

**McVAY DRILLING COMPANY**

P.O. Box 2450
Hobbs, New Mexico 88241
(575) 397-3311
FAX: 39-DRILL

HOBBS NM
OCT 06 2017
RECEIVED

Well Name and Num: Viking Helmet State Com #24H
Location: Sec 20, T24S, R35E
Operator: COG
Drilling Contractor: McVay Drilling Company

The undersigned certifies that he is an authorized representative of the drilling contractor who drilled the above described well and that he has conducted deviation tests and obtained the following results:

<u>Degrees @</u>	<u>Depth</u>	<u>Degrees @</u>	<u>Depth</u>	<u>Degrees @</u>	<u>Depth</u>	<u>Degrees @</u>	<u>Depth</u>
1.10	1307	0.40	7592	33.00	12249	96.13	19071
0.80	1685	0.00	7974	56.28	12488	94.42	19166
0.60	2065	0.20	8357	63.19	12585	90.32	19546
0.20	2446	0.40	8547	88.50	12873	87.35	19831
1.60	2827	0.40	8929	90.13	13255	89.37	20117
1.20	3208	0.80	9311	91.02	13636		
2.30	3589	1.10	9787	88.36	13932		
0.50	3970	0.70	9978	90.00	14326		
1.80	4353	1.40	10359	89.57	14862		
2.20	4735	0.10	10740	89.79	15367		
0.90	5166	1.00	11120	88.80	15559		
1.10	5497	1.30	11310	89.99	15844		
0.80	5877	1.10	11690	88.80	16035		
0.40	6258	1.20	11913	92.03	16607		
0.60	6449	27.37	12153	93.60	16799		
0.40	6830	33.00	12249	86.51	17271		
0.00	7212	56.28	12488	94.61	18882		

By: Marc A. Gamm S.

Subscribed and sworn to before me this 21st day of July, 2017

Tina Flemens
Notary Public, Lea County, New Mexico





CONCHO

HOBBS OCD
OCT 06 2017
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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

Design: Wellbore #1

Standard Survey Report

26 June, 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:	Wellbore #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:	32.1962063
		Longitude:	-103.3877066
		Grid Convergence:	0.50 °

Well	Viking Helmet State Com 24H, ACTIVE		
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:	32.1962063
		Longitude:	-103.3877066
		Ground Level:	3,318.70 ft

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

Design	Wellbore #1			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 0.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.00	0.00	0.00	180.09

Survey Program	Date 6/26/2017			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
100.00	11,761.00	Keeper Gyros (Wellbore #1)	Keeper	Standard Wireline Keeper ver 1.0.2
11,913.00	20,176.00	IDS MWD (Wellbore #1)	MWD	MWD - Standard

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)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
100.00	0.70	161.67	100.00	-0.58	0.19	0.58	0.70	0.70	0.00	
125.00	0.79	167.25	125.00	-0.89	0.28	0.89	0.46	0.36	22.32	
150.00	0.73	162.17	149.99	-1.21	0.36	1.21	0.36	-0.24	-20.32	
175.00	0.74	161.27	174.99	-1.52	0.47	1.52	0.06	0.04	-3.60	
200.00	0.72	145.99	199.99	-1.80	0.61	1.80	0.78	-0.08	-61.12	
225.00	0.75	133.93	224.99	-2.04	0.81	2.04	0.63	0.12	-48.24	
250.00	0.76	125.36	249.98	-2.25	1.06	2.25	0.45	0.04	-34.28	
275.00	0.83	121.04	274.98	-2.44	1.35	2.44	0.37	0.28	-17.28	
300.00	0.83	120.60	299.98	-2.63	1.67	2.63	0.03	0.00	-1.76	



