

Bratcher, Mike, EMNRD

From: Kindley, Jeff [Jeff.Kindley@tetrattech.com]
Sent: Tuesday, October 13, 2009 3:17 PM
To: VonGonten, Glenn, EMNRD; Bratcher, Mike, EMNRD; Miller, Gary
Cc: Skip Wedel; mark.schell@unitcorp.com; bscott@modrall.com; brad.guidry@unitcorp.com; mark.colclasure@unitcorp.com; rick.heck@unitcorp.com; jerry.farmer@unitcorp.com
Subject: Stage 1 Abatement Plan for the Unit Petroleum Gourley Federal #3 Well
Attachments: finalabatementplan.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Gentlemen,

Please find enclosed a copy of the Stage 1 Abatement Plan for the Unit Petroleum Gourley Federal #3 Well located in Eddy County, New Mexico.

A hard copy of the report, along with an attached CD of the report, has been sent by Fedex to Mr. von Gonten and Mr. Mike Bratcher of the NMOCD.

If you have any questions regarding the report, please do not hesitate to contact either Gary Miller, Tim Reed, or myself 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

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OCD Case #AP-100

**STAGE 1 ABATEMENT PLAN
OF
UNIT PETROLEUM COMPANY
GOURLEY FEDERAL #3 WELL
UNIT H, SECTION 28, T-22-S, R-28-E**

**LOCATED IN
EDDY COUNTY, NEW MEXICO**

Prepared for:

UNIT PETROLEUM COMPANY
7130 S. Lewis Ave.
Tulsa, OK 74136

Prepared by:

Tetra Tech
1910 N. Big Spring St.
Midland, Texas 79705
(432) 682-4559
Fax (432) 682-3946

Tetra Tech Project No. 115-6403654
October 13, 2009



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STAGE I ABATEMENT PLAN

OCD Case #AP-100

**STAGE I ABATEMENT PLAN
Unit Petroleum Company
Gourley Federal #3 Well
Unit H, Section 28, T-22-S, R-28-E
Eddy County, New Mexico**

1.0 EXECUTIVE SUMMARY

Soil samples collected from the Gourley Federal #3 open reserve pit (Pit) in June and July, 2007 and again in January, 2009 establish that chloride concentrations in the soil within the Pit were generally below 10,000 mg/kg, with the exception of 3 samples, two collected from the center of the Pit at the Pit bottom and at 15 feet below the bottom (bpb) and one from the Pit bottom in the northeast corner. Samples collected from the center of the Pit at depths below 15 feet bpb were below 10,000 mg/kg. Unit proposes to delineate the depth and areal extent of Pit soils having chloride concentrations in excess of 10,000 mg/kg and to then excavate those soils. Upon completion of the excavation, the balance of the Pit would be leveled, lined with sand, and covered with a 40 mil synthetic impermeable liner. The Pit would then be backfilled with clean fill material and brought up to grade.

The reported regional hydraulic gradient is directed southwest, towards the Pecos River. However, groundwater sampling in the vicinity of the Pit suggests that local groundwater flow may be to the west/northwest. Groundwater samples collected from monitor wells located east and west of the Pit and on the south edge of the Pit, contained chloride concentrations of 1110 mg/L, 1270 mg/L and 907 mg/L respectively. A groundwater sample collected from monitor well MW-1 located 180 feet north of the northwest corner of the Pit and essentially cross gradient of local groundwater flow contained chloride concentrations of 3,220 mg/L. To further evaluate the elevated chlorides in MW-1, and to confirm the west/northwest gradient of the groundwater around the site, additional delineation may be required. Figures 1 and 2 show the site location. A site map of the property is presented as Figure 3.

2.0 CHRONOLOGY OF EVENTS

April 23, 2007

NMOCD District II Office received Operator's C-144 pit closure plan from Sweatt Construction Co. (Sweatt)

Tetra Tech

Tetra Tech
Tel: (972) 372-1000 Fax: (972) 372-1001



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April 24, 2008	NMOCD District II Supervisor Tim Gum approved operator's C-144 pit closure plan submitted by Sweatt.
May 31, 2007- July 25, 2007	Sweatt excavates the reserve pit contents and samples the Pit for closure.
October 5, 2008	Don Peterson from the Bureau of Land Management's Carlsbad Field Office called Mr. Bratcher and told him that the pit was still open and what appeared to be drill cuttings were stockpiled in the middle of the Pit.
November 17, 2008	NMOCD issued a Notice of Violation (NOV No. 02-08-23) to Unit for an open pit.
December 3, 2008	An administrative conference was held on the NOV. Unit's district engineer and E-Tech Environmental & Safety Solutions were onsite for conference. Conclusion was that Sweat had failed to complete the Pit closure at the site.
January 7, 2009	Unit contacted Tetra Tech to perform confirmation sampling of the open Pit.
February 19, 2009	Tetra Tech was onsite to install one monitor well northwest of the Pit.
February 25, 2009	Tetra Tech personnel were onsite to sample monitor well MW-1 and the water well located one mile southwest of the site.
May 29, 2009	Tetra Tech emailed the NMOCD requesting an extension of the Pit closure.
June 1, 2009	NMOCD grants extension of closure of the Pit until October 1, 2009.
June 1, 2009	Unit files a C-141 with the NMOCD.
June 2, 2009	Unit submits revised C-141 to the NMOCD.
June 5, 2009	NMOCD issued letter requiring a Stage I Abatement Plan for the site.
June 25, 2009	Two additional monitor wells (MW-2 and MW-3) are installed on the pad adjacent to the open Pit.
July 17, 2009	First submission of Stage 1 Abatement Plan to the NMOCD



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September 28, 2009 Unit requested extension of October 1, 2009 closure deadline from NMOCD.

September 30, 2009 NMOCD grants requested extension.

