



COG Operating L L C
 Project: Lea County, NM (NAD27 NME)
 Site: Sec. 20, T 24 S. , R 35 E
 Well: Viking Helmet State Com 24H
 Wellbore: Wellbore #1
 Plan: Plan #1 (Viking Helmet State Com 24H/Wellbore #1)
 McVay 8



WELL DETAILS: Viking Helmet State Com 24H

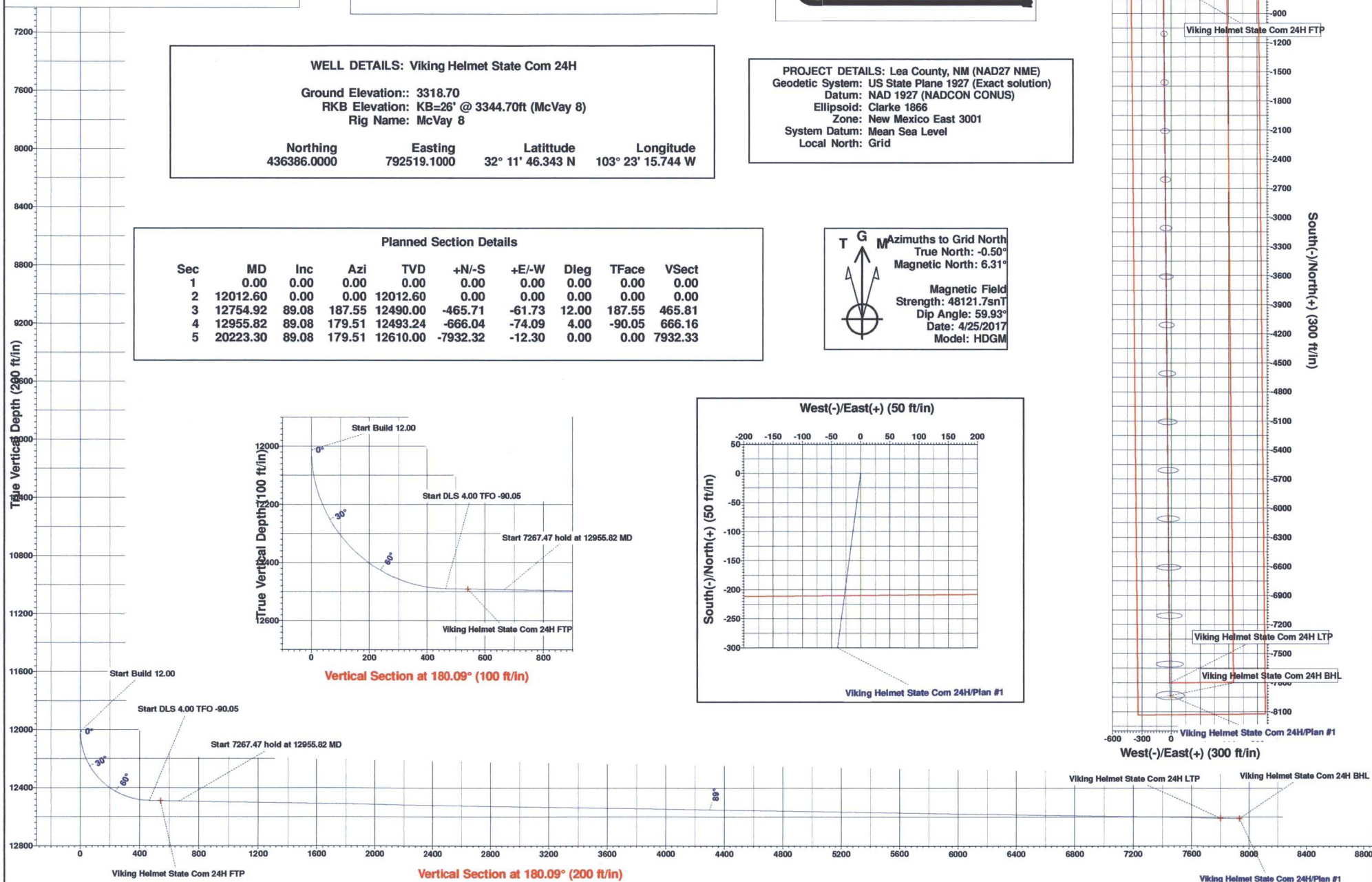
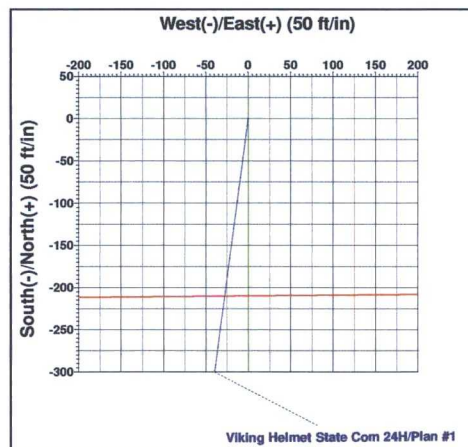
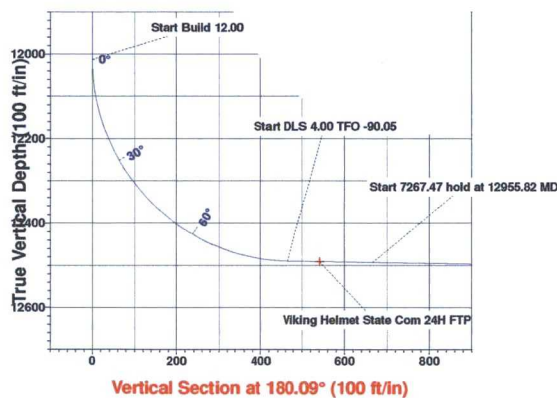
Ground Elevation:: 3318.70
 RKB Elevation: KB=26' @ 3344.70ft (McVay 8)
 Rig Name: McVay 8

