



30-015-37979

COG Operating LLC

Eddy County, NM (NAN27 NME)

Skelly Unit #654

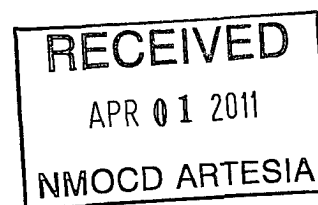
Skelly Unit #654

OH

Design: Actual

Standard Survey Report

22 February, 2011



Scientific Drilling
Directional Drilling Operations



Scientific Drilling

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Skelly Unit #654
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Site:	Skelly Unit #654	MD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Well:	Skelly Unit #654	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

Project	Eddy County, NM (NAN27 NME)		
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	Skelly Unit #654		
Site Position:		Northing:	669,674.20 usft
From:	Map	Easting:	649,580.40 usft
Position Uncertainty:	0.00 usft	Slot Radius:	0 "
		Latitude:	32° 50' 24.260 N
		Longitude:	103° 50' 46.743 W
		Grid Convergence:	0.26 °

Well	Skelly Unit #654		
Well Position	+N/-S	0.00 usft	Northing:
	+E/-W	0.00 usft	Easting:
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32° 50' 24.260 N
		Longitude:	103° 50' 46.743 W
		Ground Level:	3,913.00 usft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	2011/02/08	7.80	60.72	48,989

Design	Actual				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	136.06	

Survey Program	Date 2011/02/22				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	1,902.00	Gyro Survey (OH)	Keeper	Standard Wireline Keeper ver 1.0.2	
1,980.00	6,835.00	MWD Survey (OH)	MWD	MWD - Standard	

Survey										
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	0.41	345.20	100.00	0.35	-0.09	-0.31	0.41	0.41	0.00	
200.00	0.43	348.33	200.00	1.06	-0.26	-0.94	0.03	0.02	3.13	
300.00	0.59	349.25	299.99	1.93	-0.43	-1.69	0.16	0.16	0.92	
400.00	0.49	349.73	399.99	2.86	-0.60	-2.48	0.10	-0.10	0.48	
500.00	0.60	353.52	499.98	3.80	-0.74	-3.25	0.12	0.11	3.79	
600.00	0.44	353.34	599.98	4.70	-0.84	-3.97	0.16	-0.16	-0.18	
700.00	0.47	351.17	699.98	5.49	-0.95	-4.61	0.03	0.03	-2.17	
800.00	0.60	351.67	799.97	6.41	-1.09	-5.37	0.13	0.13	0.50	
900.00	0.53	345.41	899.97	7.38	-1.28	-6.20	0.09	-0.07	-6.26	



Scientific Drilling Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Skelly Unit #654
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Site:	Skelly Unit #654	MD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Well:	Skelly Unit #654	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

