

COG OPERATING

Fren
Eddy County, NM
Willow State #5
VH - Job #32K0411300

30-015-29495

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NMOCD ARTESIA

Survey: Actual

SDI Standard Survey Report

13 May, 2011

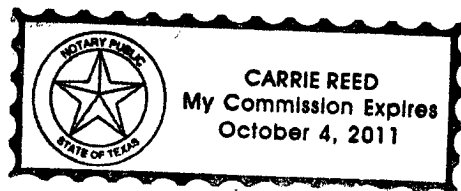
This survey is correct to the best of my knowledge and is supported by actual field data.

Richard

Notarized this date 17th of May, 2011.

Carrie Reed

Notary Signature
County of Midland
State of Texas



Scientific Drilling
Directional Drilling Operations

Scientific Drilling International, Inc.
SDI Standard Survey Report



Company:	COG OPERATING	Local Co-ordinate Reference:	Well Willow State #5
Project:	Fren	TVD Reference:	WELL @ 0.0usft (Original Well Elev)
Site:	Eddy County, NM	MD Reference:	WELL @ 0.0usft (Original Well Elev)
Well:	Willow State #5	North Reference:	Grid
Wellbore:	VH - Job #32K0411300	Survey Calculation Method:	Minimum Curvature
Design:	VH - Job #32K0411300	Database:	EDM-Regulatory

Project	Fren		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico Central 3002		

Site		Eddy County, NM			
Site Position:		Northing:	675,503.50 usft	Latitude:	32° 50' 2.400 N
From:	Lat/Long	Easting:	1,237,871.91 usft	Longitude:	103° 50' 52.800 W
Position Uncertainty:	0.0 usft	Slot Radius:	0"	Grid Convergence:	1.30 °

Well	Willow State #5, Vertical					
Well Position	+N/-S	0.0 usft	Northing:	675,371.24 usft	Latitude:	32° 50' 2.400 N
	+E/-W	0.0 usft	Easting:	1,232,033.88 usft	Longitude:	103° 52' 1.200 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	0.0 usft

Wellbore	VH - Job #32K0411300				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	4/1/2011	7.80	60.71	48,998

Design		VH - Job #32K0411300			
Audit Notes:					
Version:		1.0	Phase:	ACTUAL	Tie On Depth: 0.0
Vertical Section:		Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
		0.0	0.0	0.0	223.48

Survey Program		Date	5/13/2011		
From (usft)	To (usft)	Survey (Wellbore)		Tool Name	Description
100.0	6,385.0	Actual (VH - Job #32K0411300)		Keeper	Keeper Gyro

Survey							
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.0
100.0	0.07	76.52	100.0	0.0	0.1	76.52	0.1
200.0	0.04	151.05	200.0	0.0	0.1	90.87	0.1
300.0	0.14	206.13	300.0	-0.1	0.1	145.23	0.2
400.0	0.29	215.68	400.0	-0.5	-0.1	192.64	0.5
500.0	0.55	218.10	500.0	-1.0	-0.5	207.70	1.2
600.0	0.57	208.09	600.0	-1.9	-1.1	210.10	2.1
700.0	0.73	211.97	700.0	-2.8	-1.6	210.16	3.3
800.0	0.73	214.29	800.0	-3.9	-2.3	210.99	4.6
900.0	0.85	226.26	900.0	-4.9	-3.2	213.24	5.9
1,000.0	0.86	214.14	1,000.0	-6.1	-4.2	214.63	7.4
1,100.0	0.71	192.87	1,099.9	-7.3	-4.8	213.08	8.7

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Well:	Willow State #5	North Reference:	Grid
Wellbore:	VH - Job #32K0411300	Survey Calculation Method:	Minimum Curvature
Design:	VH - Job #32K0411300	Database:	EDM-Regulatory