Northing	Easting	Latitude	Longitude
436386.0000	792519.1000	32° 11' 46.343 N	103° 23' 15.744 W

PROJECT DETAILS: Lea County, NM (NAD27 NME)
 Geodetic System: US State Plane 1927 (Exact solution)
 Datum: NAD 1927 (NADCON CONUS)
 Ellipsoid: Clarke 1866
 Zone: New Mexico East 3001
 System Datum: Mean Sea Level
 Local North: Grid

Planned Section Details

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSec
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	12012.60	0.00	0.00	12012.60	0.00	0.00	0.00	0.00	0.00
3	12754.92	89.08	187.55	12490.00	-465.71	-61.73	12.00	187.55	465.81
4	12955.82	89.08	179.51	12493.24	-666.04	-74.09	4.00	-90.05	666.16
5	20223.30	89.08	179.51	12610.00	-7932.32	-12.30	0.00	0.00	7932.33





COG Operating L L C

Lea County, NM (NAD27 NME)

Sec. 20, T 24 S. , R 35 E

Viking Helmet State Com 24H

Wellbore #1

Plan: Plan #1

Standard Survey Report

25 April, 2017





Integrity Directional Services, LLC

Survey Report



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Viking Helmet State Com 24H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3344.70ft (McVay 8)
Site:	Sec. 20, T 24 S. , R 35 E	MD Reference:	KB=26' @ 3344.70ft (McVay 8)
Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Plan #1	Database:	EDM 5000.1 Multi User Db

Project	Lea County, NM (NAD27 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	Sec. 20, T 24 S. , R 35 E		
Site Position:		Northing:	436,386.0000 usft
From:	Map	Easting:	792,519.1000 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	32° 11' 46.343 N
		Longitude:	103° 23' 15.744 W
		Grid Convergence:	0.50 °

Well	Viking Helmet State Com 24H		
Well Position	+N/-S	0.00 ft	Northing: 436,386.0000 usft
	+E/-W	0.00 ft	Easting: 792,519.1000 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	0.00 ft
		Latitude:	32° 11' 46.343 N
		Longitude:	103° 23' 15.744 W
		Ground Level:	3,318.70 ft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination
			(°)
	HDGM	4/25/2017	6.82
			Dip Angle
			(°)
			59.93
			Field Strength
			(nT)
			48,122

Design	Plan #1		
Audit Notes:			
Version:	Phase:	PLAN	Tie On Depth: 0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(ft)	(ft)	(ft)
	0.00	0.00	0.00
			Direction
			(°)
			180.09

