2400	50%
Tear Resistance (lb) min ave	D 1004	11	22	50%
Puncture Resistance (lb) min ave	D 4833	28	56	50%

Attachment D provides papers regarding research on the life of geomembrane liners.

Monitoring Plan

We are currently monitoring the efficacy of infiltration barriers using soil moisture measurement methods (gypsum blocks) and ground water monitoring at the following sites three sites with open regulatory files in southeastern New Mexico.

At all three sites the monitoring data demonstrate that the infiltration barriers are functioning as designed and are effective in sequestering residual chloride in the vadose zone. We will implement the same monitoring protocol at the Paddy 19 #3 site. The soil moisture monitoring program at the site will be:

1. Install gypsum block soil moisture measurement devices in one location on the former pit. Devices will be nested and placed at three depths bgs:
   a. 2-feet above the liners in the lower, coarse-grained portion of the barrier

   b. 4- to 6-feet above the liners in the central portion of the barrier and
   c. 2-3 feet below the graded surface, in the lower portion of the fine-grained topsoil section of the barrier
2. Monitor vegetation cover over the former pit,
3. Four quarters of ground water monitoring for chloride and TDS. If we find the aquifer has sufficient saturated thickness, we plan to sample ground water from:
   a. Discrete samples from the upper 10-feet of the water table aquifer,
   b. Composite samples taken from the purge pump of the entire saturated thickness, and
   c. Discrete samples from the lowermost 10-feet of the water table aquifer.
4. Upon observation of 4 quarters of ground water monitoring with constituents of concern levels below WQCC standards, we plan 2 years of annual composite samples from the aquifer. Should ground water monitoring reveal chloride impact to ground water, the scheduled ground water monitoring plan will be reconsidered.

Appendix B

Monitoring Well Logs

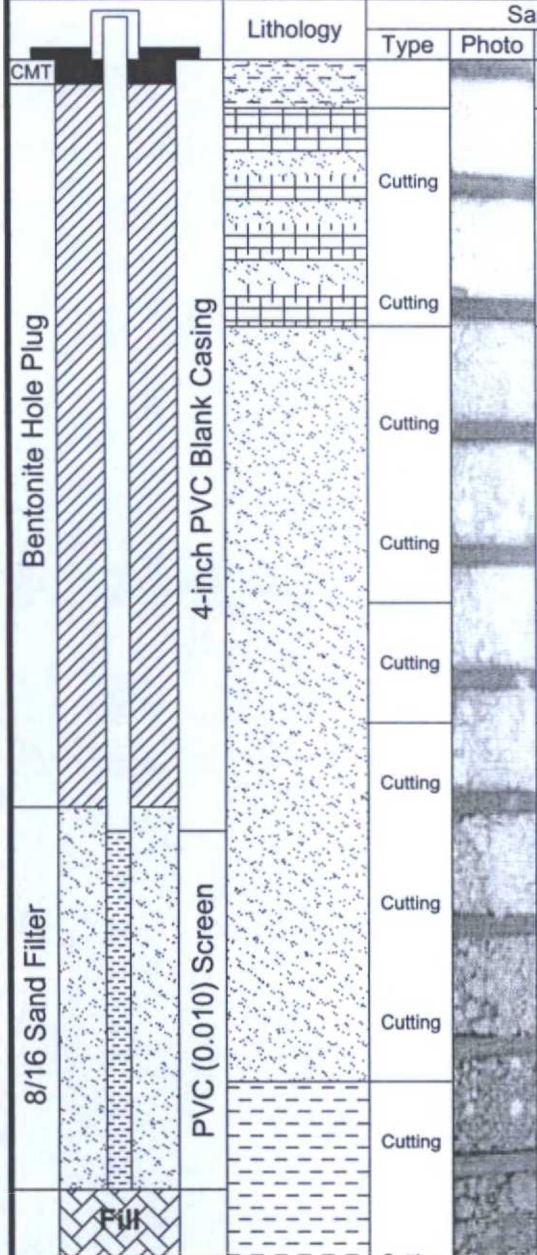
R.T. Hicks Consultants, Ltd.

