

**Bratcher, Mike, EMNRD**

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**From:** Kindley, Jeff [Jeff.Kindley@tetrattech.com]  
**Sent:** Wednesday, April 01, 2009 2:32 PM  
**To:** Bratcher, Mike, EMNRD  
**Cc:** Skip.Wedel@unitcorp.com  
**Subject:** Unit Petroleum Company Gourley #3  
**Attachments:** report.pdf

Mr. Bratcher,

Please find attached a copy of the Unit Petroleum Company Gourley #3 monitor well installation and sampling report.

A hard copy of this email will be sent to your office.

If you have any questions or comments, please feel free to contact either myself or Gary Miller at (432) 682-4559.

Thanks,

**Jeffrey Kindley, PG | Senior Environmental Geologist**  
Cell: 432.634.2263 | Main: 432.682.4559 | Fax: 432.682.3946  
[Jeff.Kindley@tetrattech.com](mailto:Jeff.Kindley@tetrattech.com)

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**TETRA TECH**

April 1 2009

Mr. Mike Bratcher  
NMOCD District II  
1301 W. Grand Avenue  
Artesia, New Mexico 88210

**Re: Groundwater Investigation for Pit Closure on the Unit Petroleum Company,  
Gourley Federal #3 Well, Unit H, Section 28, T-22-S, R-28-E, Eddy County,  
New Mexico**

Mr. Bratcher:

Tetra Tech Inc. (Tetra Tech) submits the following Groundwater Investigation for Pit Closure on the Unit Petroleum Company, Gourley Federal #3 Well, located at Unit H, Section 28, T-22-S, R-28-E in Eddy County, New Mexico. This report details the installation and sampling of one up-gradient monitor well at the site and the sampling of one off-site abandoned 18" water well located approximately 1-mile southwest of the site. Figures 1 and 2 details the site location.

### **Background**

In June 2007, Sweatt Construction was contracted to perform a pit closure at the above referenced facility. The site was excavated to maximum depth of 20 feet below ground surface (bgs) and sampled in the field for chlorides. Select confirmation samples were collected for verification, and submitted to Trace Analysis, Inc. of Lubbock, Texas for analysis of chlorides utilizing EPA Method 300.0E.

In January 2009, Tetra Tech was contacted by Unit Petroleum Company to perform confirmation sampling on the open pit. Details of the findings can be found in the report entitled "*Additional Information for Pit Closure Procedure on the Unit Corporation, Gourley Federal # 3 Well*", dated and submitted to the NMOCD on January 19, 2009.

### **Monitor Well Installation**

At the request of the NMOCD, Tetra Tech, Inc. was onsite February 19, 2009 to oversee the installation of a 2" monitor well up-gradient of the pit. The monitor well was drilled to a depth of 60' below ground surface (bgs) and installed with 30' of 0.02" slotted

Tetra Tech

1210 South Bq. Street, Suite 100, Azusa, CA 91701  
Tel: 626 582-4000 Fax: 626 582-3936 [www.tetra-tech.com](http://www.tetra-tech.com)



**TETRA TECH**

PVC at the bottom of the well boring. The remainder of the well boring from approximately 30' bgs to the surface was completed with blank PVC casing. A filtration pack of graded silica sand was placed in the well bore to approximately 3 feet above the screen (25' bgs). A layer of bentonite pellets, approximately 3 feet thick was placed in the borehole above the sand. The remainder of the borehole was filled with a 5% bentonite/concrete slurry and brought up to surface grade. The surface was completed with a monument style locking steel protector with a 3' by 3' concrete pad. Groundwater was encountered at approximately 48' bgs. See Figure 3 for monitor well location. See Appendix A for monitor well construction diagram and soil boring log.

Following installation, the well was developed by using a pump to remove the fine grain sediments, disturbed during drilling, and to ensure collection of representative groundwater samples. Water removed from the monitor well was placed in a 55-gallon drum located adjacent to the monitor well.

