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COG Operating, LLC

Eddy County, NM (NAD27)

Tumak Federal #3

SHL = 245' FSL & 230' FWL

BHL = 380' FSL & 380' FWL

15- 40459

Design: FINAL SURVEYS

Standard Survey Report

06 September, 2012





Childress Directional Drilling Survey Report



Company:	COG Operating, LLC	Local Co-ordinate Reference:	Well SHL = 245' FSL & 230' FWL
Project:	Eddy County, NM (NAD27)	TVD Reference:	WELL @ 3702.00usft (Original Well Elev)
Site:	Tumak Federal #3	MD Reference:	WELL @ 3702.00usft (Original Well Elev)
Well:	SHL = 245' FSL & 230' FWL	North Reference:	Grid
Wellbore:	BHL = 380' FSL & 380' FWL	Survey Calculation Method:	Minimum Curvature
Design:	FINAL SURVEYS	Database:	EDM 5000.1 Single User Db

Project:	Eddy County, NM (NAD27)		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site:		Tumak Federal #3, BHL = 940' FSL & 940' FWL			
Site Position:		Northing:	0.00 usft	Latitude:	30° 59' 24.512 N
From:	Map	Easting:	0.00 usft	Longitude:	105° 55' 44.137 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	-0.82 °

Well:	SHL = 245' FSL & 230' FWL					
Well Position	+N/-S	0.00 usft	Northing:	664,919.41 usft	Latitude:	32° 49' 40.158 N
	+E/-W	0.00 usft	Easting:	555,105.78 usft	Longitude:	104° 9' 14.182 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	3,702.00 usft

Wellbore						BHL = 380' FSL & 380' FWL					
Magnetics		Model Name		Sample Date		Declination		Dip Angle		Field Strength	
						(°)		(°)		(nT)	
		IGRF2010		08/23/12		7.75		60.61		48,794	

Design:	FINAL SURVEYS				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W	Direction	
	(usft)	(usft)	(usft)	(°)	
	0.00	0.00	0.00	44.30	

Survey Program		Date: 09/06/12		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.00	865.00	Vaughn gyro surveys (BHL = 380' FSL & 3	NS-GYRO-MS	North sensing gyrocompassing m/s
993.00	4,433.00	Childress MWD surveys (BHL = 380' FSL	MWD	MWD - CHILDRESS MWD

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.21	279.64	100.00	0.03	-0.18	-0.10	0.21	0.21	0.00
200.00	0.35	295.78	200.00	0.19	-0.64	-0.31	0.16	0.14	16.14
300.00	0.37	164.65	300.00	0.02	-0.83	-0.57	0.66	0.02	-131.13
400.00	0.30	17.25	400.00	-0.05	-0.66	-0.50	0.64	-0.07	-147.40
500.00	0.10	315.47	500.00	0.27	-0.65	-0.26	0.27	-0.20	-61.78
600.00	0.04	318.77	600.00	0.36	-0.73	-0.26	0.06	-0.06	3.30
700.00	0.27	119.84	700.00	0.26	-0.55	-0.19	0.31	0.23	161.07
800.00	0.21	76.61	800.00	0.19	-0.17	0.02	0.19	-0.06	-43.23
865.00	0.48	322.18	864.99	0.43	-0.22	0.16	0.92	0.42	-176.05

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Site:	Tumak Federal #3	MD Reference:	WELL @ 3702.00usft (Original Well Elev)
Well:	SHL = 245' FSL & 230' FWL	North Reference:	Grid
Wellbore:	BHL = 380' FSL & 380' FWL	Survey Calculation Method:	Minimum Curvature
Design:	FINAL SURVEYS	Database:	EDM-5000.1 Single User Db