3.0 BACKGROUND & PREVIOUS WORK

In June 2007, Sweatt excavated the Pit to a maximum depth of 6' below ground surface (bgs), with sample trenches to 20 feet (bgs) for chloride sampling. Sampling conducted on July 25, 2007 found that chloride concentrations within the Pit were generally below 10,000 mg/kg with the exception of 3 samples. One sample was collected from the center of the Pit at the Pit bottom and another was collected at 15 feet below the Pit bottom (bpb). The third sample was from the Pit bottom in the northeast corner. Chloride concentrations in the samples collected from the center of the Pit at depths below 15 feet bpb were below 10,000 mg/kg. At the request of the NMOCD, a temporary monitor well was installed on the south edge of the Pit in June 2007 to establish the depth to groundwater. The well was drilled to a depth of 50' bgs. Samples from that well showed chloride concentrations of 907 mg/L and TDS concentrations of 3990 mg/L. See Tetra Tech January 19, 2009, report to Mr. Mike Bratcher, NMOCD.

In January 2009 Tetra Tech was contracted to perform sampling of the Pit at the site. As requested by the NMOCD, samples were collected from the center and southwest corner of the Pit. Samples from a depth of 25 feet bgs were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and chlorides. Confirmation samples were also collected for chlorides from a depth of 39 feet bgs in the center and 35 feet bgs in the southwest corner. During the confirmation sampling, the soils were field screened for chlorides. A one to two foot thick clay layer was encountered in both sample trenches at 37 feet bgs in the center and 34 feet bgs in the southwest corner. Sampling in the southwest corner of the pit showed elevated chlorides ranging from 5,800 mg/kg at the bottom of the Pit, declining to 700 mg/kg at 30 feet bgs, and increasing to 6,450 mg/kg at the clay layer. The concentration below the clay layer at 35 feet bgs was 761 mg/kg. The field screening at the center of the Pit showed chloride concentrations ranging from 13,520 mg/kg at the bottom of the pit, to 19,600 at 15 feet bgs, declining to 1,050 mg/kg at 35 feet bgs. At the clay layer at 37 feet bgs, the chloride concentration increased to 9,450 mg/kg. Below the clay layer at 39 feet bgs, the field chloride concentration was 1,600 mg/kg. The laboratory results for the 39 foot sample showed a concentration of 2,170 mg/kg chlorides.

At the request of Unit, Tetra Tech was onsite February 19, 2009, to oversee the installation of one 2" monitor well approximately 180' north of the northwest corner of the Pit. This well is known as MW-1. MW-1 was drilled to a depth of 60 feet bgs and installed with 30 feet of 0.02" slotted PVC at the bottom of the well boring. Following installation, MW-1 was developed by utilizing a pump to remove the fine grain sediments, disturbed during drilling, and to ensure collection of representative groundwater samples.

On February 25, 2009, Tetra Tech personnel were onsite to purge and sample MW-1. Samples were collected and submitted to Trace Analysis Inc. (Trace) for analysis of



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major anions, cations and total dissolved solids (TDS). Analytical results showed a chloride concentration of 3,220 milligrams per liter (mg/L) and TDS concentration of 7,800 mg/L.

On June 25, 2009, Tetra Tech installed two additional monitor wells. One well (MW-2) was installed east of the Pit. The other well (MW-3) was installed west of the Pit.

4.0 GEOLOGY & HYDROGEOLOGY

4.1 Regional and Local Geology

According to the Geology and Groundwater Resources of Eddy County, New Mexico (Report 3), the Rustler, Castile and Salado formation (Ochoa Series) is present west and east of the Pecos River. The Salado formation, which consists of halite and small amounts of anhydrite, polyhalite and other potassium salts and red sandy shale, overlies the Castile formation in the area east of the Pecos River. West of the river, most of the formation has been removed by solution. Underlying the Salado formation is the Castile formation which consists of 1,300 to 2,000 feet of anhydrite, gypsum, and small amounts of halite, dolomite, and sandstone. As originally deposited, most of the gypsum probably was anhydrite, but it has since been altered by groundwater. The Rustler formation overlies the Salado formation east of the Pecos River, and the Castile formation west of the Pecos River. The Rustler formation ranges in thickness from about 200 feet in northern Eddy County to about 500 feet southeast of Carlsbad. It consists of anhydrite, gypsum, interbedded red and green sandy clay, and some beds of dolomite.

4.2 Regional and Local Hydrogeology

The groundwater in the area generally comes from the Rustler formation. Historically, chlorides and sulfate concentrations are elevated in the Rustler formation. The reported regional hydraulic gradient is to the southwest towards the Pecos River. However, based on the gauging event of MW-1, MW-2, and MW-3 on June 27, 2009, the local groundwater gradient in the vicinity of the Pit is towards the west-northwest. See groundwater gradient map Figure 4. The depth to water in this area is approximately 45 to 50 feet below ground surface.

4.3 Water Well Inventory

A water well inventory was performed to encompass a ½ mile radius around the facility. The inventory included a review of water well records on the New Mexico Office of the State Engineer W.A.T.E.R.S. database, the United States Geologic Survey (USGS) website and any water wells denoted on the USGS 7.5 minute topographic quadrangle map within the search radius. No wells were shown in either database or on the USGS 7.5 minute topographic quadrangle map within the search



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radius. One 18" diameter out of service water well was observed approximately 1 mile southwest of the site.

5.0 SUBSURFACE SOILS

The soils in the vicinity of this site are of the Bippus Series. The Bippus series consist of deep, moderately dark colored, well-drained, calcareous soils that developed in alluvium. These soils occur mainly on flood plains of intermittent streams in the southeastern part of the survey area, but smaller areas are scattered throughout the eastern part.

Soils of the Bippus series typically have a surface layer that is about 21 inches thick. The uppermost few inches consists of grayish-brown sandy loam. This material overlies dark grayish-brown silty clay loam. Beneath the surface layer is a transitional layer of dark-brown to brown silty clay loam about 16 inches thick. The substratum, about 11 inches thick, is brown clay loam enriched by calcium carbonate. It rests on weak cemented caliche at a depth of about 4 feet.