Survey									
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)
1,000.00	0.59	5.03	999.96	8.34	-1.35	-6.94	0.20	0.06	19.62
1,100.00	0.95	37.91	1,099.95	9.50	-0.80	-7.40	0.56	0.36	32.88
1,200.00	0.58	28.29	1,199.94	10.60	-0.05	-7.67	0.39	-0.37	-9.62
1,300.00	0.71	35.96	1,299.94	11.55	0.56	-7.93	0.16	0.13	7.67
1,400.00	0.97	38.01	1,399.93	12.72	1.44	-8.16	0.26	0.26	2.05
1,500.00	1.19	39.34	1,499.91	14.19	2.62	-8.40	0.22	0.22	1.33
1,600.00	1.43	52.93	1,599.88	15.75	4.27	-8.37	0.39	0.24	13.59
1,700.00	1.39	64.20	1,699.85	17.03	6.36	-7.85	0.28	-0.04	11.27
1,800.00	1.42	63.05	1,799.82	18.12	8.56	-7.11	0.04	0.03	-1.15
1,900.00	1.61	59.28	1,899.79	19.39	10.87	-6.42	0.21	0.19	-3.77
1,902.00	1.33	64.09	1,901.79	19.42	10.92	-6.41	15.29	-14.00	240.50
Gyro tie-in									
1,980.00	1.17	64.41	1,979.77	20.16	12.45	-5.88	0.21	-0.21	0.41
2,032.00	1.89	95.49	2,031.75	20.31	13.78	-5.06	2.07	1.38	59.77
2,128.00	7.32	119.53	2,127.41	17.14	20.68	2.01	5.88	5.66	25.04
2,190.00	7.04	127.05	2,188.93	12.90	27.15	9.55	1.58	-0.45	12.13
2,253.00	7.60	132.27	2,251.41	7.77	33.32	17.52	1.38	0.89	8.29
2,316.00	7.69	133.99	2,313.85	2.04	39.43	25.89	0.39	0.14	2.73
2,379.00	7.16	141.66	2,376.33	-3.96	44.90	34.01	1.78	-0.84	12.17
2,443.00	6.82	143.19	2,439.85	-10.14	49.65	41.75	0.61	-0.53	2.39
2,507.00	6.66	144.75	2,503.41	-16.21	54.07	49.19	0.38	-0.25	2.44
2,571.00	5.85	148.50	2,567.03	-22.02	57.92	56.04	1.42	-1.27	5.86
2,634.00	5.82	140.73	2,629.70	-27.23	61.62	62.36	1.25	-0.05	-12.33
2,698.00	6.50	134.89	2,693.33	-32.30	66.24	69.22	1.44	1.06	-9.13
2,762.00	7.23	139.83	2,756.87	-37.93	71.40	76.86	1.47	1.14	7.72
2,825.00	7.44	141.66	2,819.36	-44.16	76.49	84.87	0.50	0.33	2.90
2,889.00	7.10	140.43	2,882.84	-50.46	81.58	92.94	0.58	-0.53	-1.92
2,952.00	7.25	141.31	2,945.35	-56.57	86.54	100.78	0.30	0.24	1.40
3,016.00	7.93	140.39	3,008.79	-63.12	91.88	109.21	1.08	1.06	-1.44
3,079.00	7.98	141.37	3,071.18	-69.88	97.38	117.89	0.23	0.08	1.56
3,143.00	7.61	140.94	3,134.59	-76.64	102.83	126.54	0.59	-0.58	-0.67
3,207.00	7.52	142.43	3,198.03	-83.25	108.05	134.92	0.34	-0.14	2.33
3,270.00	8.81	144.34	3,260.39	-90.44	113.38	143.80	2.09	2.05	3.03
3,333.00	8.74	143.86	3,322.66	-98.23	119.01	153.31	0.16	-0.11	-0.76
3,397.00	8.44	142.72	3,385.94	-105.89	124.72	162.80	0.54	-0.47	-1.78
3,461.00	8.09	144.22	3,449.27	-113.28	130.20	171.92	0.64	-0.55	2.34
3,522.00	7.91	144.74	3,509.68	-120.19	135.14	180.32	0.32	-0.30	0.85
3,586.00	8.12	144.58	3,573.06	-127.47	140.30	189.14	0.33	0.33	-0.25
3,649.00	7.55	146.26	3,635.47	-134.54	145.17	197.61	0.97	-0.90	2.67
3,713.00	7.36	146.15	3,698.93	-141.44	149.79	205.79	0.30	-0.30	-0.17
3,776.00	7.52	137.19	3,761.40	-147.81	154.84	213.88	1.86	0.25	-14.22
3,839.00	7.31	134.11	3,823.87	-153.63	160.52	222.01	0.71	-0.33	-4.89
3,903.00	7.37	133.86	3,887.35	-159.31	166.41	230.18	0.11	0.09	-0.39



Scientific Drilling
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Skelly Unit #654
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Site:	Skelly Unit #654	MD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Well:	Skelly Unit #654	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