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
993.00	0.40	108.00	992.99	0.72	-0.12	0.43	0.66	-0.06	113.92
1,088.00	1.30	38.40	1,087.98	1.46	0.86	1.65	1.28	0.95	-73.26
1,182.00	2.30	41.40	1,181.94	3.71	2.77	4.59	1.07	1.06	3.19
1,275.00	2.60	44.20	1,274.85	6.62	5.48	8.57	0.35	0.32	3.01
1,369.00	2.60	40.90	1,368.75	9.76	8.36	12.83	0.16	0.00	-3.51
1,463.00	2.50	46.00	1,462.66	12.80	11.23	17.00	0.26	-0.11	5.43
1,556.00	2.90	43.50	1,555.56	15.91	14.31	21.38	0.45	0.43	-2.69
1,658.00	2.30	41.10	1,657.45	19.33	17.43	26.01	0.60	-0.59	-2.35
1,752.00	2.60	45.50	1,751.37	22.24	20.19	30.02	0.38	0.32	4.68
1,846.00	2.10	47.70	1,845.29	24.90	22.99	33.87	0.54	-0.53	2.34
1,940.00	2.60	46.00	1,939.21	27.54	25.79	37.72	0.54	0.53	-1.81
2,033.00	3.30	46.90	2,032.08	30.83	29.27	42.50	0.75	0.75	0.97
2,127.00	3.00	43.70	2,125.94	34.46	32.94	47.67	0.37	-0.32	-3.40
2,221.00	2.90	44.60	2,219.82	37.93	36.31	52.50	0.12	-0.11	0.96
2,314.00	2.60	38.40	2,312.71	41.26	39.27	56.96	0.45	-0.32	-6.67
2,408.00	3.50	45.80	2,406.58	44.93	42.65	61.94	1.04	0.96	7.87
2,502.00	3.30	46.20	2,500.41	48.80	46.66	67.52	0.21	-0.21	0.43
2,597.00	3.30	44.90	2,595.25	52.63	50.57	72.98	0.08	0.00	-1.37
2,692.00	2.90	42.60	2,690.11	56.34	54.12	78.12	0.44	-0.42	-2.42
2,785.00	2.60	44.90	2,783.01	59.56	57.20	82.58	0.34	-0.32	2.47
2,880.00	2.60	47.40	2,877.91	62.55	60.31	86.89	0.12	0.00	2.63
2,973.00	2.60	47.60	2,970.81	65.40	63.42	91.10	0.01	0.00	0.22
3,068.00	2.60	40.20	3,065.72	68.50	66.40	95.40	0.35	0.00	-7.79
3,161.00	2.50	41.40	3,158.62	71.63	69.11	99.53	0.12	-0.11	1.29
3,255.00	3.00	46.90	3,252.52	74.85	72.26	104.03	0.60	0.53	5.85
3,349.00	3.20	46.30	3,346.38	78.34	75.95	109.11	0.22	0.21	-0.64
3,443.00	3.30	48.80	3,440.23	81.94	79.88	114.43	0.18	0.11	2.66
3,537.00	3.00	47.60	3,534.08	85.38	83.74	119.59	0.33	-0.32	-1.28
3,630.00	3.00	48.30	3,626.96	88.64	87.35	124.44	0.04	0.00	0.75
3,724.00	2.60	47.60	3,720.84	91.71	90.76	129.03	0.43	-0.43	-0.74
3,818.00	2.60	51.60	3,814.75	94.47	94.01	133.27	0.19	0.00	4.26
3,912.00	2.40	52.70	3,908.66	96.99	97.24	137.33	0.22	-0.21	1.17
4,006.00	2.80	39.70	4,002.56	99.95	100.28	141.57	0.76	0.43	-13.83
4,100.00	2.80	45.80	4,096.45	103.32	103.39	146.15	0.32	0.00	6.49
4,194.00	2.60	44.60	4,190.35	106.43	106.53	150.58	0.22	-0.21	-1.28
4,288.00	2.60	46.30	4,284.25	109.43	109.57	154.84	0.08	0.00	1.81
4,382.00	2.60	40.50	4,378.15	112.52	112.50	159.10	0.28	0.00	-6.17
Survey @ 4382' MD 2.60° INC 40.50° AZM									
4,433.00	2.60	40.50	4,429.10	114.28	114.00	161.41	0.00	0.00	0.00
PTB at TD @ 4433' MD 2.60° INC 40.50° AZM									