On February 25, 2009, Tetra Tech personnel were onsite to purge and sample both the newly installed monitor well MW-1 and the abandoned 18" water well located approximately 1-mile southwest of the site. Prior to sampling, both of the wells were gauged and approximately three casing volumes of water were purged. The pump and associated tubing were decontaminated with a laboratory grade detergent and rinsed with deionized water. Groundwater samples were collected as soon as possible after the groundwater returned to its static level. Groundwater samples were collected using clean disposable polyethylene bailers and disposable line. The samples were transferred into labeled containers provided by the laboratory. The samples were delivered under proper chain-of-custody control to Trace Analysis, Inc. of Midland, Texas. The groundwater samples were analyzed for major anions by EPA methods 310.1, 9253, and 375.4, major cations by method 6010B, and Total Dissolved Solids (TDS) by method 160.1. Copies of the laboratory reports are enclosed in Appendix B.

#### **Monitor Well Sample Results**

The chloride concentration for the abandoned 18" water well located approximately 1-mile southwest of the site is 284 mg/L, while the up-gradient monitor well MW-1, has a chloride concentration of 3,220 mg/L. Total dissolved solids (TDS) concentrations for the abandoned 18" water well is 2,630 mg/L, while MW-1 had a TDS of 7,800 mg/L. Groundwater analytical results are summarized in Table 1.

Stiff diagrams for both monitor well MW-1 and the 18" abandoned water well were created based on the analytical results for the sampling event. The stiff diagrams for both wells are relatively uniform with no skewing. This indicates the chloride concentrations at the sites are relatively natural. The naturally elevated chloride concentration in monitor well MW-1 is indicative of groundwater associated with the Rustler Formation which is the predominant groundwater west and east of the Pecos River. Stiff diagrams are enclosed in Appendix C.

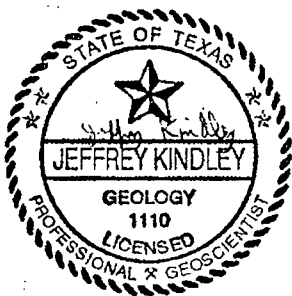


TETRA TECH

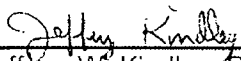
### Conclusions

1. Up-gradient monitor well MW-1 had chloride concentrations of 3,220 mg/L, while the 18" abandoned water well located approximately 1-mile southwest of the site is 284 mg/L.
2. The Stiff diagrams for both MW-1 and the 18" abandoned water well is relatively uniform with no skewing indicating the chloride concentration in the groundwater is relatively natural. The naturally elevated chloride concentration in monitor well MW-1 is indicative of groundwater associated with the Rustler Formation which is the predominant groundwater west and east of the Pecos River.