Survey							
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)
1,200.0	0.53	166.83	1,199.9	-8.4	-4.8	209.81	9.6
1,300.0	0.43	98.89	1,299.9	-8.9	-4.3	205.94	9.9
1,400.0	0.68	61.62	1,399.9	-8.6	-3.4	201.59	9.3
1,500.0	0.81	60.62	1,499.9	-8.0	-2.3	195.89	8.3
1,600.0	0.62	73.87	1,599.9	-7.5	-1.1	188.67	7.6
1,700.0	0.56	94.65	1,699.9	-7.4	-0.1	181.07	7.4
1,800.0	0.60	97.04	1,799.9	-7.5	0.9	173.40	7.6
1,900.0	0.61	110.08	1,899.9	-7.8	1.9	166.32	8.0
2,000.0	0.57	118.08	1,999.9	-8.2	2.8	160.92	8.6
2,100.0	0.60	114.40	2,099.9	-8.6	3.7	156.54	9.4
2,200.0	0.37	115.81	2,199.9	-9.0	4.5	153.33	10.0
2,300.0	0.24	123.50	2,299.9	-9.2	5.0	151.69	10.5
2,400.0	0.15	164.45	2,399.9	-9.5	5.2	151.32	10.8
2,500.0	0.14	179.48	2,499.9	-9.7	5.2	151.77	11.0
2,600.0	0.21	245.52	2,599.9	-9.9	5.1	153.00	11.1
2,700.0	0.29	257.36	2,699.9	-10.1	4.6	155.22	11.1
2,800.0	0.36	251.92	2,799.9	-10.2	4.1	158.13	11.0
2,900.0	0.40	249.93	2,899.9	-10.4	3.5	161.59	11.0
3,000.0	0.41	244.41	2,999.9	-10.7	2.8	165.24	11.1
3,100.0	0.33	246.42	3,099.9	-11.0	2.2	168.50	11.2
3,200.0	0.45	256.89	3,199.9	-11.2	1.6	171.92	11.3
3,300.0	0.46	256.17	3,299.9	-11.4	0.8	175.90	11.4
3,400.0	0.46	256.93	3,399.9	-11.5	0.0	179.84	11.5
3,500.0	0.53	259.00	3,499.9	-11.7	-0.8	183.96	11.8
3,600.0	0.59	242.87	3,599.9	-12.0	-1.7	188.15	12.2
3,700.0	0.65	236.30	3,699.9	-12.6	-2.7	191.90	12.9
3,800.0	0.72	234.07	3,799.8	-13.3	-3.6	195.31	13.8
3,900.0	0.85	237.04	3,899.8	-14.1	-4.8	198.74	14.8
4,000.0	0.93	236.56	3,999.8	-14.9	-6.1	202.15	16.1
4,100.0	0.91	232.04	4,099.8	-15.8	-7.4	204.95	17.5
4,200.0	0.95	233.84	4,199.8	-16.8	-8.7	207.26	18.9
4,300.0	1.06	236.22	4,299.8	-17.8	-10.1	209.55	20.5
4,400.0	1.05	229.22	4,399.8	-18.9	-11.6	211.42	22.2
4,500.0	1.15	221.94	4,499.7	-20.3	-12.9	212.52	24.0
4,600.0	1.10	220.00	4,599.7	-21.8	-14.2	213.16	26.0
4,700.0	1.06	213.05	4,699.7	-23.3	-15.3	213.39	27.9
4,800.0	1.01	215.04	4,799.7	-24.8	-16.3	213.43	29.7
4,900.0	1.07	226.03	4,899.7	-26.1	-17.5	213.85	31.5
5,000.0	1.12	225.22	4,999.7	-27.5	-18.9	214.52	33.3
5,100.0	0.97	226.58	5,099.6	-28.7	-20.2	215.10	35.1
5,200.0	1.06	238.60	5,199.6	-29.8	-21.6	215.94	36.8
5,300.0	0.95	241.43	5,299.6	-30.7	-23.1	217.00	38.4
5,400.0	1.08	221.07	5,399.6	-31.8	-24.5	217.59	40.1
5,500.0	1.00	232.39	5,499.6	-33.0	-25.8	217.97	41.9

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Site:	Eddy County, NM	MD Reference:	WELL @ 0.0usft (Original Well Elev)
Well:	Willow State #5	North Reference:	Grid
Wellbore:	VH - Job #32K0411300	Survey Calculation Method:	Minimum Curvature
Design:	VH - Job #32K0411300	Database:	EDM-Regulatory

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
5,600.0	1.01	229.66	5,599.6	-34.1	-27.1	218.49	43.6	
5,700.0	0.99	235.29	5,699.5	-35.2	-28.5	219.02	45.3	
5,800.0	1.06	233.23	5,799.5	-36.2	-30.0	219.59	47.0	
5,900.0	0.92	237.30	5,899.5	-37.2	-31.4	220.14	48.7	
6,000.0	1.16	238.21	5,999.5	-38.2	-32.9	220.76	50.4	
6,100.0	1.37	242.77	6,099.5	-39.3	-34.9	221.58	52.5	
6,200.0	1.56	240.22	6,199.4	-40.5	-37.1	222.49	54.9	
6,300.0	1.45	233.21	6,299.4	-41.9	-39.3	223.13	57.5	
6,385.0	1.53	231.96	6,384.4	-43.3	-41.0	223.48	59.6	



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Directional Drilling Operations

Project: Fren
Eddy County, NM
Well: Willow State #5
Wellbore: VH - Job #32K0411300
Design: VH - Job #32K0411300