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Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
325.00	0.85	123.62	324.98	-2.82	1.98	2.82	0.19	0.08	12.08
350.00	0.83	117.08	349.97	-3.01	2.29	3.00	0.39	-0.08	-26.16
375.00	0.84	114.83	374.97	-3.17	2.62	3.16	0.14	0.04	-9.00
400.00	0.84	115.02	399.97	-3.32	2.95	3.32	0.01	0.00	0.76
425.00	0.85	113.61	424.97	-3.47	3.29	3.47	0.09	0.04	-5.64
450.00	0.86	111.07	449.96	-3.62	3.63	3.61	0.16	0.04	-10.16
475.00	0.88	107.48	474.96	-3.74	3.99	3.73	0.23	0.08	-14.36
500.00	0.87	108.07	499.96	-3.86	4.35	3.85	0.05	-0.04	2.36
525.00	0.97	105.11	524.95	-3.97	4.74	3.96	0.44	0.40	-11.84
550.00	0.86	104.17	549.95	-4.07	5.12	4.06	0.44	-0.44	-3.76
575.00	0.89	108.82	574.95	-4.18	5.49	4.17	0.31	0.12	18.60
600.00	0.83	107.11	599.95	-4.30	5.85	4.29	0.26	-0.24	-6.84
625.00	0.89	105.63	624.94	-4.40	6.21	4.39	0.26	0.24	-5.92
650.00	0.90	105.79	649.94	-4.51	6.58	4.50	0.04	0.04	0.64
675.00	0.84	105.34	674.94	-4.61	6.95	4.60	0.24	-0.24	-1.80
700.00	0.87	107.02	699.93	-4.71	7.31	4.70	0.16	0.12	6.72
725.00	0.96	103.13	724.93	-4.82	7.69	4.81	0.44	0.36	-15.56
750.00	0.92	106.37	749.93	-4.92	8.09	4.91	0.27	-0.16	12.96
775.00	0.95	105.85	774.92	-5.03	8.48	5.02	0.12	0.12	-2.08
800.00	1.08	103.89	799.92	-5.15	8.91	5.13	0.54	0.52	-7.84
825.00	1.15	104.40	824.92	-5.27	9.38	5.25	0.28	0.28	2.04
850.00	1.31	104.74	849.91	-5.40	9.90	5.39	0.64	0.64	1.36
875.00	1.43	105.97	874.90	-5.56	10.48	5.54	0.49	0.48	4.92
900.00	1.52	104.05	899.89	-5.73	11.10	5.71	0.41	0.36	-7.68
925.00	1.52	101.83	924.89	-5.88	11.74	5.86	0.24	0.00	-8.88
950.00	1.49	105.28	949.88	-6.03	12.38	6.01	0.38	-0.12	13.80
975.00	1.52	105.82	974.87	-6.20	13.01	6.18	0.13	0.12	2.16
1,000.00	1.53	103.63	999.86	-6.37	13.66	6.35	0.24	0.04	-8.76
1,025.00	1.49	103.54	1,024.85	-6.53	14.30	6.51	0.16	-0.16	-0.36
1,050.00	1.49	103.98	1,049.84	-6.68	14.93	6.66	0.05	0.00	1.76
1,075.00	1.46	103.48	1,074.83	-6.84	15.56	6.81	0.13	-0.12	-2.00
1,100.00	1.48	103.08	1,099.83	-6.98	16.18	6.96	0.09	0.08	-1.60
1,125.00	1.46	104.81	1,124.82	-7.14	16.80	7.11	0.19	-0.08	6.92
1,150.00	1.41	105.41	1,149.81	-7.30	17.41	7.27	0.21	-0.20	2.40
1,175.00	0.98	110.10	1,174.80	-7.46	17.90	7.43	1.76	-1.72	18.76
1,200.00	0.40	144.60	1,199.80	-7.60	18.15	7.57	2.75	-2.32	138.00
1,225.00	0.63	230.67	1,224.80	-7.76	18.10	7.73	2.89	0.92	344.28
1,250.00	0.84	237.10	1,249.80	-7.95	17.84	7.92	0.90	0.84	25.72
1,275.00	0.84	240.26	1,274.80	-8.14	17.53	8.11	0.19	0.00	12.64
1,300.00	0.87	241.29	1,299.79	-8.32	17.20	8.29	0.13	0.12	4.12
1,325.00	0.91	239.96	1,324.79	-8.51	16.86	8.48	0.18	0.16	-5.32
1,350.00	0.84	242.41	1,349.79	-8.69	16.53	8.67	0.32	-0.28	9.80
1,375.00	0.84	242.21	1,374.79	-8.86	16.20	8.84	0.01	0.00	-0.80