Survey Tool Program	Date 4/25/2017		
From	To	Survey (Wellbore)	Tool Name
(ft)	(ft)		
0.00	20,223.16	Plan #1 (Wellbore #1)	MWD
			Description
			MWD - Standard

Planned Survey									
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn
Depth	(°)	(°)	Depth	(ft)	(ft)	Section	Rate	Rate	Rate
(ft)			(ft)			(ft)	(°/100usft)	(°/100usft)	(°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	0.00



Integrity Directional Services, LLC
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Site:	Sec. 20, T 24 S. , R 35 E	MD Reference:	KB=26' @ 3344.70ft (McVay 8)
Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Plan #1	Database:	EDM 5000.1 Multi User Db

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00
1,200.00	0.00	0.00	1,200.00	0.00	0.00	0.00	0.00	0.00	0.00
1,300.00	0.00	0.00	1,300.00	0.00	0.00	0.00	0.00	0.00	0.00
1,400.00	0.00	0.00	1,400.00	0.00	0.00	0.00	0.00	0.00	0.00
1,500.00	0.00	0.00	1,500.00	0.00	0.00	0.00	0.00	0.00	0.00
1,600.00	0.00	0.00	1,600.00	0.00	0.00	0.00	0.00	0.00	0.00
1,700.00	0.00	0.00	1,700.00	0.00	0.00	0.00	0.00	0.00	0.00
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00
1,900.00	0.00	0.00	1,900.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	0.00
2,100.00	0.00	0.00	2,100.00	0.00	0.00	0.00	0.00	0.00	0.00
2,200.00	0.00	0.00	2,200.00	0.00	0.00	0.00	0.00	0.00	0.00
2,300.00	0.00	0.00	2,300.00	0.00	0.00	0.00	0.00	0.00	0.00
2,400.00	0.00	0.00	2,400.00	0.00	0.00	0.00	0.00	0.00	0.00
2,500.00	0.00	0.00	2,500.00	0.00	0.00	0.00	0.00	0.00	0.00
2,600.00	0.00	0.00	2,600.00	0.00	0.00	0.00	0.00	0.00	0.00
2,700.00	0.00	0.00	2,700.00	0.00	0.00	0.00	0.00	0.00	0.00
2,800.00	0.00	0.00	2,800.00	0.00	0.00	0.00	0.00	0.00	0.00
2,900.00	0.00	0.00	2,900.00	0.00	0.00	0.00	0.00	0.00	0.00
3,000.00	0.00	0.00	3,000.00	0.00	0.00	0.00	0.00	0.00	0.00
3,100.00	0.00	0.00	3,100.00	0.00	0.00	0.00	0.00	0.00	0.00
3,200.00	0.00	0.00	3,200.00	0.00	0.00	0.00	0.00	0.00	0.00
3,300.00	0.00	0.00	3,300.00	0.00	0.00	0.00	0.00	0.00	0.00
3,400.00	0.00	0.00	3,400.00	0.00	0.00	0.00	0.00	0.00	0.00
3,500.00	0.00	0.00	3,500.00	0.00	0.00	0.00	0.00	0.00	0.00
3,600.00	0.00	0.00	3,600.00	0.00	0.00	0.00	0.00	0.00	0.00
3,700.00	0.00	0.00	3,700.00	0.00	0.00	0.00	0.00	0.00	0.00
3,800.00	0.00	0.00	3,800.00	0.00	0.00	0.00	0.00	0.00	0.00
3,900.00	0.00	0.00	3,900.00	0.00	0.00	0.00	0.00	0.00	0.00
4,000.00	0.00	0.00	4,000.00	0.00	0.00	0.00	0.00	0.00	0.00
4,100.00	0.00	0.00	4,100.00	0.00	0.00	0.00	0.00	0.00	0.00
4,200.00	0.00	0.00	4,200.00	0.00	0.00	0.00	0.00	0.00	0.00
4,300.00	0.00	0.00	4,300.00	0.00	0.00	0.00	0.00	0.00	0.00
4,400.00	0.00	0.00	4,400.00	0.00	0.00	0.00	0.00	0.00	0.00
4,500.00	0.00	0.00	4,500.00	0.00	0.00	0.00	0.00	0.00	0.00
4,600.00	0.00	0.00	4,600.00	0.00	0.00	0.00	0.00	0.00	0.00
4,700.00	0.00	0.00	4,700.00	0.00	0.00	0.00	0.00	0.00	0.00
4,800.00	0.00	0.00	4,800.00	0.00	0.00	0.00	0.00	0.00	0.00
4,900.00	0.00	0.00	4,900.00	0.00	0.00	0.00	0.00	0.00	0.00
5,000.00	0.00	0.00	5,000.00	0.00	0.00	0.00	0.00	0.00	0.00
5,100.00	0.00	0.00	5,100.00	0.00	0.00	0.00	0.00	0.00	0.00
5,200.00	0.00	0.00	5,200.00	0.00	0.00	0.00	0.00	0.00	0.00
5,300.00	0.00	0.00	5,300.00	0.00	0.00	0.00	0.00	0.00	0.00