901 Rio Grande Blvd. NW, Suite F-142

RT Hicks Consultants Ltd
P O Box 7624
Midland, Texas 79708
(432) 528-3878
(432) 689-4578 (fax)

LITHOLOGIC LOG (Monitoring Well)

SOIL BORING NO.: MW-1
TOTAL DEPTH: 100 Feet
SITE ID: Paddy 19 State #3
CLIENT: CML Exploration
SURFACE ELEVATION: 4091.0 (4092.99 csg)
COUNTY: Lea County
CONTRACTOR: Harrison Cooper
STATE: New Mexico
DRILLING METHOD: Air-Rotary
LOCATION: T17-S R33-E Sec 19
INSTALLATION DATE: 7/30/09
FIELD REP: D. Littlejohn
WELL PLACEMENT: 30' South of Res. Pit
FILE NAME: \CML\Paddy 19
BORING LAT /LONG: Lat. 32° 49' 16.9" N, Long. 103° 42' 20.2" W



Sample Type	Cl (mg/kg)	PID (ppm)	Depth (feet)
Cutting	52	--	10
Cutting	53	--	20
Cutting	142	--	30
Cutting	92	--	40
Cutting	50	--	50
Cutting	54	--	60
Cutting	71	--	70
Cutting	76	--	80
Cutting	78	--	90
Cutting	108	--	100

Lithologic Description: LITHOLOGY, Color, grain size, sorting, rounding, special features

- SILTY SAND Reddish brown with some caliche from pad.
- CALICHE AND SAND Light brown to light reddish brown, solid caliche layers at 4 to 6 feet and 18 to 20 feet, fine grain well sorted angular sand.
- SAND Reddish brown, with some caliche, fine to medium grain, poorly sorted, sub-angular sand.
- SAND Reddish brown, with some caliche, fine to medium grain, well sorted, sub-angular sand.
- SAND Reddish brown, medium grain, well sorted, sub-rounded.
- Saturated Formation from approximately 75 to 80 feet
- SILTY CLAY Dark purple, dry (red beds).

TD = 100 Feet

Laboratory Results for Soil (8-11-09)

Depth (feet)	Chloride (mg/kg)	TDS (mg/kg)
30	106	--
80	<5.27	--

Laboratory Results for Ground Water

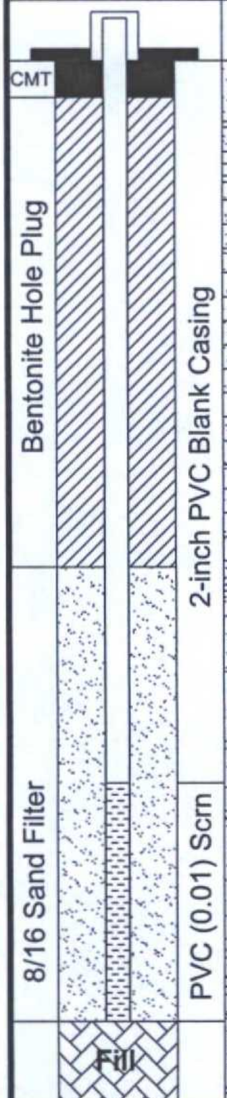
Date	Chloride (mg/L)	TDS (mg/L)
9-14-10	6,020	14,400

RT Hicks Consultants Ltd

P O Box 7624
Midland, Texas 79708
(432) 528-3878
(432) 689-4578 (fax)

LITHOLOGIC LOG (Monitoring Well)

SOIL BORING NO.: MW-2
TOTAL DEPTH: 87 Feet
SITE ID: Paddy 19 State #3
CLIENT: CML Exploration
SURFACE ELEVATION: 4087.2 (4089.03 csg)
COUNTY: Lea County
CONTRACTOR: Atkins Engineering
STATE: New Mexico
DRILLING METHOD: Air-Rotary
LOCATION: T17-S R33-E Sec 19
INSTALLATION DATE: 9/7/10
FIELD REP: D. Littlejohn
WELL PLACEMENT: 136' South of MW-1
FILE NAME: \CML\Paddy 19
BORING LAT /LONG: Lat. 32° 49' 15.6" N, Long. 103° 42' 20.3" W



Depth (feet)	Type	Cl (mg/kg)	PID (ppm)	Lithologic Description: LITHOLOGY, Color, grain size, sorting, rounding, special features
0				SILTY SAND Reddish brown poorly sorted, angular.
5				CALICHE with some interbedded silt.
10	Cutting	151	--	SILTY SAND Light brown to grayish brown, very fine grain, poorly sorted, angular, silt decreasing with depth.
20	Cutting	177	--	
30	Cutting	145	--	
40	Cutting	126	--	
45				SAND Light brown, fine to medium grain, poorly sorted, sub-angular.
50	Cutting	217	--	
60	Cutting	129	--	
64				SAND Brown to light brown, fine to medium grain, poorly sorted, rounded to sub-rounded, slightly moist from 68 feet.
70	Cutting	156	--	
78				SAND Reddish Brown, medium grain, medium sorted, rounded to sub-rounded, moist.
80	Cutting	128	--	
86				CLAY Dark reddish brown (red beds), plugged bit.