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Well:	Viking Helmet State Com 24H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
1,400.00	0.79	247.46	1,399.78	-9.01	15.88	8.99	0.36	-0.20	21.00
1,425.00	0.91	244.74	1,424.78	-9.17	15.54	9.14	0.51	0.48	-10.88
1,450.00	0.87	242.67	1,449.78	-9.34	15.19	9.31	0.21	-0.16	-8.28
1,475.00	0.87	242.18	1,474.77	-9.51	14.86	9.49	0.03	0.00	-1.96
1,500.00	0.88	240.93	1,499.77	-9.69	14.52	9.67	0.09	0.04	-5.00
1,525.00	0.92	240.07	1,524.77	-9.89	14.18	9.87	0.17	0.16	-3.44
1,550.00	0.90	241.57	1,549.77	-10.08	13.83	10.06	0.12	-0.08	6.00
1,575.00	0.90	242.59	1,574.76	-10.27	13.49	10.24	0.06	0.00	4.08
1,600.00	0.92	242.96	1,599.76	-10.45	13.13	10.43	0.08	0.08	1.48
1,625.00	0.90	243.03	1,624.76	-10.63	12.78	10.61	0.08	-0.08	0.28
1,650.00	0.89	240.43	1,649.75	-10.81	12.44	10.79	0.17	-0.04	-10.40
1,675.00	0.93	238.06	1,674.75	-11.02	12.10	11.00	0.22	0.16	-9.48
1,700.00	0.96	240.49	1,699.75	-11.23	11.74	11.21	0.20	0.12	9.72
1,725.00	0.92	245.26	1,724.74	-11.41	11.38	11.40	0.35	-0.16	19.08
1,750.00	0.88	243.70	1,749.74	-11.58	11.02	11.57	0.19	-0.16	-6.24
1,775.00	0.89	244.39	1,774.74	-11.75	10.68	11.73	0.06	0.04	2.76
1,800.00	0.94	242.75	1,799.73	-11.93	10.32	11.91	0.23	0.20	-6.56
1,825.00	0.81	242.95	1,824.73	-12.10	9.98	12.09	0.52	-0.52	0.80
1,850.00	0.83	238.62	1,849.73	-12.28	9.67	12.26	0.26	0.08	-17.32
1,875.00	0.83	242.51	1,874.73	-12.46	9.35	12.44	0.23	0.00	15.56
1,900.00	0.81	245.46	1,899.72	-12.61	9.03	12.60	0.19	-0.08	11.80
1,925.00	0.76	242.50	1,924.72	-12.76	8.72	12.75	0.26	-0.20	-11.84
1,950.00	0.72	245.37	1,949.72	-12.90	8.43	12.89	0.22	-0.16	11.48
1,975.00	0.64	243.12	1,974.72	-13.03	8.16	13.02	0.34	-0.32	-9.00
2,000.00	0.62	246.30	1,999.72	-13.15	7.92	13.14	0.16	-0.08	12.72
2,025.00	0.65	244.32	2,024.71	-13.27	7.66	13.25	0.15	0.12	-7.92
2,050.00	0.66	244.41	2,049.71	-13.39	7.41	13.38	0.04	0.04	0.36
2,075.00	0.56	243.29	2,074.71	-13.51	7.17	13.50	0.40	-0.40	-4.48
2,100.00	0.44	258.21	2,099.71	-13.58	6.96	13.57	0.70	-0.48	59.68
2,125.00	0.55	248.47	2,124.71	-13.65	6.76	13.64	0.55	0.44	-38.96
2,150.00	0.55	247.46	2,149.71	-13.74	6.54	13.73	0.04	0.00	-4.04
2,175.00	0.48	249.64	2,174.71	-13.82	6.33	13.81	0.29	-0.28	8.72
2,200.00	0.48	244.03	2,199.71	-13.90	6.14	13.89	0.19	0.00	-22.44
2,225.00	0.45	254.16	2,224.71	-13.97	5.95	13.96	0.35	-0.12	40.52
2,250.00	0.46	248.39	2,249.70	-14.04	5.76	14.03	0.19	0.04	-23.08
2,275.00	0.33	249.80	2,274.70	-14.10	5.60	14.09	0.52	-0.52	5.64
2,300.00	0.30	233.51	2,299.70	-14.16	5.48	14.15	0.38	-0.12	-65.16
2,325.00	0.25	240.63	2,324.70	-14.23	5.38	14.22	0.24	-0.20	28.48
2,350.00	0.19	252.86	2,349.70	-14.27	5.29	14.26	0.30	-0.24	48.92
2,375.00	0.10	259.25	2,374.70	-14.28	5.23	14.28	0.37	-0.36	25.56
2,400.00	0.04	56.98	2,399.70	-14.28	5.22	14.27	0.55	-0.24	630.92
2,425.00	0.12	85.70	2,424.70	-14.28	5.25	14.27	0.35	0.32	114.88
2,450.00	0.10	98.80	2,449.70	-14.28	5.30	14.27	0.13	-0.08	52.40

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2,475.00	0.18	88.05	2,474.70	-14.28	5.36	14.27	0.34	0.32	-43.00
2,500.00	0.23	78.88	2,499.70	-14.27	5.45	14.26	0.24	0.20	-36.68
2,525.00	0.49	71.53	2,524.70	-14.22	5.60	14.22	1.05	1.04	-29.40
2,550.00	0.51	79.07	2,549.70	-14.17	5.81	14.16	0.27	0.08	30.16
2,575.00	0.58	81.25	2,574.70	-14.13	6.04	14.12	0.29	0.28	8.72
2,600.00	0.76	83.83	2,599.70	-14.09	6.33	14.08	0.73	0.72	10.32
2,625.00	0.98	85.61	2,624.70	-14.06	6.71	14.05	0.89	0.88	7.12
2,650.00	1.24	86.91	2,649.69	-14.03	7.19	14.02	1.04	1.04	5.20
2,675.00	1.33	88.70	2,674.68	-14.01	7.75	13.99	0.39	0.36	7.16
2,700.00	1.53	90.48	2,699.68	-14.00	8.38	13.99	0.82	0.80	7.12
2,725.00	1.56	89.74	2,724.67	-14.00	9.05	13.99	0.14	0.12	-2.96
2,750.00	1.68	88.18	2,749.66	-13.99	9.76	13.98	0.51	0.48	-6.24
2,775.00	1.78	90.10	2,774.65	-13.98	10.51	13.96	0.46	0.40	7.68
2,800.00	1.75	90.13	2,799.63	-13.98	11.28	13.96	0.12	-0.12	0.12
2,825.00	1.74	90.01	2,824.62	-13.98	12.04	13.96	0.04	-0.04	-0.48
2,850.00	1.84	90.61	2,849.61	-13.99	12.82	13.97	0.41	0.40	2.40
2,875.00	1.94	90.37	2,874.60	-13.99	13.65	13.97	0.40	0.40	-0.96
2,900.00	1.86	92.56	2,899.58	-14.01	14.48	13.99	0.43	-0.32	8.76
2,925.00	2.02	93.73	2,924.57	-14.06	15.32	14.04	0.66	0.64	4.68
2,950.00	1.99	90.83	2,949.55	-14.10	16.20	14.07	0.42	-0.12	-11.60
2,975.00	2.02	90.75	2,974.54	-14.11	17.07	14.08	0.12	0.12	-0.32
3,000.00	2.09	89.79	2,999.52	-14.11	17.97	14.08	0.31	0.28	-3.84
3,025.00	2.04	91.06	3,024.51	-14.12	18.87	14.09	0.27	-0.20	5.08
3,050.00	2.06	90.49	3,049.49	-14.13	19.76	14.10	0.11	0.08	-2.28
3,075.00	2.03	89.91	3,074.47	-14.13	20.65	14.10	0.15	-0.12	-2.32
3,100.00	1.88	83.19	3,099.46	-14.08	21.50	14.05	1.09	-0.60	-26.88
3,125.00	1.58	67.39	3,124.45	-13.90	22.23	13.87	2.24	-1.20	-63.20
3,150.00	1.54	67.23	3,149.44	-13.64	22.86	13.61	0.16	-0.16	-0.64
3,175.00	1.50	65.97	3,174.43	-13.38	23.47	13.34	0.21	-0.16	-5.04
3,200.00	1.47	66.25	3,199.42	-13.12	24.06	13.08	0.12	-0.12	1.12
3,225.00	1.54	64.48	3,224.41	-12.84	24.65	12.80	0.34	0.28	-7.08
3,250.00	1.60	66.12	3,249.40	-12.56	25.28	12.52	0.30	0.24	6.56
3,275.00	1.70	67.96	3,274.39	-12.27	25.94	12.23	0.45	0.40	7.36
3,300.00	1.78	66.81	3,299.38	-11.98	26.64	11.94	0.35	0.32	-4.60
3,325.00	1.86	67.95	3,324.37	-11.68	27.37	11.64	0.35	0.32	4.56
3,350.00	1.98	68.18	3,349.35	-11.36	28.15	11.32	0.48	0.48	0.92
3,375.00	1.99	67.99	3,374.34	-11.04	28.95	11.00	0.05	0.04	-0.76
3,400.00	1.97	68.51	3,399.33	-10.72	29.76	10.68	0.11	-0.08	2.08
3,425.00	1.95	68.20	3,424.31	-10.41	30.55	10.36	0.09	-0.08	-1.24
3,450.00	1.91	65.78	3,449.30	-10.08	31.33	10.03	0.36	-0.16	-9.68
3,475.00	1.73	49.31	3,474.28	-9.66	31.99	9.61	2.20	-0.72	-65.88
3,500.00	1.58	34.69	3,499.27	-9.13	32.47	9.08	1.79	-0.60	-58.48
3,525.00	1.59	22.94	3,524.26	-8.53	32.81	8.48	1.30	0.04	-47.00
3,550.00	1.59	10.14	3,549.25	-7.87	33.00	7.82	1.42	0.00	-51.20