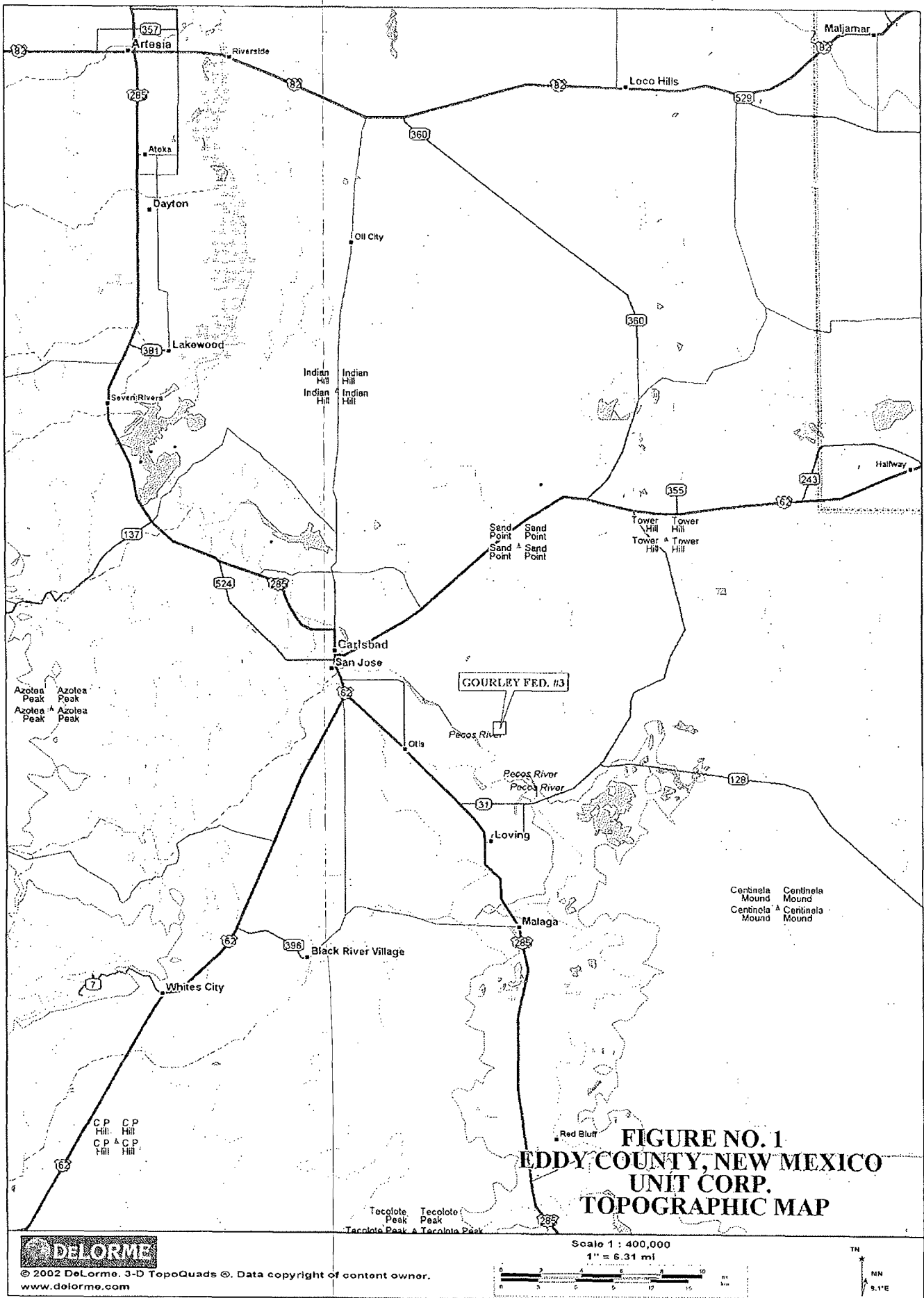
Since it appears the groundwater at the site is naturally elevated with chlorides, Unit Petroleum Company respectfully requests that the NMOCD consider releasing Unit from further sampling at the site.