Integrity Directional Services, LLC

Survey Report



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Viking Helmet State Com 24H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3344.70ft (McVay 8)
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Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,400.00	0.00	0.00	5,400.00	0.00	0.00	0.00	0.00	0.00	0.00
5,500.00	0.00	0.00	5,500.00	0.00	0.00	0.00	0.00	0.00	0.00
5,600.00	0.00	0.00	5,600.00	0.00	0.00	0.00	0.00	0.00	0.00
5,700.00	0.00	0.00	5,700.00	0.00	0.00	0.00	0.00	0.00	0.00
5,800.00	0.00	0.00	5,800.00	0.00	0.00	0.00	0.00	0.00	0.00
5,900.00	0.00	0.00	5,900.00	0.00	0.00	0.00	0.00	0.00	0.00
6,000.00	0.00	0.00	6,000.00	0.00	0.00	0.00	0.00	0.00	0.00
6,100.00	0.00	0.00	6,100.00	0.00	0.00	0.00	0.00	0.00	0.00
6,200.00	0.00	0.00	6,200.00	0.00	0.00	0.00	0.00	0.00	0.00
6,300.00	0.00	0.00	6,300.00	0.00	0.00	0.00	0.00	0.00	0.00
6,400.00	0.00	0.00	6,400.00	0.00	0.00	0.00	0.00	0.00	0.00
6,500.00	0.00	0.00	6,500.00	0.00	0.00	0.00	0.00	0.00	0.00
6,600.00	0.00	0.00	6,600.00	0.00	0.00	0.00	0.00	0.00	0.00
6,700.00	0.00	0.00	6,700.00	0.00	0.00	0.00	0.00	0.00	0.00
6,800.00	0.00	0.00	6,800.00	0.00	0.00	0.00	0.00	0.00	0.00
6,900.00	0.00	0.00	6,900.00	0.00	0.00	0.00	0.00	0.00	0.00
7,000.00	0.00	0.00	7,000.00	0.00	0.00	0.00	0.00	0.00	0.00
7,100.00	0.00	0.00	7,100.00	0.00	0.00	0.00	0.00	0.00	0.00
7,200.00	0.00	0.00	7,200.00	0.00	0.00	0.00	0.00	0.00	0.00
7,300.00	0.00	0.00	7,300.00	0.00	0.00	0.00	0.00	0.00	0.00
7,400.00	0.00	0.00	7,400.00	0.00	0.00	0.00	0.00	0.00	0.00
7,500.00	0.00	0.00	7,500.00	0.00	0.00	0.00	0.00	0.00	0.00
7,600.00	0.00	0.00	7,600.00	0.00	0.00	0.00	0.00	0.00	0.00
7,700.00	0.00	0.00	7,700.00	0.00	0.00	0.00	0.00	0.00	0.00
7,800.00	0.00	0.00	7,800.00	0.00	0.00	0.00	0.00	0.00	0.00
7,900.00	0.00	0.00	7,900.00	0.00	0.00	0.00	0.00	0.00	0.00
8,000.00	0.00	0.00	8,000.00	0.00	0.00	0.00	0.00	0.00	0.00
8,100.00	0.00	0.00	8,100.00	0.00	0.00	0.00	0.00	0.00	0.00
8,200.00	0.00	0.00	8,200.00	0.00	0.00	0.00	0.00	0.00	0.00
8,300.00	0.00	0.00	8,300.00	0.00	0.00	0.00	0.00	0.00	0.00
8,400.00	0.00	0.00	8,400.00	0.00	0.00	0.00	0.00	0.00	0.00
8,500.00	0.00	0.00	8,500.00	0.00	0.00	0.00	0.00	0.00	0.00
8,600.00	0.00	0.00	8,600.00	0.00	0.00	0.00	0.00	0.00	0.00
8,700.00	0.00	0.00	8,700.00	0.00	0.00	0.00	0.00	0.00	0.00
8,800.00	0.00	0.00	8,800.00	0.00	0.00	0.00	0.00	0.00	0.00
8,900.00	0.00	0.00	8,900.00	0.00	0.00	0.00	0.00	0.00	0.00
9,000.00	0.00	0.00	9,000.00	0.00	0.00	0.00	0.00	0.00	0.00
9,100.00	0.00	0.00	9,100.00	0.00	0.00	0.00	0.00	0.00	0.00
9,200.00	0.00	0.00	9,200.00	0.00	0.00	0.00	0.00	0.00	0.00
9,300.00	0.00	0.00	9,300.00	0.00	0.00	0.00	0.00	0.00	0.00
9,400.00	0.00	0.00	9,400.00	0.00	0.00	0.00	0.00	0.00	0.00
9,500.00	0.00	0.00	9,500.00	0.00	0.00	0.00	0.00	0.00	0.00
9,600.00	0.00	0.00	9,600.00	0.00	0.00	0.00	0.00	0.00	0.00