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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
3,575.00	1.79	348.00	3,574.24	-7.14	32.98	7.09	2.71	0.80	-88.56
3,600.00	2.05	335.65	3,599.23	-6.35	32.72	6.30	1.95	1.04	-49.40
3,625.00	2.15	335.34	3,624.21	-5.52	32.34	5.47	0.40	0.40	-1.24
3,650.00	2.16	334.30	3,649.20	-4.67	31.94	4.62	0.16	0.04	-4.16
3,675.00	2.16	334.96	3,674.18	-3.82	31.53	3.77	0.10	0.00	2.64
3,700.00	2.16	334.39	3,699.16	-2.97	31.13	2.92	0.09	0.00	-2.28
3,725.00	2.09	334.52	3,724.14	-2.13	30.73	2.08	0.28	-0.28	0.52
3,750.00	2.06	332.25	3,749.13	-1.32	30.32	1.27	0.35	-0.12	-9.08
3,775.00	2.07	332.89	3,774.11	-0.52	29.91	0.48	0.10	0.04	2.56
3,800.00	2.11	334.41	3,799.09	0.29	29.50	-0.34	0.27	0.16	6.08
3,825.00	2.10	334.03	3,824.08	1.12	29.11	-1.17	0.07	-0.04	-1.52
3,850.00	2.05	334.94	3,849.06	1.94	28.72	-1.98	0.24	-0.20	3.64
3,875.00	2.16	337.34	3,874.04	2.78	28.34	-2.82	0.56	0.44	9.60
3,900.00	2.07	334.53	3,899.03	3.62	27.97	-3.66	0.55	-0.36	-11.24
3,925.00	1.70	335.53	3,924.01	4.37	27.62	-4.41	1.49	-1.48	4.00
3,950.00	1.35	335.94	3,949.00	4.97	27.35	-5.01	1.40	-1.40	1.64
3,975.00	0.97	332.87	3,974.00	5.43	27.13	-5.47	1.54	-1.52	-12.28
4,000.00	0.64	332.54	3,999.00	5.74	26.97	-5.78	1.32	-1.32	-1.32
4,025.00	0.50	343.85	4,023.99	5.97	26.88	-6.01	0.72	-0.56	45.24
4,050.00	0.44	10.57	4,048.99	6.17	26.86	-6.21	0.90	-0.24	106.88
4,075.00	0.42	17.01	4,073.99	6.35	26.91	-6.39	0.21	-0.08	25.76
4,100.00	0.44	48.96	4,098.99	6.50	27.01	-6.54	0.95	0.08	127.80
4,125.00	0.47	70.84	4,123.99	6.60	27.18	-6.64	0.70	0.12	87.52
4,150.00	0.59	64.49	4,148.99	6.69	27.39	-6.73	0.53	0.48	-25.40
4,175.00	0.75	82.70	4,173.99	6.76	27.67	-6.81	1.06	0.64	72.84
4,200.00	0.93	90.61	4,198.99	6.78	28.03	-6.83	0.85	0.72	31.64
4,225.00	1.10	91.03	4,223.98	6.78	28.47	-6.82	0.68	0.68	1.68
4,250.00	1.26	88.01	4,248.98	6.78	28.99	-6.83	0.69	0.64	-12.08
4,275.00	1.38	85.87	4,273.97	6.81	29.56	-6.86	0.52	0.48	-8.56
4,300.00	1.58	82.07	4,298.96	6.88	30.21	-6.93	0.89	0.80	-15.20
4,325.00	1.77	81.23	4,323.95	6.99	30.93	-7.04	0.77	0.76	-3.36
4,350.00	1.90	76.62	4,348.94	7.14	31.71	-7.19	0.79	0.52	-18.44
4,375.00	2.22	76.93	4,373.92	7.35	32.59	-7.40	1.28	1.28	1.24
4,400.00	2.48	72.52	4,398.90	7.62	33.58	-7.67	1.27	1.04	-17.64
4,425.00	2.66	68.49	4,423.88	8.00	34.63	-8.05	1.02	0.72	-16.12
4,450.00	2.85	69.57	4,448.85	8.43	35.75	-8.48	0.79	0.76	4.32
4,475.00	2.79	68.86	4,473.82	8.86	36.90	-8.92	0.28	-0.24	-2.84
4,500.00	2.82	67.26	4,498.79	9.32	38.04	-9.38	0.34	0.12	-6.40
4,525.00	2.39	60.39	4,523.76	9.81	39.06	-9.87	2.12	-1.72	-27.48
4,550.00	2.08	52.59	4,548.74	10.35	39.87	-10.41	1.73	-1.24	-31.20
4,575.00	1.89	46.86	4,573.73	10.90	40.53	-10.97	1.10	-0.76	-22.92
4,600.00	1.86	46.95	4,598.71	11.46	41.13	-11.53	0.12	-0.12	0.36
4,625.00	1.79	44.64	4,623.70	12.02	41.70	-12.08	0.41	-0.28	-9.24