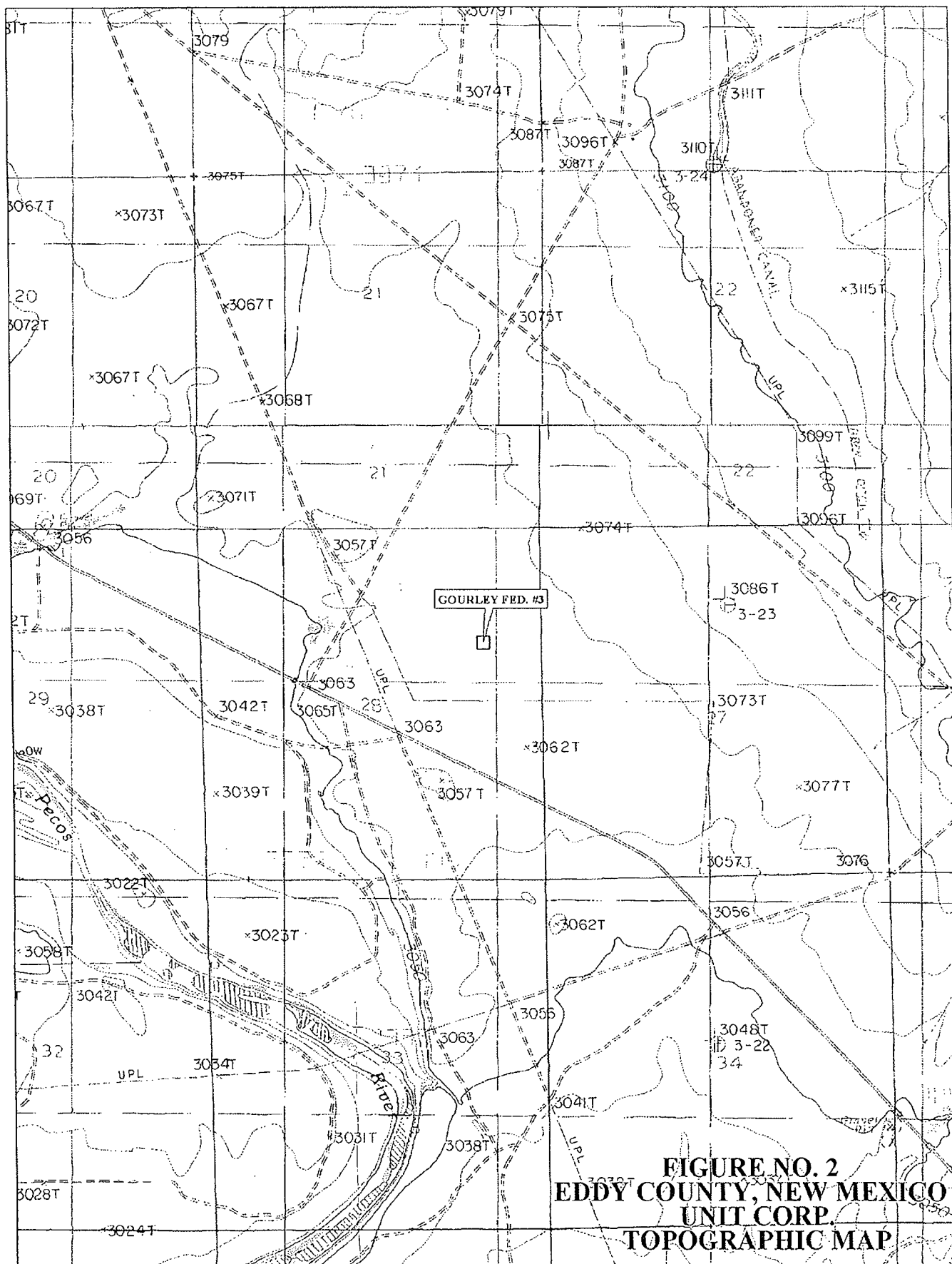


Respectfully Submitted,  
Tetra Tech, Inc.

  
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Jeffrey W. Kindley, P.G.  
Senior Project Manager

## FIGURES





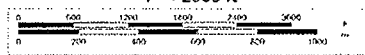
**FIGURE NO. 2**  
**EDDY COUNTY, NEW MEXICO**  
**UNIT CORP.**  
**TOPOGRAPHIC MAP**