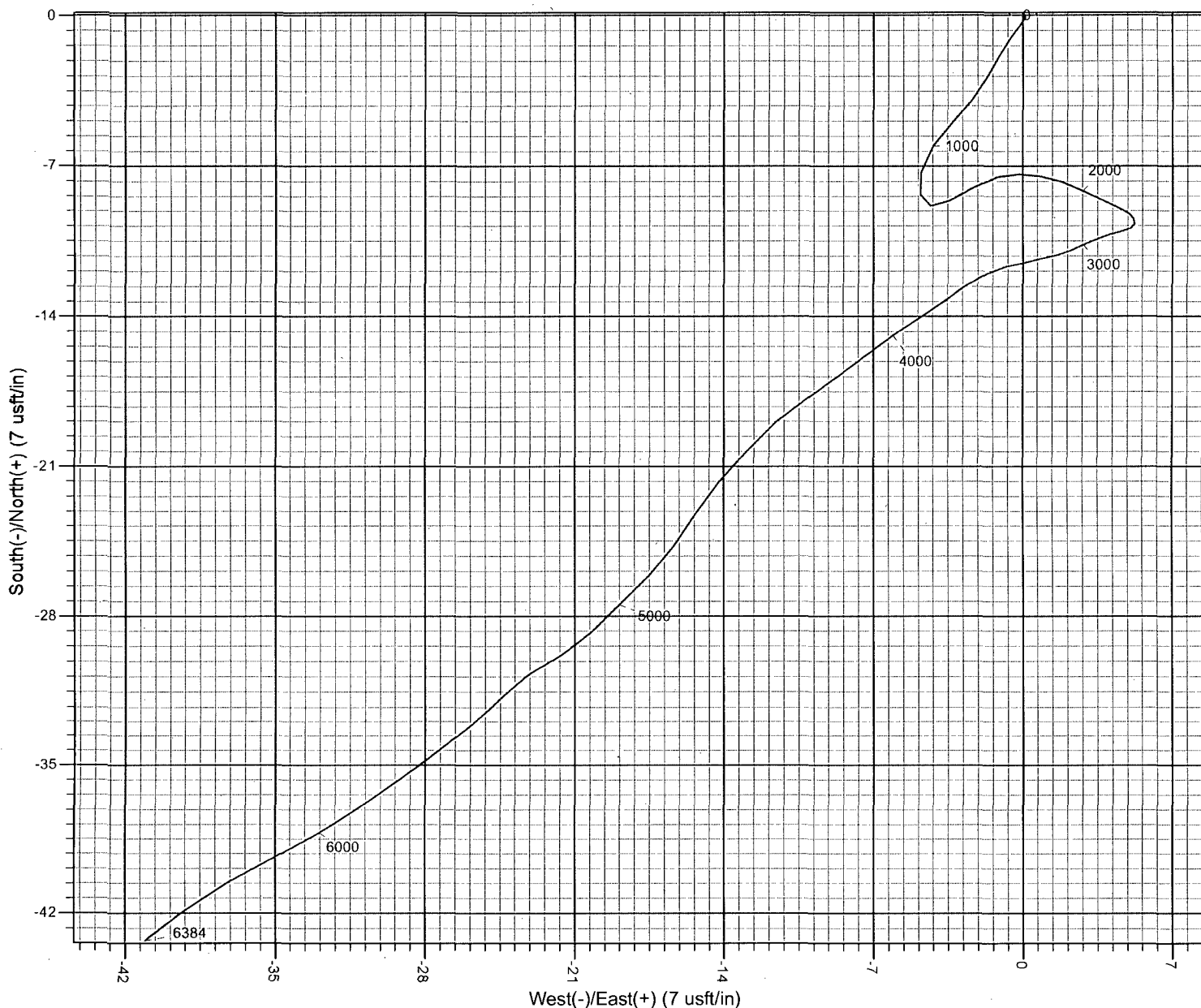


Azimuths to Grid North
True North: -1.29°
Magnetic North: 6.50°

Magnetic Field
Strength: 48997.9snT
Dip Angle: 60.71°
Date: 4/1/2011
Model: IGRF2010

WELL DETAILS: Willow State #5
WELL @ 0.0usft (Original Well Elev)
Ground Level: 0.0

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	675371.24	1232033.88	32° 50' 2.400 N	103° 52' 1.200 W	



PROJECT DETAILS: Fren
Geodetic System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1866
Zone: New Mexico Central 3002
System Datum: Mean Sea Level

SITE DETAILS: Eddy County, NM
Site Centre Latitude: 32° 50' 2.400 N
Longitude: 103° 50' 52.800 W
Positional Uncertainty: 0.0
Convergence: 1.30
Local North: Grid