Childress Directional Drilling
Survey Report



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Site:	Tumak Federal #3	MD Reference:	WELL @ 3702.00usft (Original Well Elev)
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Wellbore:	BHL = 380' FSL & 380' FWL	Survey Calculation Method:	Minimum Curvature
Design:	FINAL SURVEYS	Database:	EDM 5000.1 Single User Db

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
4,382.00	4,378.15	112.52	112.50	Survey @ 4382' MD 2.60° INC 40.50° AZM
4,433.00	4,429.10	114.28	114.00	PTB at TD @ 4433' MD 2.60° INC 40.50° AZM

Checked By: _____	Approved By: _____	Date: _____
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Company Name: COG Operating, LLC
 Site: Tumak Federal
 Well: #3
 Project: Eddy County, NM (NAD27)
 Rig Name: Original Well Elev



Created By: Gail Deering
 Date: 15:51, September 06 2012
 Plan: Design #1

ANNOTATIONS

MD	TVD	Inc	Azi	+N/-S	+E/-W	VSDeparture	Annotation
865.00	864.99	0.48	322.18	0.43	-0.22	0.16	0.00
950.00	949.99	0.48	322.18	0.99	-0.65	0.25	0.71
1085.16	1085.10	2.72	44.78	3.72	1.26	3.54	4.23
5404.94	5400.00	2.72	44.78	149.40	145.80	208.75	209.45

WELL DETAILS: #3

Ground Level: 3702.00
 Northing: 664919.41
 Easting: 555105.77

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting
PBHL	5400.00	149.40	145.80	665068.81	555251.57