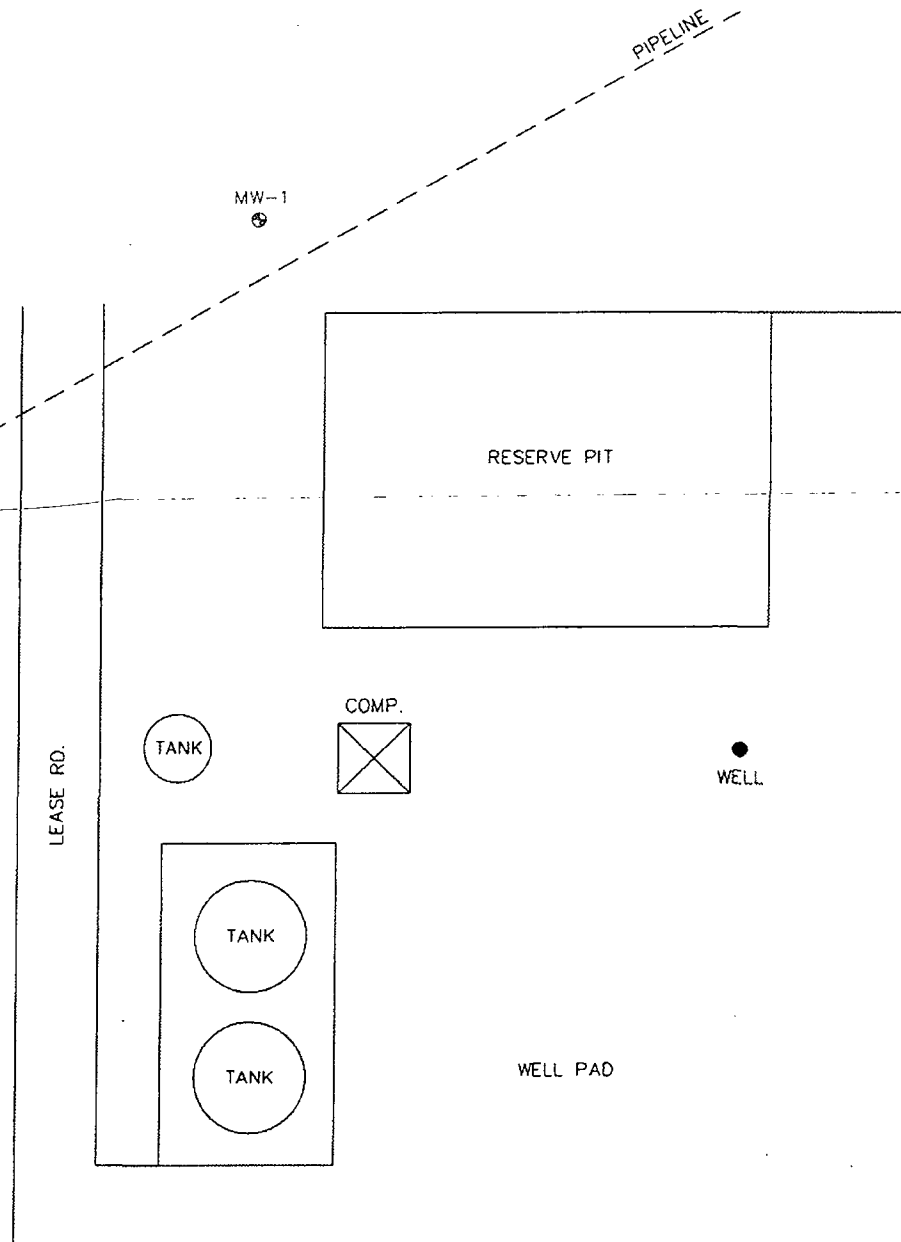


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Scale 1 : 24,000

1" = 2000 ft





NOT TO SCALE

DATE:  
3/23/09  
OWN. BY:  
JJ  
FILE:  
H:\UNIT3\654  
GOURLEY FED 13

FIGURE NO. 3
EDDY COUNTY, NEW MEXICO
UNIT PETROLEUM COMPANY
GOURLEY FEDERAL #3
TETRA TECH, INC. MIDLAND, TEXAS



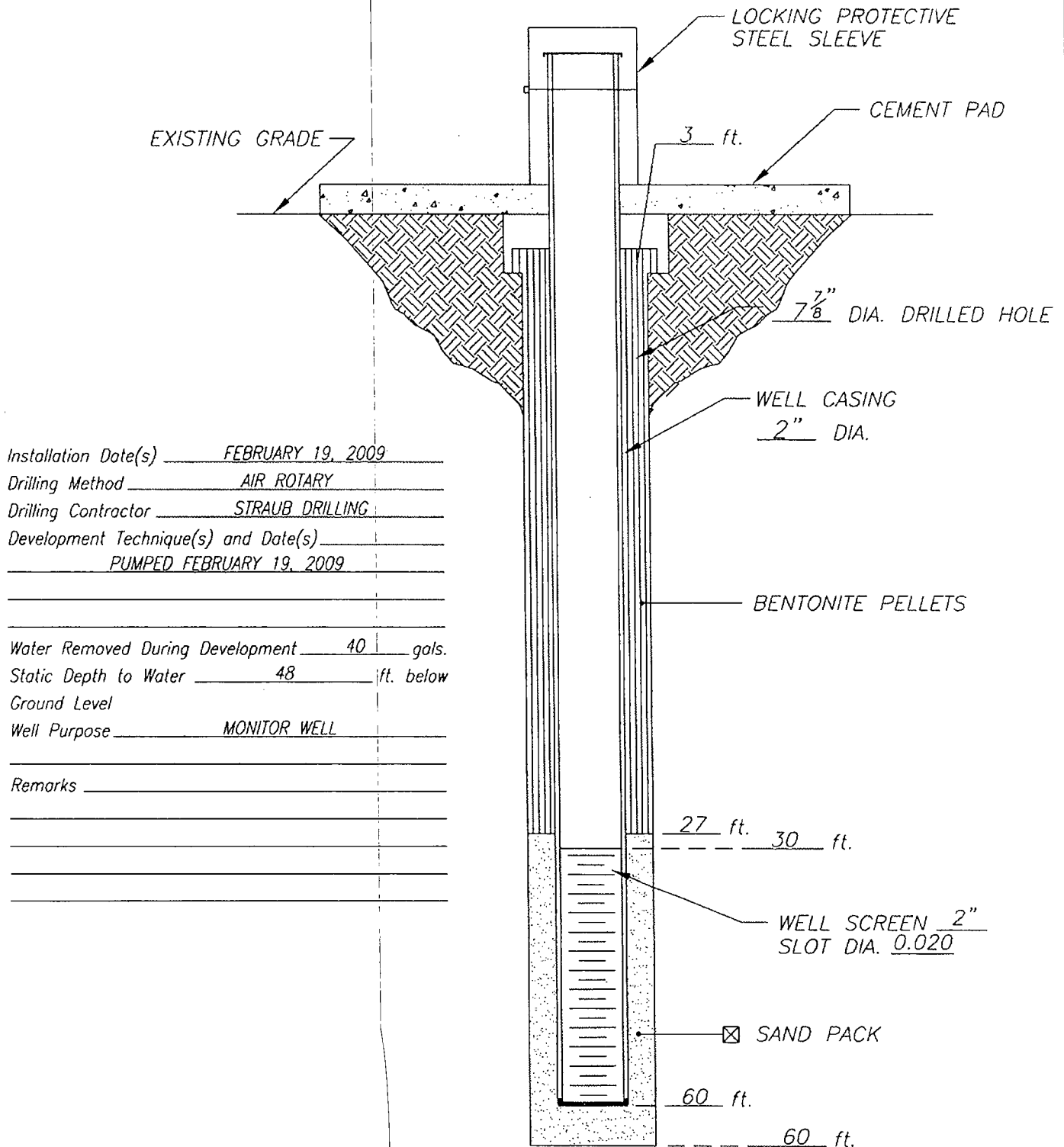
# TABLE

Table 1  
Unit Petroleum Company Gourley #3  
Groundwater Analytical Results  
Eddy County, New Mexico

Monitor Well	Date Sampled	Dissolved Calcium (mg/L)	Dissolved Magnesium (mg/L)	Dissolved Sodium (mg/L)	Dissolved Potassium (mg/L)	Hydroxide Alkalinity (mg/L)	Carbonate Alkalinity (mg/L)	Bicarbonate Alkalinity (mg/L)	Total Alkalinity (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Hardness (mg/L)	pH
MW-1	02/25/09	1,340	473	1,190	16.0	<1.00	<1.00	94	94	1,800	3,220	7,800	5,290	7.26
18" Abandoned Well	02/25/09	482	160	275	10.2	<1.00	<1.00	140	140	1,390	284	2,630	1,860	7.62

**APPENDIX A**  
**MONITOR WELL INSTALLATION DIAGRAM/SOIL**  
**BORING LOG**

# WELL CONSTRUCTION LOG



DATE: FEBRUARY 19, 2009

**TETRA TECH, INC.**  
MIDLAND, TEXAS

CLIENT: UNIT PETROLEUM COMPANY

PROJECT: GOURLEY FEDERAL #3

LOCATION: EDDY COUNTY, NEW MEXICO

WELL NO.