Survey

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)
3,967.00	7.24	133.08	3,950.83	-164.90	172.31	238.31	0.26	-0.20	-1.22
4,030.00	7.12	135.01	4,013.33	-170.38	177.97	246.18	0.43	-0.19	3.06
4,093.00	7.01	133.94	4,075.86	-175.81	183.50	253.92	0.27	-0.17	-1.70
4,156.00	7.99	134.61	4,138.32	-181.55	189.38	262.14	1.56	1.56	1.06
4,220.00	8.73	132.35	4,201.64	-187.95	196.14	271.44	1.26	1.16	-3.53
4,283.00	8.44	131.74	4,263.93	-194.24	203.12	280.82	0.48	-0.46	-0.97
4,347.00	8.57	133.20	4,327.23	-200.64	210.10	290.26	0.39	0.20	2.28
4,409.00	8.68	139.38	4,388.53	-207.35	216.52	299.55	1.50	0.18	9.97
4,473.00	9.14	141.10	4,451.75	-214.97	222.85	309.43	0.83	0.72	2.69
4,537.00	7.63	143.20	4,515.07	-222.33	228.59	318.71	2.41	-2.36	3.28
4,601.00	7.33	144.41	4,578.52	-229.05	233.51	326.97	0.53	-0.47	1.89
4,665.00	7.02	143.82	4,642.02	-235.53	238.20	334.88	0.50	-0.48	-0.92
4,728.00	6.95	145.21	4,704.55	-241.77	242.64	342.46	0.29	-0.11	2.21
4,791.00	7.03	144.45	4,767.09	-248.03	247.06	350.04	0.19	0.13	-1.21
4,855.00	7.05	143.30	4,830.60	-254.37	251.69	357.81	0.22	0.03	-1.80
4,917.00	6.82	144.00	4,892.15	-260.40	256.12	365.23	0.40	-0.37	1.13
4,981.00	6.95	144.46	4,955.69	-266.62	260.61	372.82	0.22	0.20	0.72
5,044.00	6.87	144.11	5,018.23	-272.78	265.03	380.32	0.14	-0.13	-0.56
5,108.00	6.85	142.05	5,081.77	-278.89	269.62	387.91	0.39	-0.03	-3.22
5,173.00	5.38	138.74	5,146.40	-284.23	274.02	394.81	2.32	-2.26	-5.09
5,268.00	3.09	137.02	5,241.14	-289.46	278.70	401.82	2.41	-2.41	-1.81
5,331.00	2.89	136.98	5,304.05	-291.86	280.94	405.10	0.32	-0.32	-0.06
5,395.00	2.22	116.17	5,367.99	-293.59	283.15	407.88	1.77	-1.05	-32.52
5,459.00	2.90	124.95	5,431.92	-295.06	285.59	410.64	1.22	1.06	13.72
5,521.00	3.15	134.38	5,493.84	-297.15	288.10	413.88	0.90	0.40	15.21
5,585.00	4.02	131.70	5,557.71	-299.87	291.03	417.87	1.38	1.36	-4.19
5,648.00	4.32	130.52	5,620.54	-302.88	294.48	422.44	0.50	0.48	-1.87
5,711.00	4.32	130.71	5,683.37	-305.97	298.08	427.16	0.02	0.00	0.30
5,775.00	4.52	129.76	5,747.18	-309.16	301.85	432.07	0.33	0.31	-1.48
5,839.00	3.36	136.72	5,811.02	-312.14	305.07	436.45	1.96	-1.81	10.88
5,903.00	3.40	142.96	5,874.91	-315.02	307.50	440.21	0.58	0.06	9.75
5,967.00	3.35	141.84	5,938.80	-318.00	309.80	443.95	0.13	-0.08	-1.75
6,030.00	3.10	139.16	6,001.70	-320.74	312.05	447.49	0.46	-0.40	-4.25
6,095.00	3.64	140.41	6,066.59	-323.66	314.52	451.30	0.84	0.83	1.92
6,158.00	3.57	137.10	6,129.46	-326.63	317.13	455.25	0.35	-0.11	-5.25
6,221.00	3.67	139.40	6,192.34	-329.60	319.77	459.23	0.28	0.16	3.65
6,284.00	3.93	138.88	6,255.20	-332.76	322.51	463.40	0.42	0.41	-0.83
6,347.00	3.76	137.88	6,318.06	-335.92	325.31	467.62	0.29	-0.27	-1.59
6,410.00	3.27	140.13	6,380.94	-338.83	327.85	471.48	0.81	-0.78	3.57
6,474.00	3.33	140.33	6,444.83	-341.66	330.21	475.15	0.10	0.09	0.31
6,538.00	3.39	141.20	6,508.72	-344.57	332.58	478.89	0.12	0.09	1.36
6,602.00	3.38	134.04	6,572.61	-347.35	335.12	482.66	0.66	-0.02	-11.19
6,665.00	3.34	140.47	6,635.50	-350.06	337.62	486.34	0.60	-0.06	10.21