TD = 87 Feet

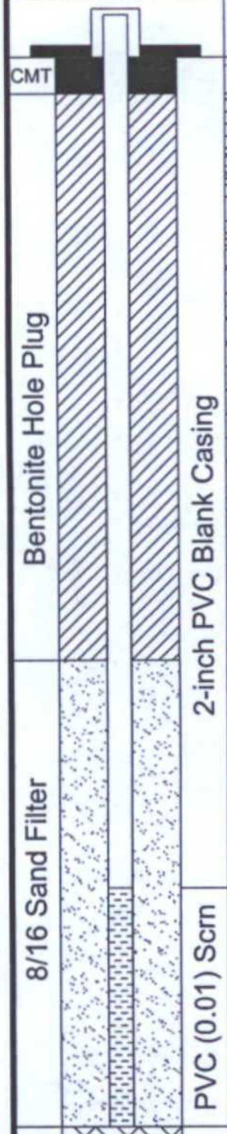
Saturated Formation from approximately 73 to 86 feet

Laboratory Results for Ground Water		
Date	Chloride (mg/L)	TDS (mg/L)
9-14-10	12.3	434

RT Hicks
Consultants Ltd
P O Box 7624
Midland, Texas 79708
(432) 528-3878
(432) 689-4578 (fax)

LITHOLOGIC LOG (Monitoring Well)

SOIL BORING NO.:	MW-3	TOTAL DEPTH:	90 Feet
SITE ID:	Paddy 19 State #3	CLIENT:	CML Exploration
SURFACE ELEVATION:	4092.6 (4094.87 csg)	COUNTY:	Lea County
CONTRACTOR:	Atkins Engineering	STATE:	New Mexico
DRILLING METHOD:	Air-Rotary	LOCATION:	T17-S R33-E Sec 19
INSTALLATION DATE:	9/7/10	FIELD REP:	D. Littlejohn
WELL PLACEMENT:	201' East of MW-1	FILE NAME:	\CML\Paddy 19
BORING LAT /LONG:	Lat. 32° 49' 17.0" N, Long. 103° 42' 17.8" W		



Type	Cl (mg/kg)	PID (ppm)	Depth (feet)	Lithologic Description: LITHOLOGY, Color, grain size, sorting, rounding, special features
			0–4	SILTY SAND Reddish brown poorly sorted, angular.
			4–9	CALICHE with some interbedded silt.
			9–11	SILT with some interbedded caliche.
Cutting	271	--	10	CALICHE AND SANDSTONE Grayish white, with some dark gray quartzite.
			15–60	SILTY SAND Pinkish brown, very fine grain, well sorted, angular, silt decreasing with depth.
Cutting	325	--	20	
Cutting	131	--	30	
Cutting	217	--	40	
Cutting	205	--	50	
Cutting	194	--	60	
			61–72	SAND Light brown to pinkish brown, fine grain, moderate to poorly sorted, sub-angular, slightly moist.
Cutting	77	--	70	
			72–78	SAND Brown, fine to medium grain, moderately sorted, sub-rounded.
Cutting	127	--	80	SAND Reddish Brown, medium grain, well sorted, rounded to sub-rounded, very moist.
			85–90	SILTY CLAY Dark reddish brown (red beds).