MW-1

## SAMPLE LOG

**Boring/Well:** MW-1  
**Project Number:** 3654  
**Client:** Unit Petroleum Company  
**Site Location:** Gourley Federal #3  
**Location:** Eddy County, New Mexico  
**Total Depth** 60  
**Date Installed:** 02/19/09

DEPTH (Ft)	OVM	SAMPLE DESCRIPTION
0-5	--	Hard buff caliche
5-10	--	Hard buff/tan calcareous fine grain sand
10-15	--	Tan medium grain sand with caliche intermixed
15-20	--	Tan/brown medium grain sand
20-25	--	Tan/brown medium grain sand
25-30	--	Tan/brown medium grain sand
30-35	--	Tan/brown medium to coarse grain sand
35-40	--	Tan/brown medium to coarse grain sand
40-45	--	Tan/brown medium to coarse grain sand
45-50	--	Tan/brown medium to coarse grain sand
50-55	--	Tan/brown medium to coarse grain sand
55-60	--	Tan/brown medium to coarse grain sand
60-66	--	Tan sandy clay intermixed with red clay

Total Depth is 60 feet

Groundwater encountered at 48 feet

**APPENDIX B**  
**LABORATORY ANALYTICAL**

Report Date: March 16, 2009  
115-6403654

Work Order: 9022610  
Unit Corp/Gourley #3

Page Number: 1 of 1  
Eddy Co., NM

## Summary Report

Jeff Kindley  
Tetra Tech  
1910 N. Big Spring Street  
Midland, TX 79705

Report Date: March 16, 2009

Work Order: 9022610



Project Location: Eddy Co., NM  
Project Name: Unit Corp/Gourley #3  
Project Number: 115-6403654

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
188487	MW-1	water	2009-02-25	13:45	2009-02-26

### Sample: 188487 - MW-1

Param	Flag	Result	Units	RL
Hydroxide Alkalinity		<1.00	mg/L as CaCo3	1.00
Carbonate Alkalinity		<1.00	mg/L as CaCo3	1.00
Bicarbonate Alkalinity		94.0	mg/L as CaCo3	4.00
Total Alkalinity		94.0	mg/L as CaCo3	4.00
Dissolved Calcium		1340	mg/L	1.00
Dissolved Potassium		16.0	mg/L	1.00
Dissolved Magnesium		473	mg/L	1.00
Dissolved Sodium		1190	mg/L	1.00
Chloride		3220	mg/L	2.50
Hardness (by ICP)		5290	mg eq CaCO3/L	0.00
pH		7.26	s.u.	0.00
Sulfate		1800	mg/L	2.50
Total Dissolved Solids		7800	mg/L	10.0

Report Date: March 16, 2009  
115-6403654

Work Order: 9022607  
Unit Corp/Abandoned Well-Unit K, Sec. 28, T22SR28E

Page Number: 1 of 1  
Eddy County, NM

## Summary Report

Jeff Kindley  
Tetra Tech  
1910 N. Big Spring Street  
Midland, TX 79705

Report Date: March 16, 2009

Work Order: 9022607



Project Location: Eddy County, NM  
Project Name: Unit Corp/Abandoned Well-Unit K, Sec. 28, T22SR28E  
Project Number: 115-6403654

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
188485	Abandoned Well 18 in.	water	2009-02-25	11:20	2009-02-26

### Sample: 188485 - Abandoned Well 18 in.

Param	Flag	Result	Units	RL
Hydroxide Alkalinity		<1.00	mg/L as CaCO <sub>3</sub>	1.00
Carbonate Alkalinity		<1.00	mg/L as CaCO <sub>3</sub>	1.00
Bicarbonate Alkalinity		140	mg/L as CaCO <sub>3</sub>	4.00
Total Alkalinity		140	mg/L as CaCO <sub>3</sub>	4.00
Dissolved Calcium		482	mg/L	1.00
Dissolved Potassium		10.2	mg/L	1.00
Dissolved Magnesium		160	mg/L	1.00
Dissolved Sodium		275	mg/L	1.00
Chloride		284	mg/L	2.50
Hardness (by ICP)		1860	mg eq CaCO <sub>3</sub> /L	0.00
pH		7.62	s.u.	0.00
Sulfate		1390	mg/L	2.50
Total Dissolved Solids		2630	mg/L	10.0