Bippus soils are uneroded to slightly eroded. They are subject to periodic flooding, and there is some deposition of sandy material at the edges of the flood plain. Runoff is medium. Permeability is moderately slow, and the water-holding capacity is high.

6.0 GROUNDWATER GRADIENT and QUALITY

A monitor well (MW-1) was installed north of the Pit on February 19, 2009. The monitor well was drilled to a maximum depth of 60 feet bgs and installed with 30 feet of 0.02" slotted PVC piping.

In order to determine a groundwater gradient at the site, two additional monitor wells (MW-2 and MW-3) were installed adjacent to the Pit on June 25, 2009. The two monitor wells were drilled to a maximum depth of 60 feet bgs and installed with 20 feet of 0.02" slotted PVC piping. Upon completion of the monitor wells, all three wells were gauged, purged and sampled on June 27, 2009. The samples were submitted to Trace Analysis, Inc. for analysis of major anions/cations and TDS. Analytical results indicate chloride concentrations of 4,140 mg/L in monitor well MW-1, 1,110 mg/L in MW-2, and 1,270 mg/L in MW-3. The gauging and analytical data are presented in Tables 1 and 2. Laboratory analytical is presented in Appendix A. Based upon the data collected from MW-1, MW-2 and MW-3, the groundwater gradient in the vicinity of the pit appears to be towards the west/northwest. MW-1 appears to be located essentially cross-gradient from the Pit.

Stiff diagrams were created for the three wells based upon the analytical data. The stiff diagrams for MW-2 and MW-3 are nearly identical and may be indicative of background quality of the Rustler Formation in this area. The stiff diagrams for the three monitor wells and the abandoned 18" water well are included in Appendix B.



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7.0 STAGE I ABATEMENT PLAN

7.1 Pit Closure

In order to close the Pit at the site, Unit proposes to drill a total of five (5) soil borings in the center horseshoe section of the Pit in order to delineate chloride concentrations to below 10,000 mg/kg. The soil borings will be advanced with an air-rotary drilling rig to an estimated depth of 20 feet bgs. Once the data has been collected and analyzed, the center of the Pit will be excavated to the depth at which the chloride concentrations have declined below 10,000 mg/kg. Upon completion of the excavation, the site will be leveled, lined with sand, and a 40 mil synthetic impermeable liner placed into the excavation to isolate the residual chloride impacted soils. The remainder of the excavation will be backfilled with clean fill material and brought up to grade.

7.2 Additional Monitor Wells

Monitor well MW-2 and MW-3 had nearly identical qualities and may be consistent with background quality for the Rustler Formation in the vicinity of the Pit. Groundwater samples collected from MW-1, which is located 180 feet north of the northwest corner of the pit and essentially cross gradient of local groundwater flow, contained higher chloride concentrations than the samples collected from MW-2 and MW-3. To further evaluate the elevated chlorides in MW-1, and to confirm the gradient of the groundwater around the site, two additional monitor wells are proposed to be installed up and down gradient of the Pit. See attached Figure 5 for proposed additional monitor well locations. Upon completion of the drilling, a new site survey of the property will be performed to include the newly installed monitor wells.

7.3 Sampling and Analysis Plan

Upon completion of the installation of the additional wells, Unit Petroleum proposes to perform quarterly sampling of the monitor wells. During the quarterly events, each of the wells will be gauged, then immediately purged of three well volumes of water. Once the groundwater has been properly purged and the well stabilizes, groundwater samples will be collected and submitted to Trace Analysis Inc. for analysis of major anions, cations, and TDS. Data collected from the sampling will be utilized to create chloride isoconcentration maps and geologic cross sections of the site. Once the data is evaluated, additional monitor wells maybe required to complete delineation of the site. Upon completion of the delineation of the site, an effective abatement plan, if necessary, will be designed and implemented.

8.0 QUALITY ASSURANCE/ QUALITY CONTROL

Any additional monitor wells, to be installed at the site, will be constructed to EPA and industry standards. All downhole equipment (i.e., drill pipe, drill bits, etc.) will be thoroughly decontaminated between each use with a steam cleaner. The wells will be



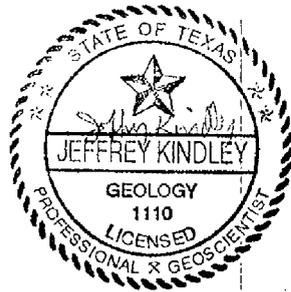
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STAGE I ABATEMENT PLAN
OCD Case #AP-100

properly purged and sampled with clean, dedicated, polyethylene bailers and disposable line. The groundwater samples will be submitted to a laboratory for analysis of major anions/cations and TDS by EPA methods 310.1, 9253, 375.4, 6010B, 160.1 and 300.0E.

9.0 PROPOSED SCHEDULE OF ACTIVITIES

Upon approval, the work outlined above will be implemented in a timely manner, dependent upon availability of local drilling contractors and trackhoe operators.



Respectfully submitted,
Tetra Tech Inc.