Saturated Formation from approximately 77 to 85 feet

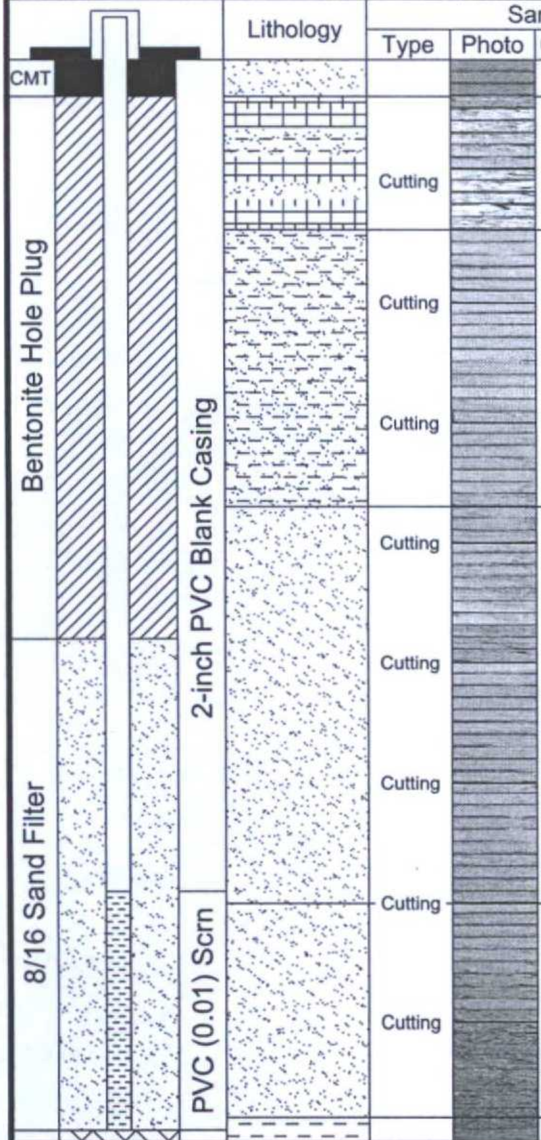
Laboratory Results for Ground Water		
Date	Chloride (mg/L)	TDS (mg/L)
9-14-10	9,820	27,600

RT Hicks Consultants Ltd

P O Box 7624
Midland, Texas 79708
(432) 528-3878
(432) 689-4578 (fax)

LITHOLOGIC LOG (Monitoring Well)

SOIL BORING NO.:	MW-4	TOTAL DEPTH:	90 Feet
SITE ID:	Paddy 19 State #3	CLIENT:	CML Exploration
SURFACE ELEVATION:	4093.2 (4095.51 csg)	COUNTY:	Lea County
CONTRACTOR:	Atkins Engineering	STATE:	New Mexico
DRILLING METHOD:	Air-Rotary	LOCATION:	T17-S R33-E Sec 19
INSTALLATION DATE:	9/7/10	FIELD REP:	D. Littlejohn
WELL PLACEMENT:	238' NNE of MW-1	FILE NAME:	\CML\Paddy 19
BORING LAT /LONG:	Lat. 32° 49' 19.2" N, Long. 103° 42' 19.4" W		



TD = 90 Feet

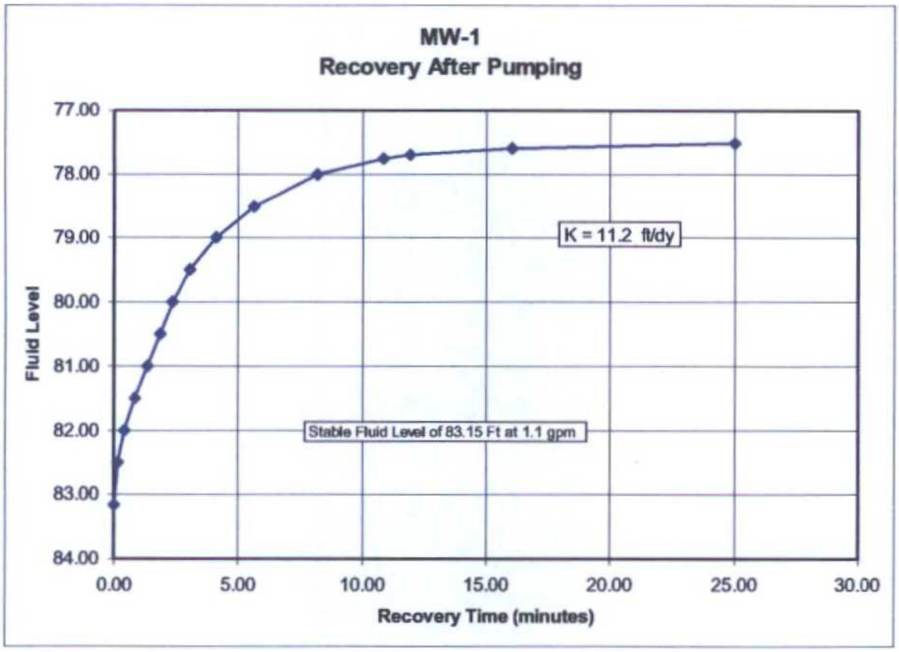
Depth (feet)	Sample Type	Cl (mg/kg)	PID (ppm)	Lithologic Description: LITHOLOGY, Color, grain size, sorting, rounding, special features
0				SILTY SAND Reddish brown poorly sorted, angular.
3				CALICHE AND SANDSTONE Grayish white, with some dark gray quartzite.
10	Cutting	286	--	
15				SILTY SAND Light pinkish brown, sand fine grain, well sorted, angular, interbedded with siltier sand.
20	Cutting	319	--	
30	Cutting	308	--	
37				SAND Light brown, with some silt, fine grain, moderately sorted, angular.
40	Cutting	255	--	
50	Cutting	225	--	
60	Cutting	272	--	
68				Thin hard sandstone at 68 feet.
70	Cutting	54	--	SAND Brown, fine to medium grain, moderately sorted, sub-rounded.
77				Saturated Formation from approximately 77 to 88 feet
80	Cutting	256	--	
88				CLAY Dark reddish brown (red beds).