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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
4,650.00	1.75	45.08	4,648.69	12.57	42.25	-12.63	0.17	-0.16	1.76
4,675.00	1.80	45.09	4,673.68	13.11	42.79	-13.18	0.20	0.20	0.04
4,700.00	1.84	44.29	4,698.66	13.68	43.35	-13.74	0.19	0.16	-3.20
4,725.00	1.94	47.21	4,723.65	14.25	43.94	-14.32	0.56	0.40	11.68
4,750.00	2.09	50.51	4,748.64	14.83	44.61	-14.90	0.76	0.60	13.20
4,775.00	2.34	53.84	4,773.62	15.42	45.37	-15.49	1.12	1.00	13.32
4,800.00	2.59	59.91	4,798.59	16.00	46.27	-16.08	1.44	1.00	24.28
4,825.00	2.82	63.16	4,823.57	16.57	47.31	-16.64	1.11	0.92	13.00
4,850.00	2.82	64.48	4,848.54	17.11	48.41	-17.18	0.26	0.00	5.28
4,875.00	2.82	64.36	4,873.51	17.64	49.52	-17.72	0.02	0.00	-0.48
4,900.00	2.51	68.34	4,898.48	18.11	50.58	-18.19	1.44	-1.24	15.92
4,925.00	2.10	75.81	4,923.46	18.42	51.54	-18.50	2.03	-1.64	29.88
4,950.00	1.53	87.59	4,948.45	18.55	52.32	-18.63	2.71	-2.28	47.12
4,975.00	1.15	100.78	4,973.44	18.52	52.89	-18.60	1.95	-1.52	52.76
5,000.00	0.53	142.39	4,998.44	18.38	53.21	-18.46	3.33	-2.48	166.44
5,025.00	0.56	220.25	5,023.44	18.19	53.20	-18.27	2.74	0.12	311.44
5,050.00	0.74	230.18	5,048.43	18.00	53.00	-18.08	0.85	0.72	39.72
5,075.00	0.74	231.60	5,073.43	17.79	52.75	-17.87	0.07	0.00	5.68
5,100.00	0.72	235.32	5,098.43	17.60	52.49	-17.68	0.21	-0.08	14.88
5,125.00	0.77	236.18	5,123.43	17.42	52.23	-17.50	0.20	0.20	3.44
5,150.00	0.76	232.83	5,148.43	17.23	51.95	-17.31	0.18	-0.04	-13.40
5,175.00	0.74	233.08	5,173.42	17.03	51.69	-17.11	0.08	-0.08	1.00
5,200.00	0.75	232.20	5,198.42	16.83	51.43	-16.91	0.06	0.04	-3.52
5,225.00	0.73	230.57	5,223.42	16.63	51.18	-16.71	0.12	-0.08	-6.52
5,250.00	0.84	232.85	5,248.42	16.42	50.91	-16.50	0.46	0.44	9.12
5,275.00	0.74	231.30	5,273.41	16.21	50.64	-16.28	0.41	-0.40	-6.20
5,300.00	0.75	230.70	5,298.41	16.00	50.39	-16.08	0.05	0.04	-2.40
5,325.00	0.84	224.47	5,323.41	15.77	50.13	-15.84	0.50	0.36	-24.92
5,350.00	0.88	219.20	5,348.41	15.49	49.88	-15.56	0.35	0.16	-21.08
5,375.00	0.95	213.46	5,373.40	15.17	49.65	-15.24	0.46	0.28	-22.96
5,400.00	1.03	212.12	5,398.40	14.80	49.41	-14.88	0.33	0.32	-5.36
5,425.00	0.97	213.30	5,423.40	14.44	49.18	-14.51	0.25	-0.24	4.72
5,450.00	0.98	212.44	5,448.39	14.08	48.95	-14.15	0.07	0.04	-3.44
5,475.00	0.99	214.05	5,473.39	13.72	48.71	-13.79	0.12	0.04	6.44
5,500.00	0.97	210.43	5,498.39	13.36	48.48	-13.43	0.26	-0.08	-14.48
5,525.00	0.98	209.26	5,523.38	12.99	48.27	-13.06	0.09	0.04	-4.68
5,550.00	0.95	202.84	5,548.38	12.61	48.09	-12.69	0.45	-0.12	-25.68
5,575.00	0.93	202.19	5,573.37	12.23	47.93	-12.31	0.09	-0.08	-2.60
5,600.00	0.92	199.66	5,598.37	11.86	47.79	-11.93	0.17	-0.04	-10.12
5,625.00	0.94	194.42	5,623.37	11.47	47.67	-11.54	0.35	0.08	-20.96
5,650.00	0.85	188.55	5,648.37	11.09	47.59	-11.16	0.51	-0.36	-23.48
5,675.00	0.84	187.42	5,673.36	10.72	47.54	-10.79	0.08	-0.04	-4.52
5,700.00	0.81	180.87	5,698.36	10.36	47.51	-10.44	0.40	-0.12	-26.20