CASING DETAILS

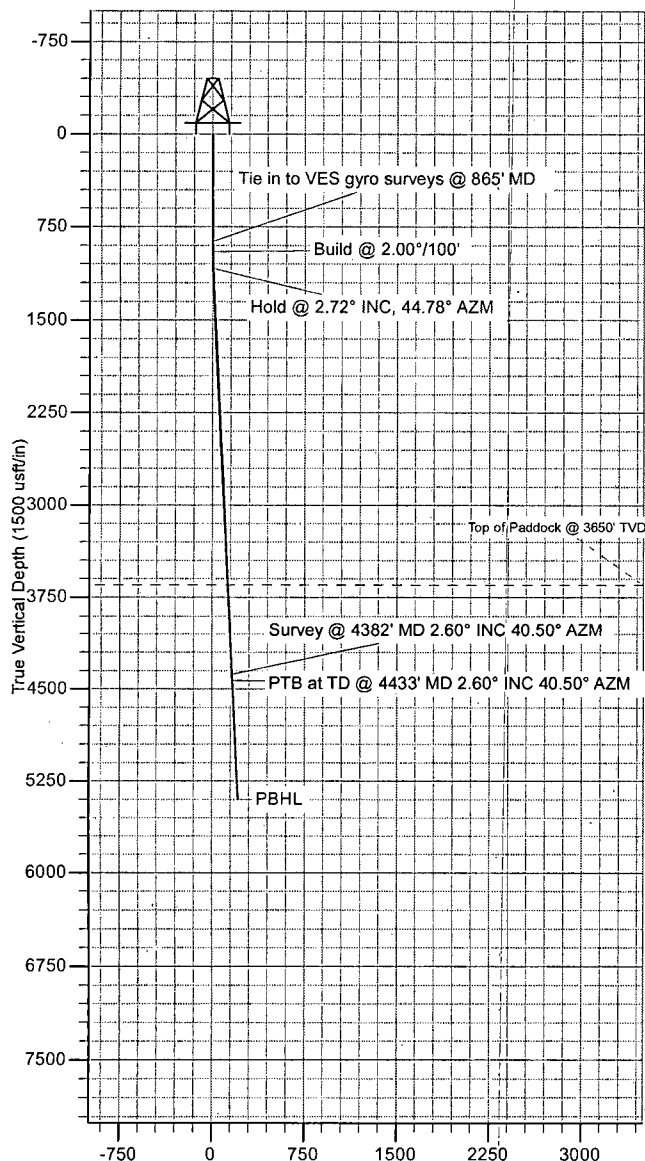
No casing data is available



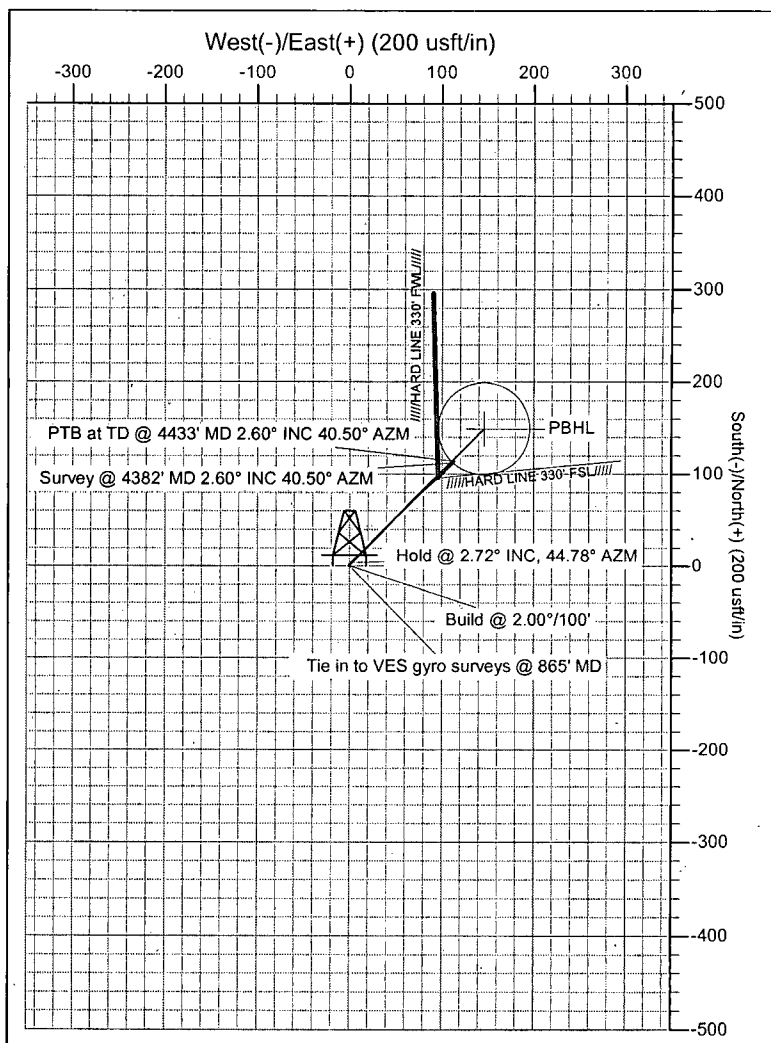
Azimuths to Grid North
 True North: -0.10°
 Magnetic North: 7.66°

Magnetic Field
 Strength: 48793.9nT
 Dip Angle: 60.61°
 Date: 08/23/2012
 Model: IGRF2010

**Magnetic Azimuth Apply:
 7.66° to convert to Grid North**



Vertical Section at 44.30° (1500 usft/in)



FORMATION TOP DETAILS

TVDPath	MDPath	Formation
3650.00	Top of Paddock @ 3650' TVD	

DipAngle
 0.00

DipDir