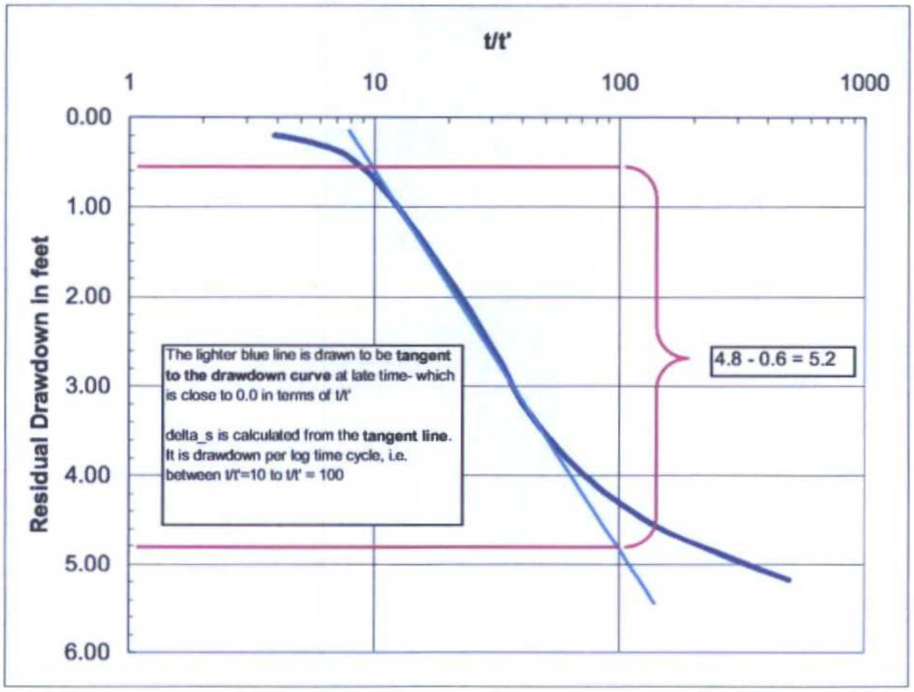
Laboratory Results for Ground Water		
Date	Chloride (mg/L)	TDS (mg/L)
9-14-10	13,600	35,800