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
5,725.00	0.76	179.38	5,723.36	10.02	47.51	-10.09	0.22	-0.20	-5.96
5,750.00	0.76	179.84	5,748.36	9.69	47.51	-9.76	0.02	0.00	1.84
5,775.00	0.76	173.67	5,773.35	9.36	47.53	-9.43	0.33	0.00	-24.68
5,800.00	0.75	177.15	5,798.35	9.03	47.56	-9.10	0.19	-0.04	13.92
5,825.00	0.78	178.58	5,823.35	8.70	47.57	-8.77	0.14	0.12	5.72
5,850.00	0.79	179.84	5,848.35	8.35	47.58	-8.43	0.08	0.04	5.04
5,875.00	0.75	177.06	5,873.34	8.02	47.58	-8.09	0.22	-0.16	-11.12
5,900.00	0.72	171.84	5,898.34	7.70	47.61	-7.77	0.29	-0.12	-20.88
5,925.00	0.72	171.80	5,923.34	7.39	47.66	-7.46	0.00	0.00	-0.16
5,950.00	0.71	166.11	5,948.34	7.08	47.72	-7.16	0.29	-0.04	-22.76
5,975.00	0.69	165.15	5,973.34	6.79	47.79	-6.86	0.09	-0.08	-3.84
6,000.00	0.67	164.51	5,998.33	6.50	47.87	-6.57	0.09	-0.08	-2.56
6,025.00	0.67	163.33	6,023.33	6.22	47.95	-6.29	0.06	0.00	-4.72
6,050.00	0.65	165.36	6,048.33	5.94	48.03	-6.02	0.12	-0.08	8.12
6,075.00	0.55	157.53	6,073.33	5.69	48.11	-5.77	0.52	-0.40	-31.32
6,100.00	0.53	158.64	6,098.33	5.47	48.20	-5.55	0.09	-0.08	4.44
6,125.00	0.48	157.53	6,123.33	5.27	48.28	-5.35	0.20	-0.20	-4.44
6,150.00	0.51	162.10	6,148.33	5.07	48.36	-5.14	0.20	0.12	18.28
6,175.00	0.56	158.67	6,173.33	4.85	48.44	-4.92	0.24	0.20	-13.72
6,200.00	0.58	157.20	6,198.32	4.62	48.53	-4.69	0.10	0.08	-5.88
6,225.00	0.56	161.25	6,223.32	4.39	48.62	-4.46	0.18	-0.08	16.20
6,250.00	0.51	156.68	6,248.32	4.17	48.70	-4.24	0.26	-0.20	-18.28
6,275.00	0.50	162.77	6,273.32	3.96	48.78	-4.04	0.22	-0.04	24.36
6,300.00	0.47	157.36	6,298.32	3.76	48.85	-3.84	0.22	-0.12	-21.64
6,325.00	0.53	161.35	6,323.32	3.56	48.93	-3.63	0.28	0.24	15.96
6,350.00	0.54	161.24	6,348.32	3.34	49.00	-3.41	0.04	0.04	-0.44
6,375.00	0.55	158.06	6,373.32	3.11	49.08	-3.19	0.13	0.04	-12.72
6,400.00	0.56	165.72	6,398.32	2.88	49.16	-2.96	0.30	0.04	30.64
6,425.00	0.55	160.48	6,423.31	2.65	49.23	-2.73	0.21	-0.04	-20.96
6,450.00	0.57	159.85	6,448.31	2.42	49.31	-2.50	0.08	0.08	-2.52
6,475.00	0.55	155.09	6,473.31	2.20	49.40	-2.27	0.20	-0.08	-19.04
6,500.00	0.51	163.13	6,498.31	1.98	49.49	-2.06	0.34	-0.16	32.16
6,525.00	0.49	165.03	6,523.31	1.77	49.55	-1.85	0.10	-0.08	7.60
6,550.00	0.49	163.26	6,548.31	1.57	49.61	-1.64	0.06	0.00	-7.08
6,575.00	0.42	167.54	6,573.31	1.37	49.66	-1.45	0.31	-0.28	17.12
6,600.00	0.47	159.97	6,598.31	1.19	49.71	-1.27	0.31	0.20	-30.28
6,625.00	0.40	157.06	6,623.31	1.01	49.78	-1.09	0.29	-0.28	-11.64
6,650.00	0.42	166.15	6,648.31	0.84	49.84	-0.92	0.27	0.08	36.36
6,675.00	0.39	171.52	6,673.31	0.67	49.87	-0.75	0.19	-0.12	21.48
6,700.00	0.40	164.71	6,698.31	0.50	49.91	-0.58	0.19	0.04	-27.24
6,725.00	0.40	172.43	6,723.30	0.33	49.94	-0.41	0.22	0.00	30.88
6,750.00	0.34	169.86	6,748.30	0.17	49.97	-0.25	0.25	-0.24	-10.28
6,775.00	0.31	177.72	6,773.30	0.03	49.98	-0.11	0.21	-0.12	31.44
6,800.00	0.38	173.41	6,798.30	-0.12	49.99	0.04	0.30	0.28	-17.24