Jeffrey Kindley
Jeffrey Kindley, P.G.
Senior Environmental Geologist

Tim Reed
Tim Reed, P.G.
Senior Project Manager



FIGURES

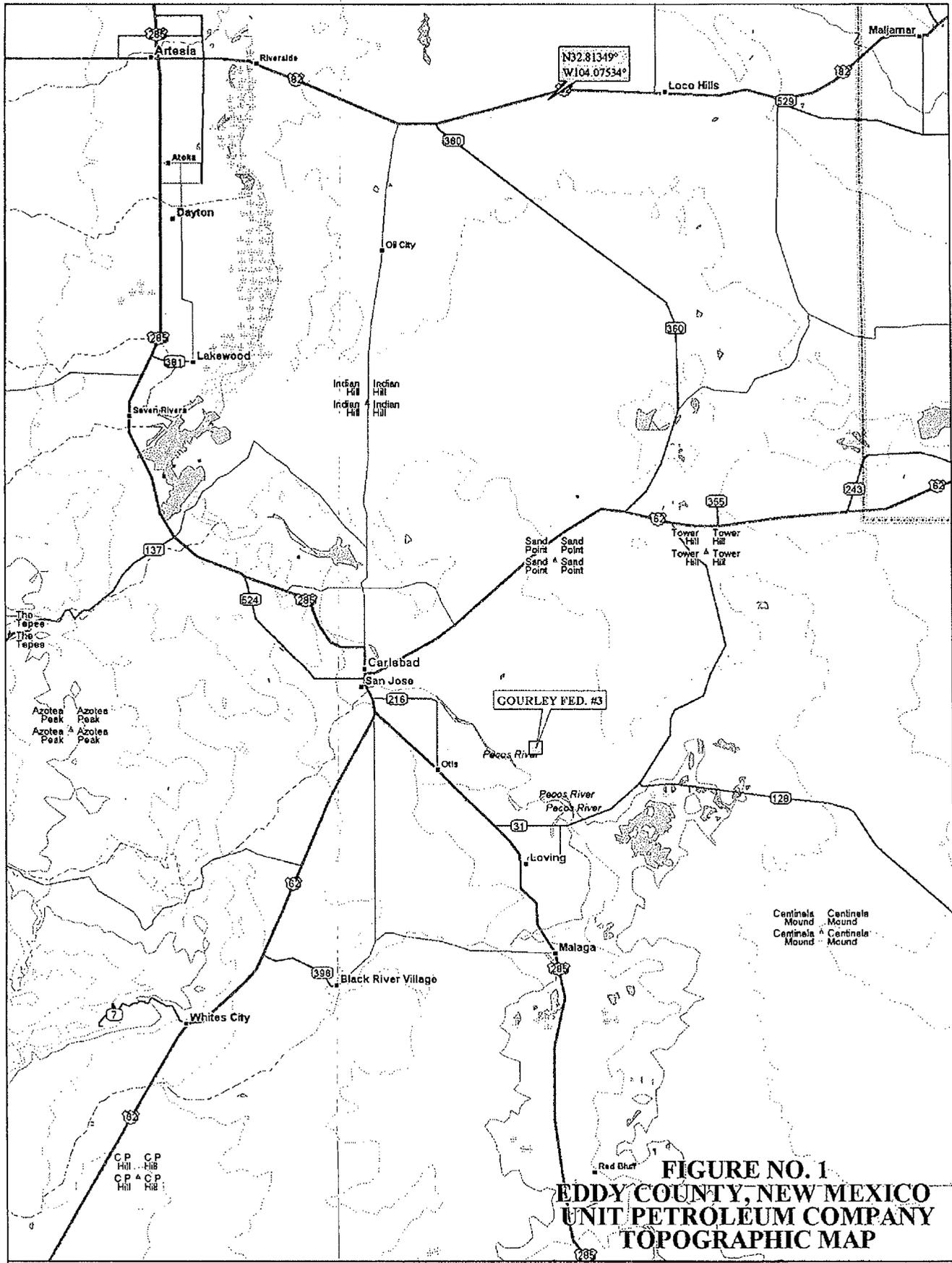
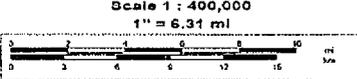
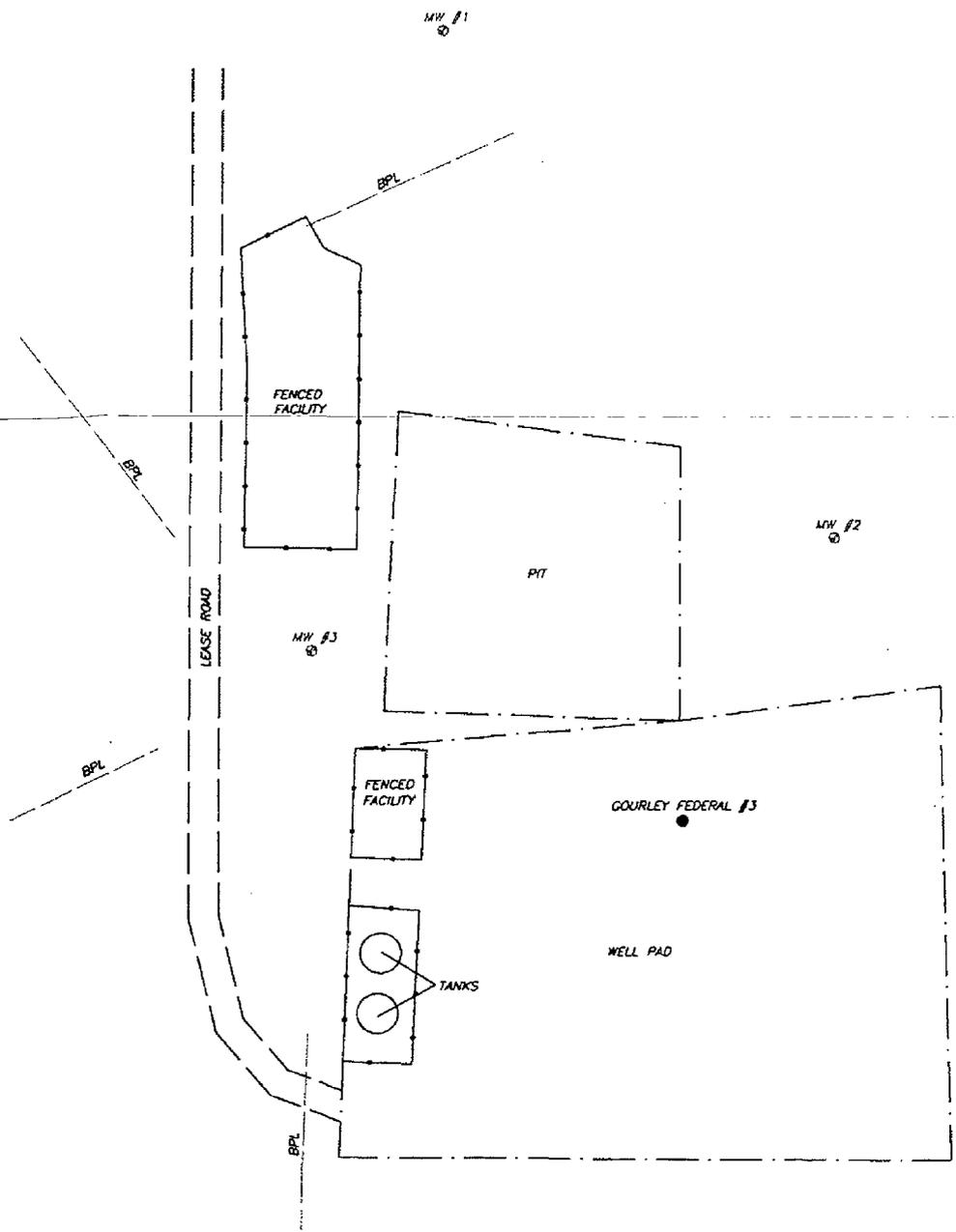