Appendix C

Draw Down Test Results

R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142

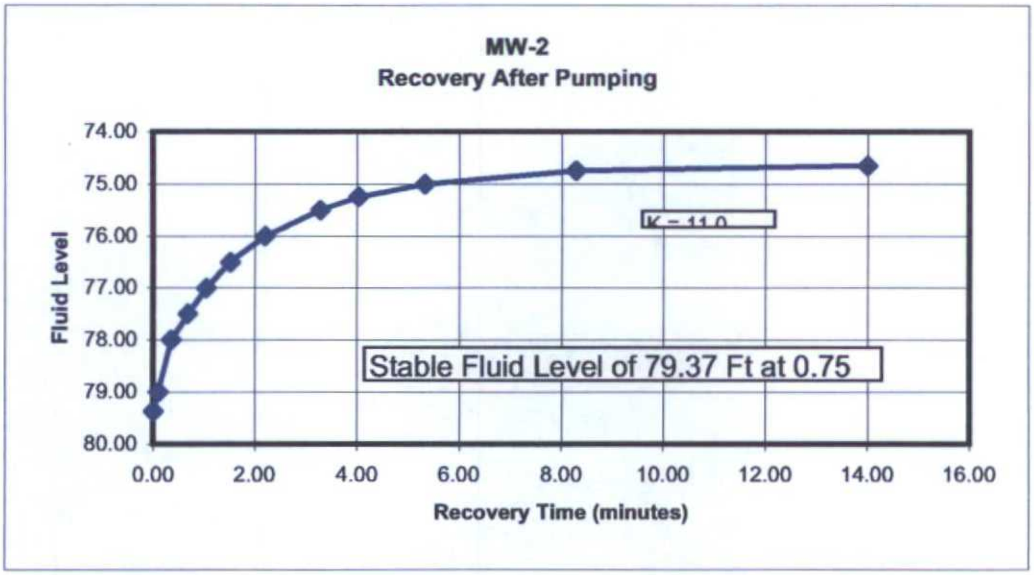


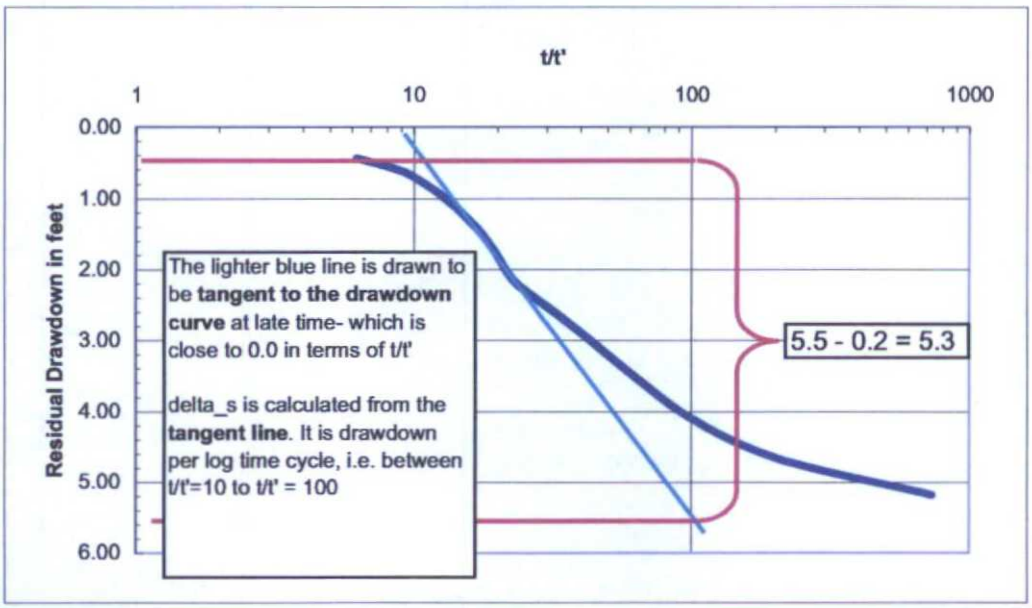


				delta_s is calculated from graph
Input	Pumping Rate	1.10	[gal/min]	Input 5.2 [feet]

T = (264*Q)/delta_s delta_s is residual drawdown in feet per log time cycle (Page 256, Groundwater and Wells)

Output	T =	55.84615	[feet^2/day]
Input	Aquifer thickness	5	[feet]
Output	Resultant K	11.16923	[feet/day]





				delta_s is calculated from graph	
Input	Pumping Rate	1.10	[gal/min]	Input	5.3 [feet]

T = (264*Q)/delta_s delta_s is residual drawdown in feet per log time cycle (Page 256, Groundwater and Wells)