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
6,825.00	0.34	178.56	6,823.30	-0.28	50.00	0.20	0.21	-0.16	20.60
6,850.00	0.33	181.29	6,848.30	-0.42	50.00	0.34	0.08	-0.04	10.92
6,875.00	0.35	173.00	6,873.30	-0.57	50.01	0.49	0.21	0.08	-33.16
6,900.00	0.34	171.17	6,898.30	-0.72	50.03	0.64	0.06	-0.04	-7.32
6,925.00	0.29	185.68	6,923.30	-0.85	50.04	0.78	0.38	-0.20	58.04
6,950.00	0.26	173.49	6,948.30	-0.97	50.04	0.90	0.26	-0.12	-48.76
6,975.00	0.22	186.55	6,973.30	-1.08	50.04	1.00	0.27	-0.16	52.24
7,000.00	0.18	199.16	6,998.30	-1.16	50.02	1.09	0.24	-0.16	50.44
7,025.00	0.18	174.04	7,023.30	-1.24	50.01	1.16	0.31	0.00	-100.48
7,050.00	0.16	196.89	7,048.30	-1.31	50.01	1.23	0.28	-0.08	91.40
7,075.00	0.16	207.52	7,073.30	-1.38	49.98	1.30	0.12	0.00	42.52
7,100.00	0.15	161.89	7,098.30	-1.44	49.97	1.36	0.48	-0.04	-182.52
7,125.00	0.16	211.60	7,123.30	-1.50	49.97	1.42	0.52	0.04	198.84
7,150.00	0.16	191.90	7,148.30	-1.56	49.94	1.49	0.22	0.00	-78.80
7,175.00	0.12	176.96	7,173.30	-1.62	49.93	1.55	0.22	-0.16	-59.76
7,200.00	0.14	213.20	7,198.30	-1.67	49.92	1.60	0.33	0.08	144.96
7,225.00	0.18	225.95	7,223.30	-1.73	49.87	1.65	0.21	0.16	51.00
7,250.00	0.15	230.04	7,248.30	-1.78	49.82	1.70	0.13	-0.12	16.36
7,275.00	0.18	215.88	7,273.30	-1.83	49.77	1.75	0.20	0.12	-56.64
7,300.00	0.20	219.77	7,298.30	-1.89	49.72	1.82	0.10	0.08	15.56
7,325.00	0.17	229.30	7,323.30	-1.95	49.67	1.87	0.17	-0.12	38.12
7,350.00	0.22	217.99	7,348.30	-2.01	49.61	1.94	0.25	0.20	-45.24
7,375.00	0.22	229.17	7,373.30	-2.08	49.54	2.01	0.17	0.00	44.72
7,400.00	0.23	215.20	7,398.30	-2.16	49.48	2.08	0.22	0.04	-55.88
7,425.00	0.23	217.69	7,423.30	-2.24	49.42	2.16	0.04	0.00	9.96
7,450.00	0.26	220.28	7,448.30	-2.32	49.35	2.24	0.13	0.12	10.36
7,475.00	0.26	233.52	7,473.30	-2.40	49.27	2.32	0.24	0.00	52.96
7,500.00	0.30	222.81	7,498.30	-2.48	49.18	2.40	0.26	0.16	-42.84
7,525.00	0.31	216.70	7,523.30	-2.58	49.09	2.50	0.14	0.04	-24.44
7,550.00	0.32	218.83	7,548.30	-2.69	49.01	2.61	0.06	0.04	8.52
7,575.00	0.32	209.23	7,573.30	-2.80	48.93	2.73	0.21	0.00	-38.40
7,600.00	0.36	219.12	7,598.30	-2.93	48.85	2.85	0.28	0.16	39.56
7,625.00	0.33	212.24	7,623.30	-3.05	48.76	2.97	0.20	-0.12	-27.52
7,650.00	0.31	212.96	7,648.30	-3.17	48.68	3.09	0.08	-0.08	2.88
7,675.00	0.32	217.44	7,673.30	-3.28	48.60	3.20	0.11	0.04	17.92
7,700.00	0.32	214.26	7,698.29	-3.39	48.52	3.32	0.07	0.00	-12.72
7,725.00	0.30	216.80	7,723.29	-3.50	48.44	3.43	0.10	-0.08	10.16
7,750.00	0.31	215.34	7,748.29	-3.61	48.37	3.53	0.05	0.04	-5.84
7,775.00	0.29	211.55	7,773.29	-3.72	48.29	3.64	0.11	-0.08	-15.16
7,800.00	0.17	220.51	7,798.29	-3.80	48.24	3.72	0.50	-0.48	35.84
7,825.00	0.31	213.90	7,823.29	-3.88	48.18	3.81	0.57	0.56	-26.44
7,850.00	0.20	207.22	7,848.29	-3.98	48.12	3.90	0.46	-0.44	-26.72
7,875.00	0.18	237.54	7,873.29	-4.04	48.06	3.96	0.40	-0.08	121.28