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Survey Report



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9,700.00	0.00	0.00	9,700.00	0.00	0.00	0.00	0.00	0.00	0.00
9,800.00	0.00	0.00	9,800.00	0.00	0.00	0.00	0.00	0.00	0.00
9,900.00	0.00	0.00	9,900.00	0.00	0.00	0.00	0.00	0.00	0.00
10,000.00	0.00	0.00	10,000.00	0.00	0.00	0.00	0.00	0.00	0.00
10,100.00	0.00	0.00	10,100.00	0.00	0.00	0.00	0.00	0.00	0.00
10,200.00	0.00	0.00	10,200.00	0.00	0.00	0.00	0.00	0.00	0.00
10,300.00	0.00	0.00	10,300.00	0.00	0.00	0.00	0.00	0.00	0.00
10,400.00	0.00	0.00	10,400.00	0.00	0.00	0.00	0.00	0.00	0.00
10,500.00	0.00	0.00	10,500.00	0.00	0.00	0.00	0.00	0.00	0.00
10,600.00	0.00	0.00	10,600.00	0.00	0.00	0.00	0.00	0.00	0.00
10,700.00	0.00	0.00	10,700.00	0.00	0.00	0.00	0.00	0.00	0.00
10,800.00	0.00	0.00	10,800.00	0.00	0.00	0.00	0.00	0.00	0.00
10,900.00	0.00	0.00	10,900.00	0.00	0.00	0.00	0.00	0.00	0.00
11,000.00	0.00	0.00	11,000.00	0.00	0.00	0.00	0.00	0.00	0.00
11,100.00	0.00	0.00	11,100.00	0.00	0.00	0.00	0.00	0.00	0.00
11,200.00	0.00	0.00	11,200.00	0.00	0.00	0.00	0.00	0.00	0.00
11,300.00	0.00	0.00	11,300.00	0.00	0.00	0.00	0.00	0.00	0.00
11,400.00	0.00	0.00	11,400.00	0.00	0.00	0.00	0.00	0.00	0.00
11,500.00	0.00	0.00	11,500.00	0.00	0.00	0.00	0.00	0.00	0.00
11,600.00	0.00	0.00	11,600.00	0.00	0.00	0.00	0.00	0.00	0.00
11,700.00	0.00	0.00	11,700.00	0.00	0.00	0.00	0.00	0.00	0.00
11,800.00	0.00	0.00	11,800.00	0.00	0.00	0.00	0.00	0.00	0.00
11,900.00	0.00	0.00	11,900.00	0.00	0.00	0.00	0.00	0.00	0.00
12,000.00	0.00	0.00	12,000.00	0.00	0.00	0.00	0.00	0.00	0.00
12,012.60	0.00	0.00	12,012.60	0.00	0.00	0.00	0.00	0.00	0.00
Start Build 12.00									
12,100.00	10.49	187.55	12,099.51	-7.91	-1.05	7.91	12.00	12.00	0.00
12,200.00	22.49	187.55	12,195.23	-35.99	-4.77	36.00	12.00	12.00	0.00
12,300.00	34.49	187.55	12,282.96	-83.19	-11.03	83.21	12.00	12.00	0.00
12,400.00	46.49	187.55	12,358.87	-147.44	-19.54	147.47	12.00	12.00	0.00
12,500.00	58.49	187.55	12,419.65	-225.93	-29.94	225.97	12.00	12.00	0.00
12,600.00	70.49	187.55	12,462.65	-315.23	-41.78	315.30	12.00	12.00	0.00
12,700.00	82.49	187.55	12,485.97	-411.45	-54.53	411.53	12.00	12.00	0.00
12,754.92	89.08	187.55	12,490.00	-465.71	-61.73	465.81	12.00	12.00	0.00
Start DLS 4.00 TFO -90.05									
12,800.00	89.08	185.75	12,490.73	-510.48	-66.94	510.58	4.00	0.00	-4.00
12,900.00	89.08	181.75	12,492.34	-610.23	-73.48	610.35	4.00	0.00	-4.00
12,955.82	89.08	179.51	12,493.24	-666.04	-74.09	666.16	4.00	0.00	-4.00
Start 7267.47 hold at 12955.82 MD									
13,000.00	89.08	179.51	12,493.95	-710.21	-73.71	710.33	0.00	0.00	0.00
13,100.00	89.08	179.51	12,495.56	-810.20	-72.86	810.31	0.00	0.00	0.00
13,200.00	89.08	179.51	12,497.16	-910.18	-72.01	910.29	0.00	0.00	0.00
13,300.00	89.08	179.51	12,498.77	-1,010.16	-71.16	1,010.27	0.00	0.00	0.00
13,400.00	89.08	179.51	12,500.38	-1,110.15	-70.31	1,110.25	0.00	0.00	0.00

Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Viking Helmet State Com 24H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3344.70ft (McVay 8)
Site:	Sec. 20, T 24 S. , R 35 E	MD Reference:	KB=26' @ 3344.70ft (McVay 8)
Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Plan #1	Database:	EDM 5000.1 Multi User Db

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
13,500.00	89.08	179.51	12,501.98	-1,210.13	-69.46	1,210.24	0.00	0.00	0.00
13,600.00	89.08	179.51	12,503.59	-1,310.11	-68.61	1,310.22	0.00	0.00	0.00
13,700.00	89.08	179.51	12,505.20	-1,410.10	-67.76	1,410.20	0.00	0.00	0.00
13,800.00	89.08	179.51	12,506.80	-1,510.08	-66.91	1,510.18	0.00	0.00	0.00
13,900.00	89.08	179.51	12,508.41	-1,610.06	-66.06	1,610.16	0.00	0.00	0.00
14,000.00	89.08	179.51	12,510.02	-1,710.05	-65.21	1,710.15	0.00	0.00	0.00
14,100.00	89.08	179.51	12,511.62	-1,810.03	-64.36	1,810.13	0.00	0.00	0.00
14,200.00	89.08	179.51	12,513.23	-1,910.01	-63.51	1,910.11	0.00	0.00	0.00
14,300.00	89.08	179.51	12,514.84	-2,010.00	-62.66	2,010.09	0.00	0.00	0.00
14,400.00	89.08	179.51	12,516.44	-2,109.98	-61.81	2,110.07	0.00	0.00	0.00
14,500.00	89.08	179.51	12,518.05	-2,209.96	-60.96	2,210.06	0.00	0.00	0.00
14,600.00	89.08	179.51	12,519.66	-2,309.95	-60.11	2,310.04	0.00	0.00	0.00
14,700.00	89.08	179.51	12,521.26	-2,409.93	-59.26	2,410.02	0.00	0.00	0.00
14,800.00	89.08	179.51	12,522.87	-2,509.92	-58.41	2,510.00	0.00	0.00	0.00
14,900.00	89.08	179.51	12,524.48	-2,609.90	-57.56	2,609.98	0.00	0.00	0.00
15,000.00	89.08	179.51	12,526.08	-2,709.88	-56.71	2,709.97	0.00	0.00	0.00
15,100.00	89.08	179.51	12,527.69	-2,809.87	-55.86	2,809.95	0.00	0.00	0.00
15,200.00	89.08	179.51	12,529.30	-2,909.85	-55.01	2,909.93	0.00	0.00	0.00
15,300.00	89.08	179.51	12,530.90	-3,009.83	-54.16	3,009.91	0.00	0.00	0.00
15,400.00	89.08	179.51	12,532.51	-3,109.82	-53.31	3,109.90	0.00	0.00	0.00
15,500.00	89.08	179.51	12,534.12	-3,209.80	-52.46	3,209.88	0.00	0.00	0.00