Scientific Drilling

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Site Skelly Unit #654
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Site:	Skelly Unit #654	MD Reference:	KB Elev (12') @ 3925.00usft (Basic #35)
Well:	Skelly Unit #654	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Julio

Survey

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)
6,729.00	2.86	139.05	6,699.41	-352.70	339.86	489.80	0.76	-0.75	-2.22
6,784.00	2.98	130.49	6,754.34	-354.67	341.84	492.59	0.82	0.22	-15.56
Last MWD Survey									
6,835.00	2.98	130.49	6,805.27	-356.39	343.86	495.23	0.00	0.00	0.00
Projection to Bit									

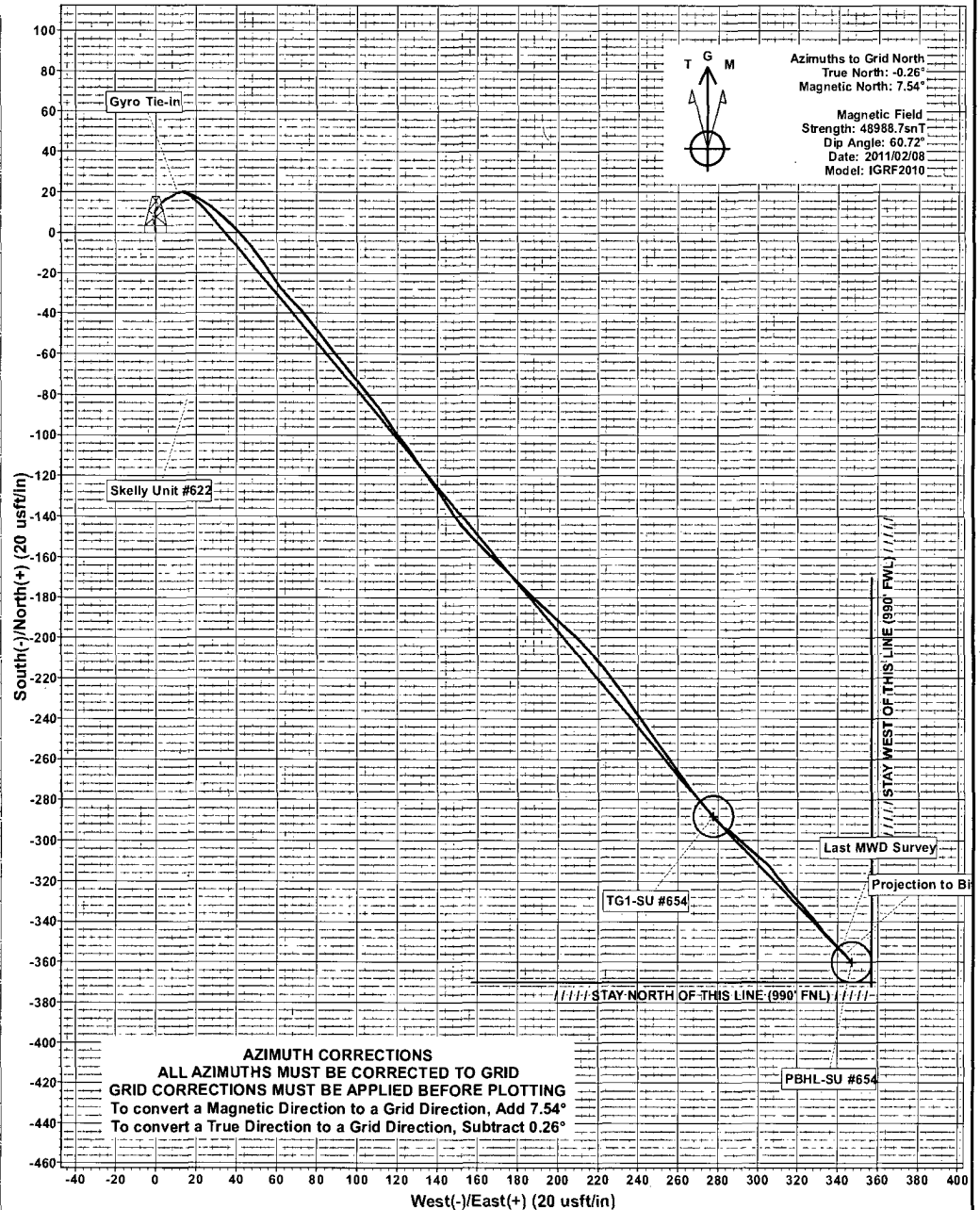
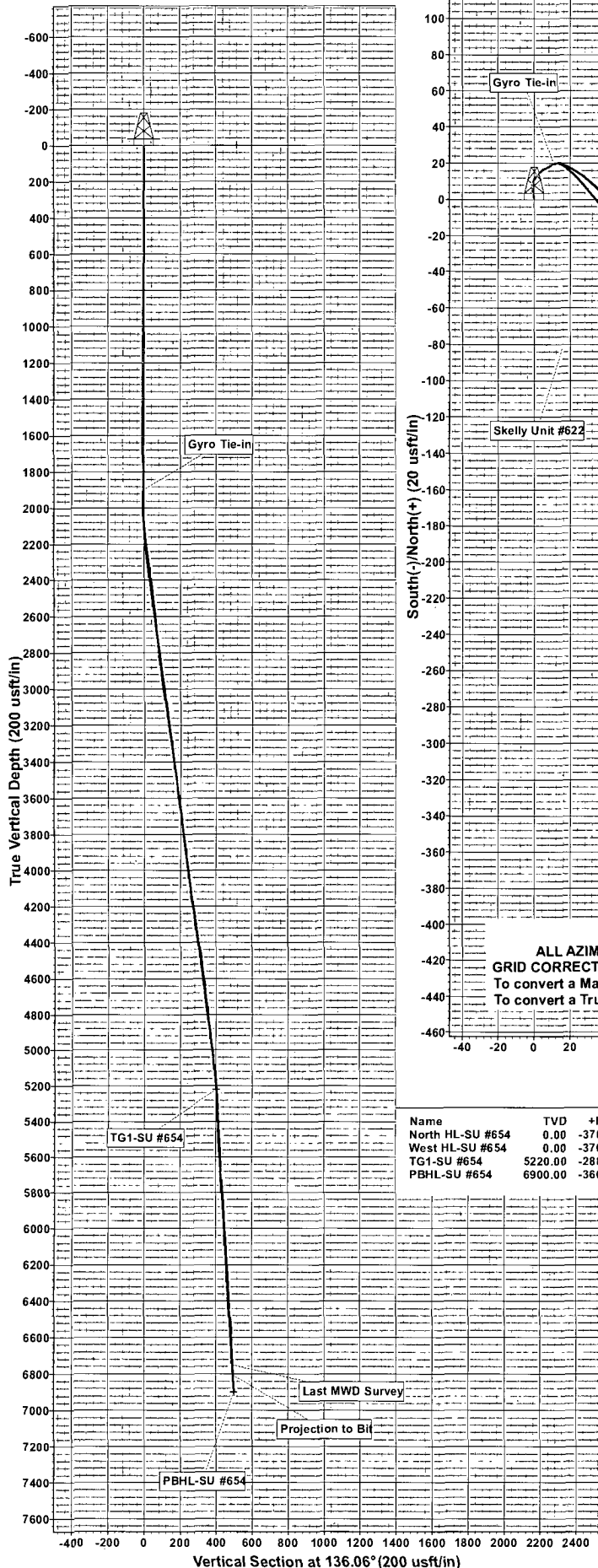
Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,902.00	1,901.79	19.42	10.92	Gyro tie-in
6,784.00	6,754.34	-354.67	341.84	Last MWD Survey
6,835.00	6,805.27	-356.39	343.86	Projection to Bit