FIGURE NO. 1
EDDY COUNTY, NEW MEXICO
UNIT PETROLEUM COMPANY
TOPOGRAPHIC MAP



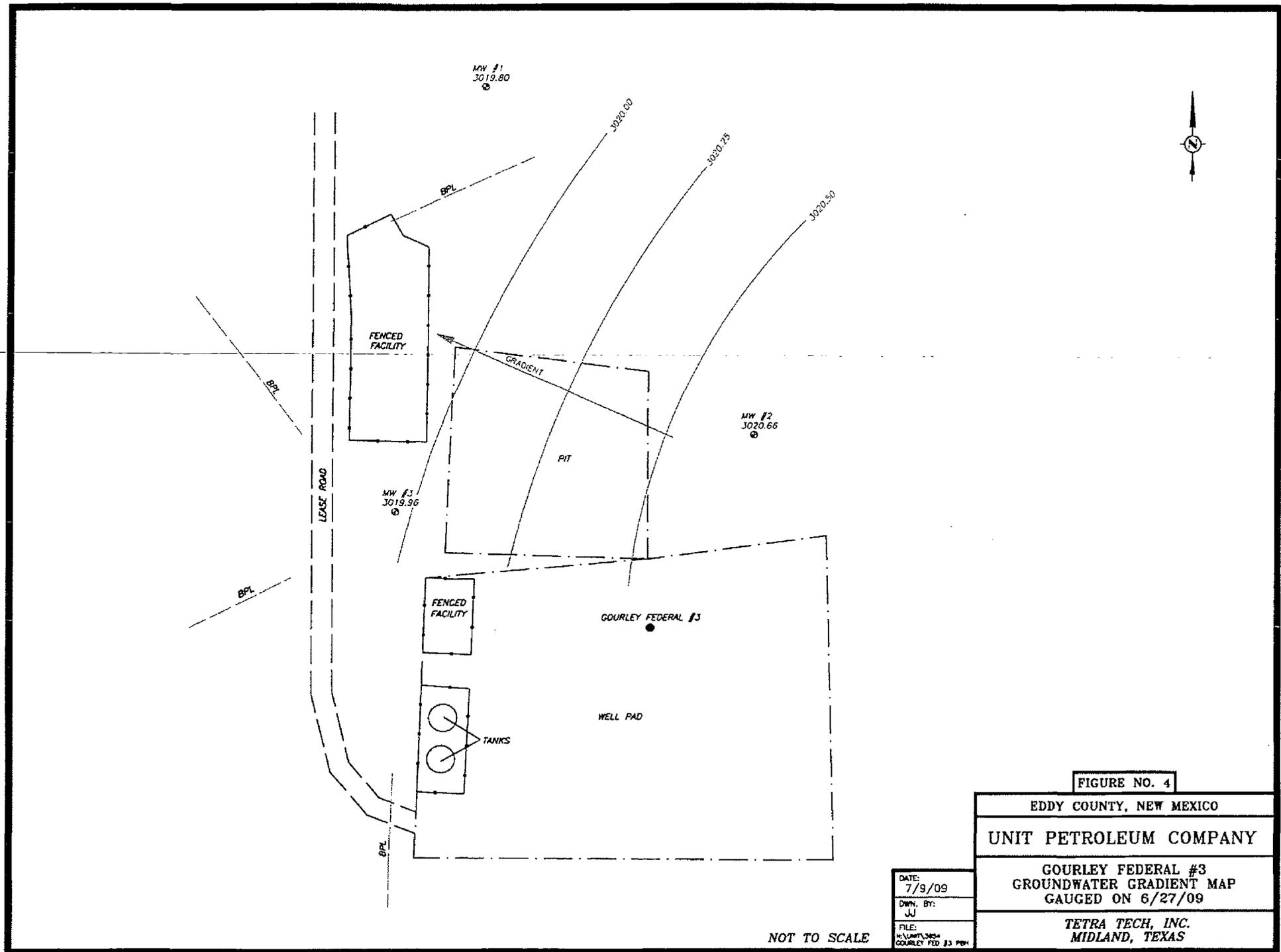
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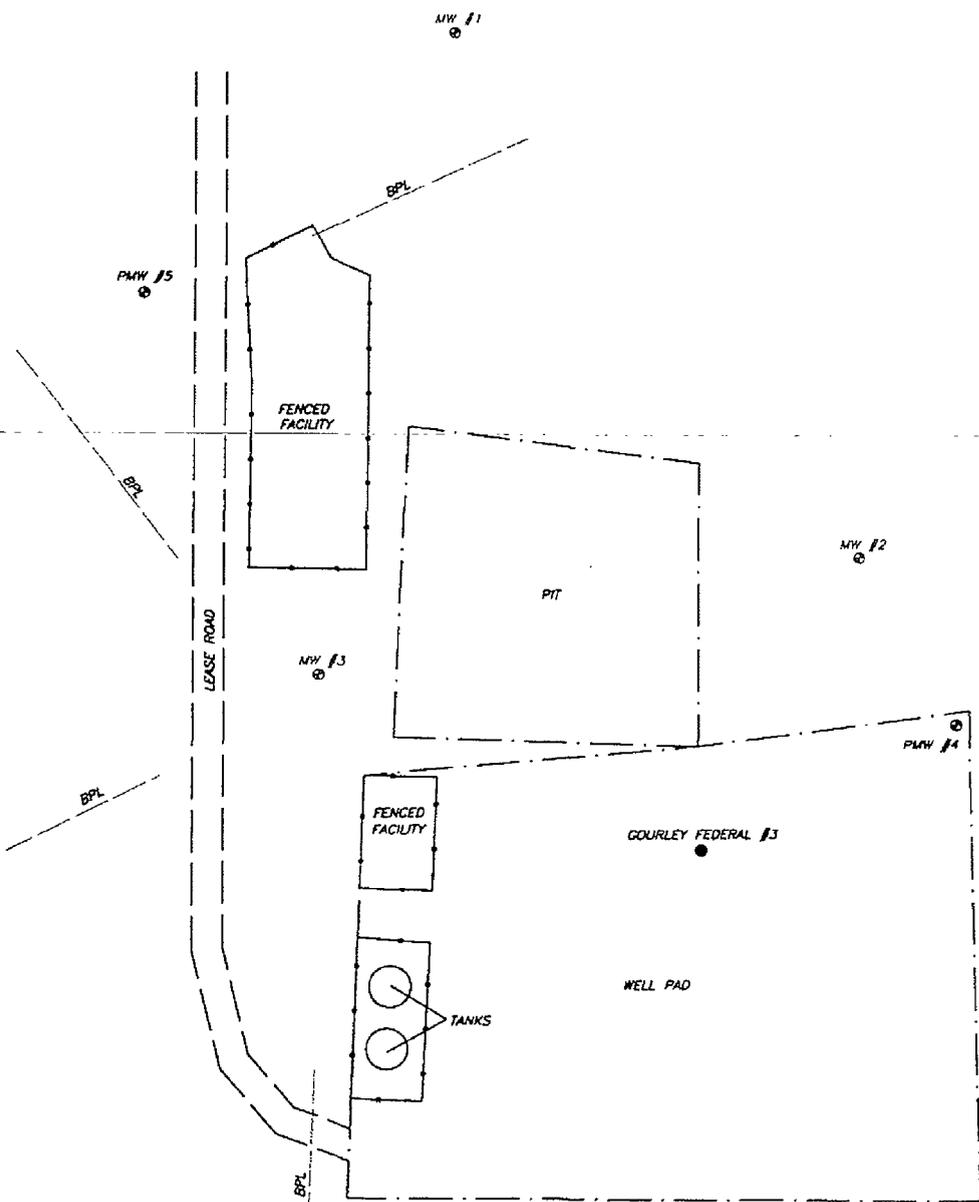
FIGURE NO. 3	
EDDY COUNTY, NEW MEXICO	
UNIT PETROLEUM COMPANY	
GOURLEY FEDERAL #3 SITE MAP	
DATE: 7/9/09	TETRA TECH, INC. MIDLAND, TEXAS
DWN. BY: JJ	
FILE: M:\UNIT3\3854 GOURLEY FED #3 PSH	