15,600.00	89.08	179.51	12,535.72	-3,309.78	-51.61	3,309.86	0.00	0.00	0.00
15,700.00	89.08	179.51	12,537.33	-3,409.77	-50.76	3,409.84	0.00	0.00	0.00
15,800.00	89.08	179.51	12,538.93	-3,509.75	-49.91	3,509.82	0.00	0.00	0.00
15,900.00	89.08	179.51	12,540.54	-3,609.73	-49.06	3,609.81	0.00	0.00	0.00
16,000.00	89.08	179.51	12,542.15	-3,709.72	-48.21	3,709.79	0.00	0.00	0.00
16,100.00	89.08	179.51	12,543.75	-3,809.70	-47.36	3,809.77	0.00	0.00	0.00
16,200.00	89.08	179.51	12,545.36	-3,909.68	-46.51	3,909.75	0.00	0.00	0.00
16,300.00	89.08	179.51	12,546.97	-4,009.67	-45.66	4,009.73	0.00	0.00	0.00
16,400.00	89.08	179.51	12,548.57	-4,109.65	-44.81	4,109.72	0.00	0.00	0.00
16,500.00	89.08	179.51	12,550.18	-4,209.63	-43.96	4,209.70	0.00	0.00	0.00
16,600.00	89.08	179.51	12,551.79	-4,309.62	-43.11	4,309.68	0.00	0.00	0.00
16,700.00	89.08	179.51	12,553.39	-4,409.60	-42.26	4,409.66	0.00	0.00	0.00
16,800.00	89.08	179.51	12,555.00	-4,509.59	-41.41	4,509.64	0.00	0.00	0.00
16,900.00	89.08	179.51	12,556.61	-4,609.57	-40.55	4,609.63	0.00	0.00	0.00
17,000.00	89.08	179.51	12,558.21	-4,709.55	-39.70	4,709.61	0.00	0.00	0.00
17,100.00	89.08	179.51	12,559.82	-4,809.54	-38.85	4,809.59	0.00	0.00	0.00
17,200.00	89.08	179.51	12,561.43	-4,909.52	-38.00	4,909.57	0.00	0.00	0.00
17,300.00	89.08	179.51	12,563.03	-5,009.50	-37.15	5,009.55	0.00	0.00	0.00
17,400.00	89.08	179.51	12,564.64	-5,109.49	-36.30	5,109.54	0.00	0.00	0.00
17,500.00	89.08	179.51	12,566.25	-5,209.47	-35.45	5,209.52	0.00	0.00	0.00
17,600.00	89.08	179.51	12,567.85	-5,309.45	-34.60	5,309.50	0.00	0.00	0.00
17,700.00	89.08	179.51	12,569.46	-5,409.44	-33.75	5,409.48	0.00	0.00	0.00

Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Viking Helmet State Com 24H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3344.70ft (McVay 8)
Site:	Sec. 20, T 24 S. , R 35 E	MD Reference:	KB=26' @ 3344.70ft (McVay 8)
Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Plan #1	Database:	EDM 5000.1 Multi User Db