Checked By: _____ Approved By: _____ Date: _____



Scientific Drilling for COG Operating LLC
Site: Eddy County, NM (NAN27 NME)
Well: Skelly Unit #654
Wellbore: OH
Design: Plan #2 vs Actual - 7-7/8" Hole



AZIMUTH CORRECTIONS
ALL AZIMUTHS MUST BE CORRECTED TO GRID
GRID CORRECTIONS MUST BE APPLIED BEFORE PLOTTING
To convert a Magnetic Direction to a Grid Direction, Add 7.54°
To convert a True Direction to a Grid Direction, Subtract 0.26°

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
North HL-SU #654	0.00	-370.20	357.10	669304.00	649937.50	32° 50' 20.580 N	103° 50' 42.578 W	Rectangle (Sides: L 0.00 W 200.00)
West HL-SU #654	0.00	-370.20	357.10	669304.00	649937.50	32° 50' 20.580 N	103° 50' 42.578 W	Rectangle (Sides: L 200.00 W 0.00)
TG1-SU #654	5220.00	-288.19	277.71	669386.01	649858.11	32° 50' 21.396 N	103° 50' 43.504 W	Circle (Radius: 10.0 0)
PBHL-SU #654	6900.00	-360.20	347.10	669314.00	649927.50	32° 50' 20.680 N	103° 50' 42.695 W	Circle (Radius: 10.00)

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec	Target
1	1902.00	1.33	64.09	1901.79	19.42	10.92	0.00	0.00	-6.41	
2	1950.00	1.33	64.09	1949.77	19.91	11.92	0.00	0.00	-6.06	
3	2321.27	7.64	139.86	2319.86	2.90	31.73	2.00	85.71	19.93	
4	5034.17	7.64	139.86	5008.68	-272.85	264.23	0.00	0.00	379.82	
5	5246.52	3.41	136.06	5220.00	-288.19	277.71	2.00	-176.95	400.22	TG1-SU #654
6	6929.50	3.41	136.06	6900.00	-360.20	347.10	0.00	0.00	500.22	PBHL-SU #654

WELL DETAILS: Skelly Unit #654

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.00	0.00	669674.20	649580.40	32° 50' 24.260 N	103° 50' 46.743 W	

PROJECT DETAILS: Eddy County, NM (NAN27 NME) Plan: Plan #2 7-7/8" Hole (Skelly Unit #654/OH)

Geodetic System: US State Plane 1927 (Exact solution)	Created By: Julio Pina	Date: 08-Feb-11
Datum: NAD 1927 (NADCON CONUS)		
Ellipsoid: Clarke 1866	Checked: _____	Date: _____
Zone: New Mexico East 3001	Reviewed: _____	Date: _____
System Datum: Mean Sea Level	Approved: _____	Date: _____