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DATE:
7/9/09
DWN. BY:
JJ
FILE:
H:\UNIT\3024
GOURLEY FED #3.PDF

FIGURE NO. 4
EDDY COUNTY, NEW MEXICO
UNIT PETROLEUM COMPANY
GOURLEY FEDERAL #3 GROUNDWATER GRADIENT MAP GAUGED ON 6/27/09
TETRA TECH, INC. MIDLAND, TEXAS



⊙ MONITOR WELL LOCATIONS
⊙ PROPOSED MONITOR WELL LOCATIONS

NOT TO SCALE

FIGURE NO. 5

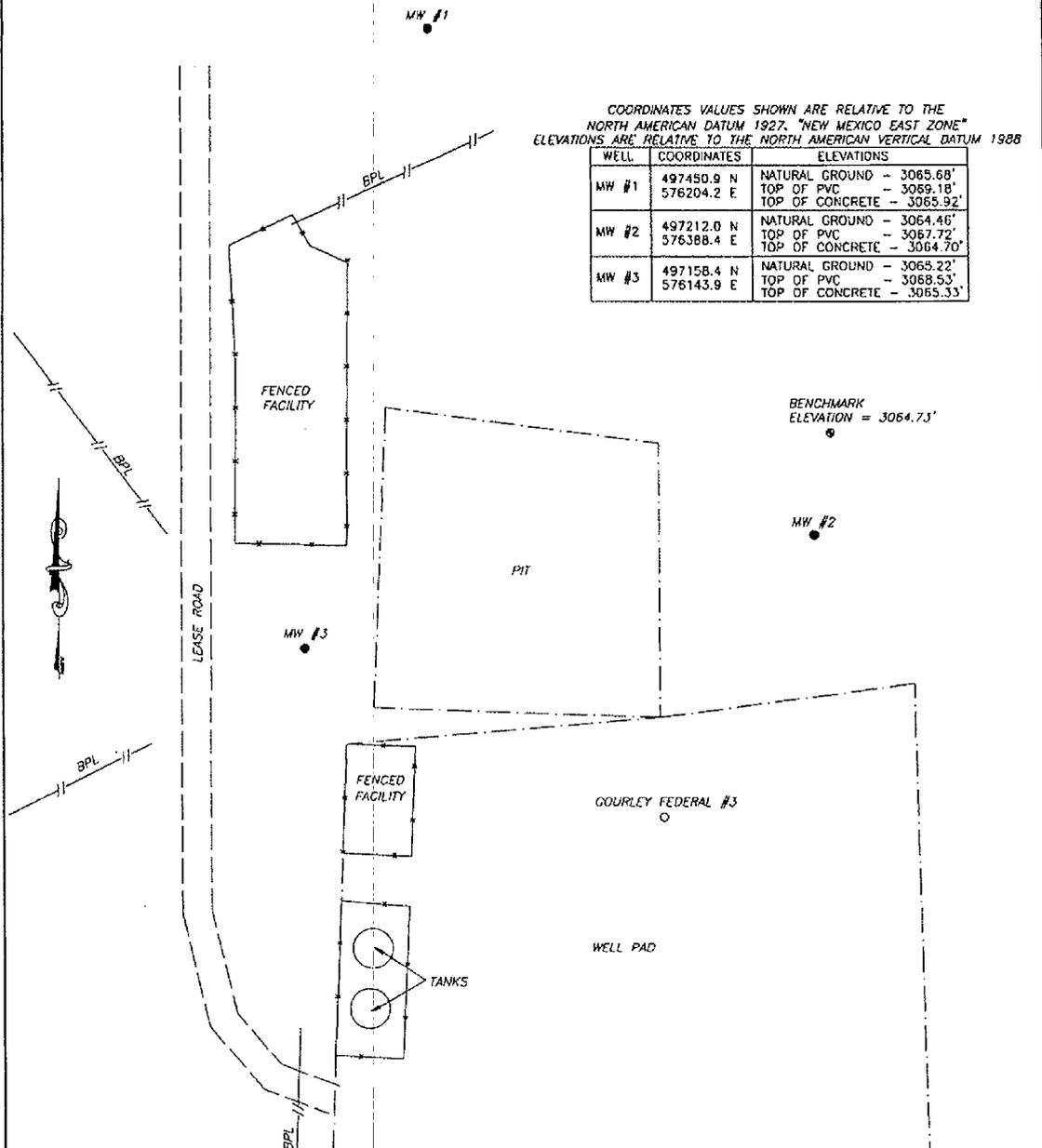
EDDY COUNTY, NEW MEXICO	
UNIT PETROLEUM COMPANY	
GOURLEY FEDERAL #3 PROPOSED MONITOR WELL LOCATIONS	
TETRA TECH, INC. MIDLAND, TEXAS	

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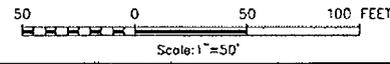
SECTION 28, TOWNSHIP 22 SOUTH, RANGE 28 EAST, N.M.P.M.,
EDDY COUNTY, NEW MEXICO

COORDINATES VALUES SHOWN ARE RELATIVE TO THE
NORTH AMERICAN DATUM 1927. "NEW MEXICO EAST ZONE"
ELEVATIONS ARE RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM 1988

WELL	COORDINATES	ELEVATIONS
MW #1	497450.9 N	NATURAL GROUND - 3065.68'
	576204.2 E	TOP OF PVC - 3069.18'
		TOP OF CONCRETE - 3065.92'
MW #2	497212.0 N	NATURAL GROUND - 3064.46'
	576388.4 E	TOP OF PVC - 3067.72'
		TOP OF CONCRETE - 3064.70'
MW #3	497158.4 N	NATURAL GROUND - 3065.22'
	576143.9 E	TOP OF PVC - 3068.53'
		TOP OF CONCRETE - 3065.33'



- LEGEND**
- - DENOTES MONITOR WELL
 - ⊙ - DENOTES BENCHMARK - SET 5/8" STL. ROD W/ALUMINUM CAP
 - — — — — DENOTES FENCE LINE



I HEREBY CERTIFY THAT I DIRECTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO

RONALD J. REIDSON N.M. P.S. No. 3239

PROVIDING SURVEYING SERVICES SINCE 1946
JOHN WEST SURVEYING COMPANY
 412 N. DAL PASO
 HOBBS, N.M. 88240
 (575) 393-3117

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SURVEY TO LOCATE MONITOR WELLS AND FACILITIES AROUND THE GOURLEY FEDERAL #3 IN SECTION 28, TOWNSHIP 22 SOUTH, RANGE 28 EAST, N.M.P.M., EDDY COUNTY, NEW MEXICO

Survey Date: 6/29/09	Sheet 1 of 1 Sheets
W.O. Number: 09.11.0560	Drawn By: L.A.