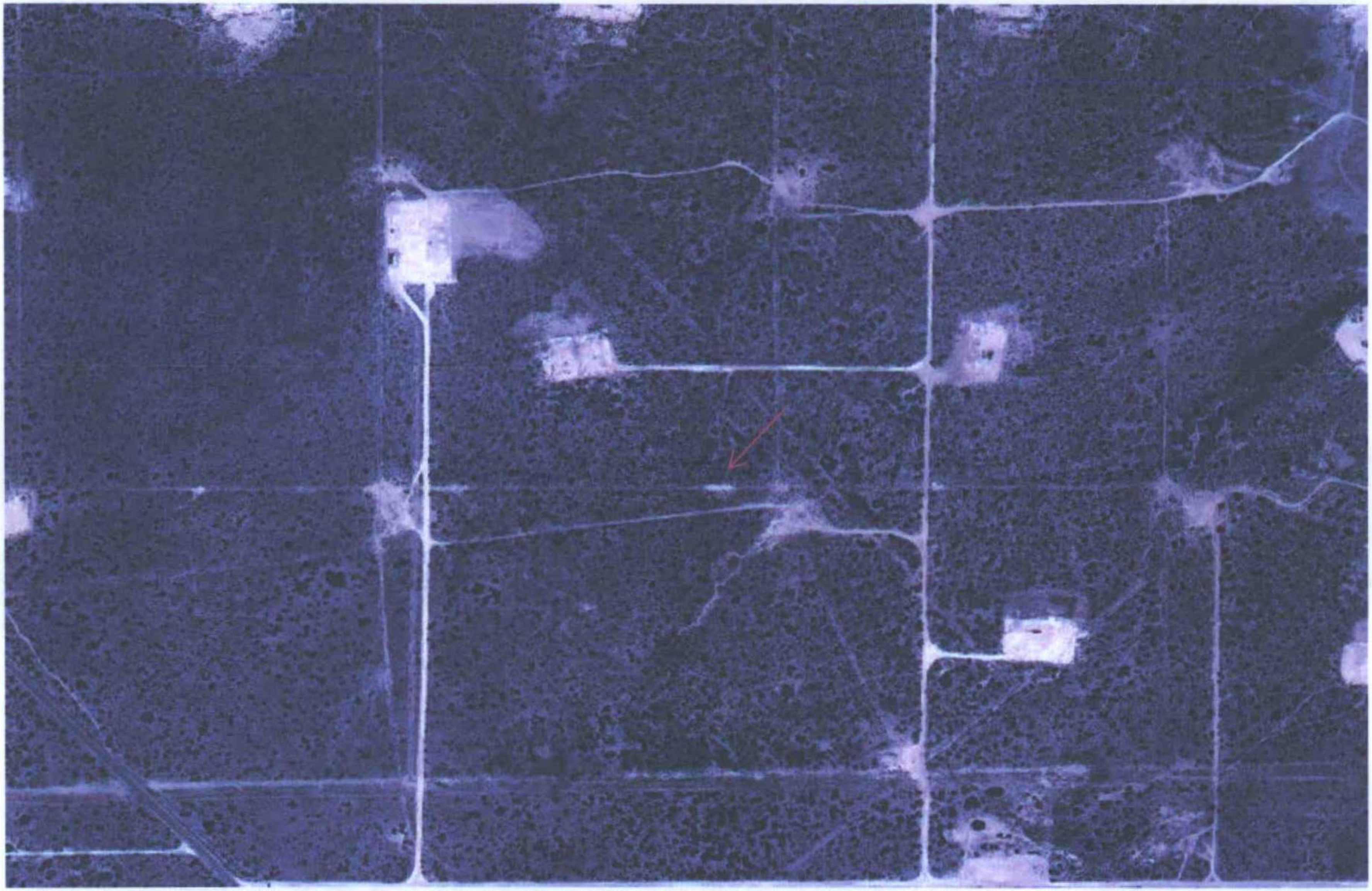
Output	T =	**54.79245**	[feet^2/day]
Input	Aquifer thickness	**5**	[feet]
Output	Resultant K	**10.95849**	[feet/day]

Appendix D
Historic Aerial Photographs

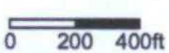
R.T. Hicks Consultants, Ltd.
901 Rio Grande Blvd. NW, Suite F-142

S:/PROJECTS/SW ROYALTIES/SECTION21BATTERY/P2USGSGEOLPADDY.MXD

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	2008 Air Photograph	Figure D1
	CML Exploration- Paddy 19 #3	Nov 10