Planned Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
17,800.00	89.08	179.51	12,571.07	-5,509.42	-32.90	5,509.46	0.00	0.00	0.00
17,900.00	89.08	179.51	12,572.67	-5,609.40	-32.05	5,609.45	0.00	0.00	0.00
18,000.00	89.08	179.51	12,574.28	-5,709.39	-31.20	5,709.43	0.00	0.00	0.00
18,100.00	89.08	179.51	12,575.89	-5,809.37	-30.35	5,809.41	0.00	0.00	0.00
18,200.00	89.08	179.51	12,577.49	-5,909.35	-29.50	5,909.39	0.00	0.00	0.00
18,300.00	89.08	179.51	12,579.10	-6,009.34	-28.65	6,009.37	0.00	0.00	0.00
18,400.00	89.08	179.51	12,580.71	-6,109.32	-27.80	6,109.36	0.00	0.00	0.00
18,500.00	89.08	179.51	12,582.31	-6,209.30	-26.95	6,209.34	0.00	0.00	0.00
18,600.00	89.08	179.51	12,583.92	-6,309.29	-26.10	6,309.32	0.00	0.00	0.00
18,700.00	89.08	179.51	12,585.53	-6,409.27	-25.25	6,409.30	0.00	0.00	0.00
18,800.00	89.08	179.51	12,587.13	-6,509.25	-24.40	6,509.28	0.00	0.00	0.00
18,900.00	89.08	179.51	12,588.74	-6,609.24	-23.55	6,609.27	0.00	0.00	0.00
19,000.00	89.08	179.51	12,590.35	-6,709.22	-22.70	6,709.25	0.00	0.00	0.00
19,100.00	89.08	179.51	12,591.95	-6,809.21	-21.85	6,809.23	0.00	0.00	0.00
19,200.00	89.08	179.51	12,593.56	-6,909.19	-21.00	6,909.21	0.00	0.00	0.00
19,300.00	89.08	179.51	12,595.17	-7,009.17	-20.15	7,009.19	0.00	0.00	0.00
19,400.00	89.08	179.51	12,596.77	-7,109.16	-19.30	7,109.18	0.00	0.00	0.00
19,500.00	89.08	179.51	12,598.38	-7,209.14	-18.45	7,209.16	0.00	0.00	0.00
19,600.00	89.08	179.51	12,599.99	-7,309.12	-17.60	7,309.14	0.00	0.00	0.00
19,700.00	89.08	179.51	12,601.59	-7,409.11	-16.75	7,409.12	0.00	0.00	0.00
19,800.00	89.08	179.51	12,603.20	-7,509.09	-15.90	7,509.11	0.00	0.00	0.00
19,900.00	89.08	179.51	12,604.81	-7,609.07	-15.05	7,609.09	0.00	0.00	0.00
20,000.00	89.08	179.51	12,606.41	-7,709.06	-14.20	7,709.07	0.00	0.00	0.00
20,100.00	89.08	179.51	12,608.02	-7,809.04	-13.35	7,809.05	0.00	0.00	0.00
20,200.00	89.08	179.51	12,609.63	-7,909.02	-12.50	7,909.03	0.00	0.00	0.00
20,223.30	89.08	179.51	12,610.00	-7,932.32	-12.30	7,932.33	0.00	0.00	0.00
TD at 20223.30									

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Viking Helmet State C	0.00	0.00	12,491.2 2	-540.67	-75.49	435,845.3299	792,443.6142	32° 11' 40.999 N	103° 23' 16.678 W
- plan misses target center by 5.81ft at 12830.69ft MD (12491.22 TVD, -541.05 N, -69.69 E)									
- Point									
Viking Helmet State C	0.00	0.00	12,607.9 1	-7,802.29	-13.52	428,583.7302	792,505.5828	32° 10' 29.140 N	103° 23' 16.699 W
- plan misses target center by 0.11ft at 20093.24ft MD (12607.91 TVD, -7802.28 N, -13.41 E)									
- Point									
Viking Helmet State C	0.00	0.00	12,610.0 0	-7,932.32	-12.30	428,453.7000	792,506.8000	32° 10' 27.853 N	103° 23' 16.698 W
- plan hits target center									
- Point									



Integrity Directional Services, LLC
Survey Report



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Viking Helmet State Com 24H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3344.70ft (McVay 8)
Site:	Sec. 20, T 24 S. , R 35 E	MD Reference:	KB=26' @ 3344.70ft (McVay 8)
Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Plan #1	Database:	EDM 5000.1 Multi User Db

Plan Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
12,013	12,013	0	0	Start Build 12.00
12,755	12,490	-466	-62	Start DLS 4.00 TFO -90.05
12,956	12,493	-666	-74	Start 7267.47 hold at 12955.82 MD
20,223	12,610	-7932	-12	TD at 20223.30

Checked By: _____ Approved By: _____ Date: _____