Date: 7/7/09	09110580

TABLES

Table 1
 Unit Petroleum Company
 Groundwater Gauging Data
 Gourley Federal #3
 Eddy County, New Mexico

Monitor Well	Date Gauged	Date of Well Installation	Top of Casing Elevation (ft)	Total Depth of Well (bgs in ft)	Water Level Below TOC (ft)	Groundwater Elevation (ft)
MW-1	06/27/09	02/19/09	3,069.18	61.24	49.38	3,019.80
MW-2	06/27/09	06/25/09	3,067.72	63.73	47.06	3,020.66
MW-3	06/27/09	06/25/09	3,068.53	63.47	48.57	3,019.96

Table 2
 Unit Petroleum Company
 Groundwater Analytical Results
 Gourley Federal #3
 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
	06/27/09	1,470	507	1,450	18.8	<1.00	<1.00	145	145	1,840	4,140	10,000	5,770	6.98
MW-2	06/27/09	582	165	474	11.4	<1.00	<1.00	115	115	1,520	1,110	3,960	2,130	7.14
MW-3	06/27/09	603	170	540	10.4	<1.00	<1.00	120	120	1,540	1,270	4,030	2,210	7.18
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
SUMMARY REPORT
JULY 1, 2009**

Summary Report

Gary Miller
 Tetra Tech
 1910 N. Big Spring Street
 Midland, TX 79705

Report Date: July 1, 2009

Work Order: 9062907



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

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
200653	MW-1	water	2009-06-27	11:30	2009-06-29
200654	MW-2	water	2009-06-27	10:00	2009-06-29
200655	MW-3	water	2009-06-27	10:45	2009-06-29

Sample: 200653 - 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		145	mg/L as CaCo3	4.00
Total Alkalinity		145	mg/L as CaCo3	4.00
Dissolved Calcium		1470	mg/L	1.00
Chloride		4140	mg/L	0.500
Hardness (by ICP)		5770	mg eq CaCO3/L	0.00
Dissolved Potassium		18.8	mg/L	1.00
Dissolved Magnesium		507	mg/L	1.00
Dissolved Sodium		1450	mg/L	1.00
pH		6.98	s.u.	0.00
Sulfate		1840	mg/L	0.500
Total Dissolved Solids		10000	mg/L	10.0

Sample: 200654 - MW-2

Param	Flag	Result	Units	RL
Hydroxide Alkalinity		<1.00	mg/L as CaCo3	1.00

continued ...

sample 200654 continued ...