## **APPENDIX C**

### **STIFF DIAGRAMS**

# Major ions

Project Name: Unit Petroleum Company, Gourley #3

County: Eddy County, New Mexico

2/25/2009

Concentrations in mg/l and me/l

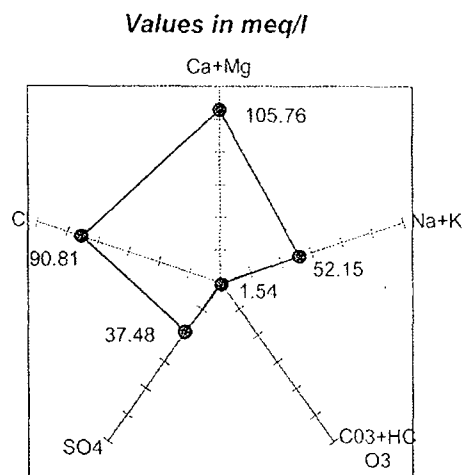
Cations	Anions	Equivalent Weight	MW-1		Abandoned 18 inch well	
			mg/l	me/l	mg/l	me/l
Ca		20.04	1340	66.87	482	24.05
Mg		12.16	473	38.90	160	13.16
Na		23.00	1,190	51.74	275	11.96
K		39.10	16	0.41	10.2	0.26
	CO <sub>3</sub>	30.00	0	0.00	0	0.00
	HCO <sub>3</sub>	61.02	94	1.54	140	2.29
	SO <sub>4</sub>	48.03	1800	37.48	140	2.91
	Cl	35.46	3,220	90.81	284	8.01
	NO <sub>3</sub>	62.01	0	0.00	0	0.00
	F	19.00	0	0.00	0	0.00
Cation (sum)				157.91		49.43
Anion (sum)				129.82		13.22
Cation/Anion difference in %				19.52		115.60

Tetra Tech, 1910 N. Big Spring St., Midland, TX - 79705.

# Stiff Diagrams (1)

	MW-1	
Ca	66.87	
Mg	38.90	Ca+Mg 105.76
Na	51.74	Na+K 52.15
K	0.41	CO <sub>3</sub> +HCO <sub>3</sub> 1.54
CO <sub>3</sub>	0.00	SO <sub>4</sub> 37.48
HCO <sub>3</sub>	1.54	Cl 90.81
SO <sub>4</sub>	37.48	
Cl	90.81	
NO <sub>3</sub>	0.00	
F	0.00	

Stiff Diagram for MW-1  
Unit Petroleum Company - Gourley #3  
Eddy County, New Mexico  
February 25, 2009

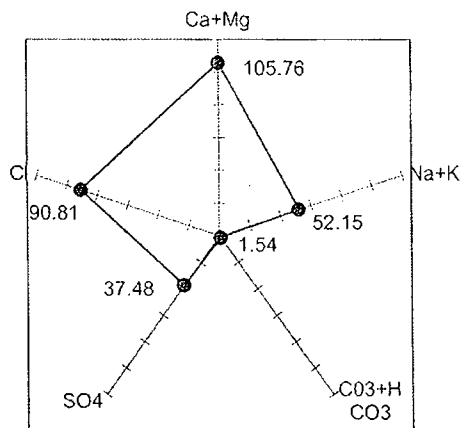


# Stiff Diagrams (1)

	MW-1	
Ca	66.87	
Mg	38.90	Ca+Mg 105.76
Na	51.74	Na+K 52.15
K	0.41	CO3+HCO3 1.54
CO3	0.00	SO4 37.48
HCO3	1.54	Cl 90.81
SO4	37.48	
Cl	90.81	
NO3	0.00	
F	0.00	

## Stiff Diagram for MW-1 Unit Petroleum Company - Gourley #3 Eddy County, New Mexico February 25, 2009

Values in meq/l



# Stiff Diagrams (2)

Abandoned 18 inch well

Ca	24.05		
Mg	13.16	Ca+Mg	37.21
Na	11.96	Na+K	12.22
K	0.26	CO <sub>3</sub> +HCO <sub>3</sub>	2.29
CO <sub>3</sub>	0.00	SO <sub>4</sub>	2.91
HCO <sub>3</sub>	2.29	Cl	8.01
SO <sub>4</sub>	2.91		
Cl	8.01		
NO <sub>3</sub>	0.00		
F	0.00		

Stiff Diagram Abandoned 18 inch well  
Unit Petroleum Company - Gourley #3  
Eddy County, New Mexico  
February 25, 2009

Values in meq/l