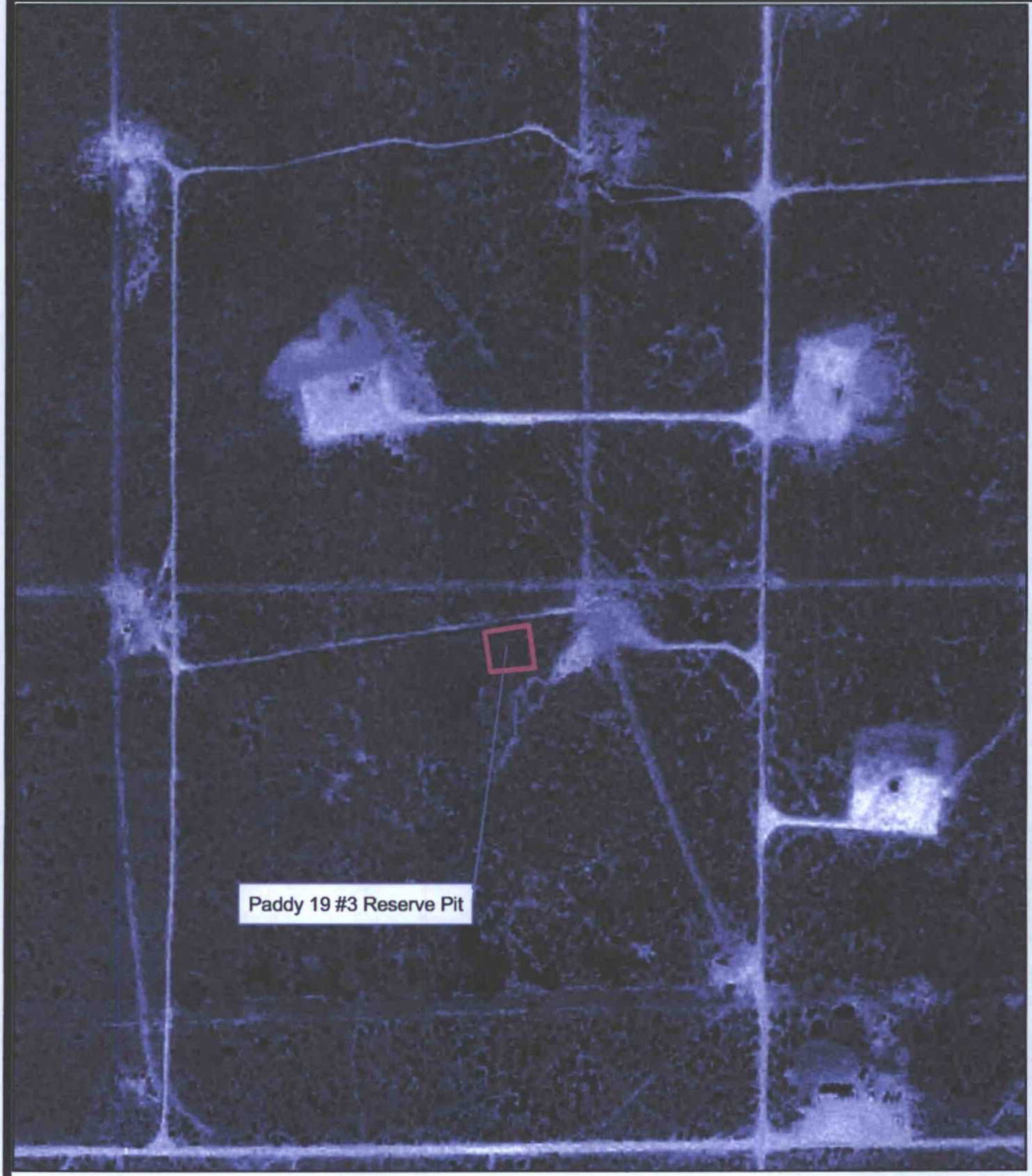


Distance (ft): 200 300 500 1000



Petroleum Recovery Research Center	2005-06 Air Photo - Location of Pipeline Release Scar	Figure D2
	CML Exploration - Paddy 19 #3	Nov 04, 2010

S:/PROJECTS/SW ROYALTIES/SECTION21BATTERY/P2USGSGEOLPADDY.MXD



0 100 200 300 400
Feet

N
W E
S

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	1996-98 Air Photograph	Figure D3
	CML Exploration- Paddy 19 #3	Nov 10