Param	Flag	Result	Units	RL
Carbonate Alkalinity		<1.00	mg/L as CaCo3	1.00
Bicarbonate Alkalinity		115	mg/L as CaCo3	4.00
Total Alkalinity		115	mg/L as CaCo3	4.00
Dissolved Calcium		582	mg/L	1.00
Chloride		1110	mg/L	0.500
Hardness (by ICP)		2130	mg eq CaCO3/L	0.00
Dissolved Potassium		11.4	mg/L	1.00
Dissolved Magnesium		165	mg/L	1.00
Dissolved Sodium		474	mg/L	1.00
pH		7.14	s.u.	0.00
Sulfate		1520	mg/L	0.500
Total Dissolved Solids		3960	mg/L	10.0

Sample: 200655 - MW-3

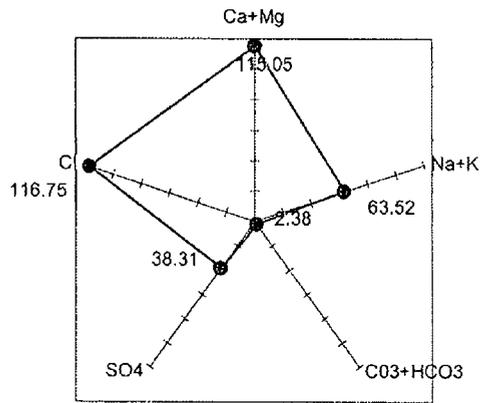
Param	Flag	Result	Units	RL
Hydroxide Alkalinity		<1.00	mg/L as CaCo3	1.00
Carbonate Alkalinity		<1.00	mg/L as CaCo3	1.00
Bicarbonate Alkalinity		120	mg/L as CaCo3	4.00
Total Alkalinity		120	mg/L as CaCo3	4.00
Dissolved Calcium		603	mg/L	1.00
Chloride		1270	mg/L	0.500
Hardness (by ICP)		2210	mg eq CaCO3/L	0.00
Dissolved Potassium		10.4	mg/L	1.00
Dissolved Magnesium		170	mg/L	1.00
Dissolved Sodium		540	mg/L	1.00
pH		7.18	s.u.	0.00
Sulfate		1540	mg/L	0.500
Total Dissolved Solids		4030	mg/L	10.0

APPENDIX B STIFF DIAGRAMS

Stiff Diagrams (1)

	MW-1		
Ca	73.35		
Mg	41.69	Ca+Mg	115.05
Na	63.04	Na+K	63.52
K	0.48	CO3+HCO3	2.38
CO3	0.00	SO4	38.31
HCO3	2.38	Cl	116.75
SO4	38.31		
Cl	116.75		
NO3	0.00		
F	0.00		

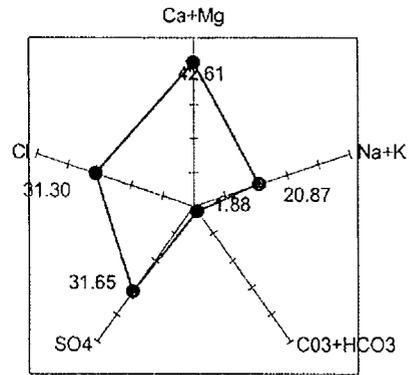
Stiff Diagram for MW-1
Unit Petroleum Company - Gourley #3
Eddy County, New Mexico
June 27, 2009



Stiff Diagrams (2)

	MW-2		
Ca	29.04		
Mg	13.57	Ca+Mg	42.61
Na	20.61	Na+K	20.87
K	0.27	CO ₃ +HCO ₃	1.88
CO ₃	0.00	SO ₄	31.65
HCO ₃	1.88	Cl	31.30
SO ₄	31.65		
Cl	31.30		
NO ₃	0.00		
F	0.00		

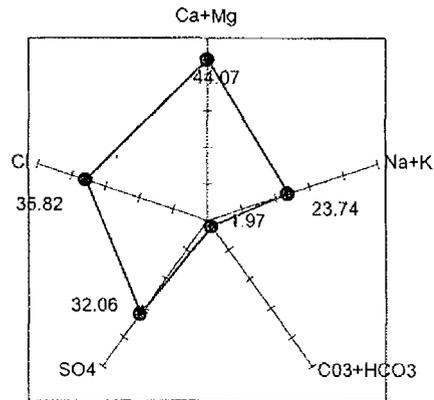
Stiff Diagram Monitor Well #2
 Unit Petroleum Company - Gourley #3
 Eddy County, New Mexico
 June 27, 2009



Stiff Diagrams (5)

	MW-3		
Ca	30.09		
Mg	13.98	Ca+Mg	44.07
Na	23.48	Na+K	23.74
K	0.27	CO₃+HCO₃	1.97
CO ₃	0.00	SO₄	32.06
HCO ₃	1.97	Cl	35.82
SO ₄	32.06		
Cl	35.82		
NO ₃	0.00		
F	0.00		

Stiff Diagram for MW-3
Unit Petroleum Company - Gourley #3
Eddy County, New Mexico
June 27, 2009



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 ₃ +HCO ₃	2.29
CO ₃	0.00	SO ₄	2.91
HCO ₃	2.29	Cl	8.01
SO ₄	2.91		
Cl	8.01		
NO ₃	0.00		
F	0.00		

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