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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
7,900.00	0.17	215.41	7,898.29	-4.09	48.01	4.02	0.27	-0.04	-88.52
7,925.00	0.16	217.43	7,923.29	-4.15	47.97	4.07	0.05	-0.04	8.08
7,950.00	0.12	199.07	7,948.29	-4.20	47.94	4.13	0.24	-0.16	-73.44
7,975.00	0.17	172.63	7,973.29	-4.26	47.93	4.19	0.33	0.20	-105.76
8,000.00	0.16	199.36	7,998.29	-4.33	47.93	4.26	0.31	-0.04	106.92
8,025.00	0.24	195.24	8,023.29	-4.41	47.90	4.34	0.32	0.32	-16.48
8,050.00	0.18	193.64	8,048.29	-4.50	47.88	4.43	0.24	-0.24	-6.40
8,075.00	0.15	209.47	8,073.29	-4.57	47.85	4.50	0.22	-0.12	63.32
8,100.00	0.15	196.95	8,098.29	-4.63	47.83	4.56	0.13	0.00	-50.08
8,125.00	0.12	204.07	8,123.29	-4.69	47.81	4.61	0.14	-0.12	28.48
8,150.00	0.15	173.42	8,148.29	-4.74	47.80	4.67	0.31	0.12	-122.60
8,175.00	0.13	195.28	8,173.29	-4.80	47.80	4.73	0.23	-0.08	87.44
8,200.00	0.13	187.59	8,198.29	-4.86	47.79	4.78	0.07	0.00	-30.76
8,225.00	0.12	200.33	8,223.29	-4.91	47.77	4.84	0.12	-0.04	50.96
8,250.00	0.20	188.11	8,248.29	-4.98	47.76	4.90	0.35	0.32	-48.88
8,275.00	0.13	184.00	8,273.29	-5.05	47.75	4.97	0.28	-0.28	-16.44
8,300.00	0.14	185.03	8,298.29	-5.11	47.74	5.03	0.04	0.04	4.12
8,325.00	0.16	152.45	8,323.29	-5.17	47.76	5.10	0.35	0.08	-130.32
8,350.00	0.15	149.73	8,348.29	-5.23	47.79	5.15	0.05	-0.04	-10.88
8,375.00	0.18	137.87	8,373.29	-5.29	47.83	5.21	0.18	0.12	-47.44
8,400.00	0.19	111.87	8,398.29	-5.33	47.90	5.26	0.34	0.04	-104.00
8,425.00	0.18	109.97	8,423.29	-5.36	47.97	5.28	0.05	-0.04	-7.60
8,450.00	0.19	113.28	8,448.29	-5.39	48.05	5.31	0.06	0.04	13.24
8,475.00	0.21	111.76	8,473.29	-5.42	48.13	5.35	0.08	0.08	-6.08
8,500.00	0.21	99.94	8,498.29	-5.45	48.22	5.37	0.17	0.00	-47.28
8,525.00	0.26	98.66	8,523.29	-5.46	48.32	5.39	0.20	0.20	-5.12
8,550.00	0.22	90.01	8,548.29	-5.47	48.42	5.40	0.22	-0.16	-34.60
8,575.00	0.25	90.70	8,573.29	-5.47	48.52	5.40	0.12	0.12	2.76
8,600.00	0.24	95.79	8,598.29	-5.48	48.63	5.40	0.10	-0.04	20.36
8,625.00	0.27	94.34	8,623.29	-5.49	48.74	5.41	0.12	0.12	-5.80
8,650.00	0.26	96.33	8,648.29	-5.50	48.86	5.42	0.05	-0.04	7.96
8,675.00	0.28	87.61	8,673.29	-5.50	48.97	5.43	0.18	0.08	-34.88
8,700.00	0.36	83.73	8,698.29	-5.49	49.11	5.42	0.33	0.32	-15.52
8,725.00	0.23	93.78	8,723.29	-5.49	49.24	5.41	0.56	-0.52	40.20
8,750.00	0.28	74.66	8,748.29	-5.47	49.35	5.40	0.39	0.20	-76.48
8,775.00	0.28	86.73	8,773.29	-5.45	49.47	5.38	0.24	0.00	48.28
8,800.00	0.29	93.04	8,798.29	-5.45	49.59	5.38	0.13	0.04	25.24
8,825.00	0.31	92.95	8,823.29	-5.46	49.73	5.38	0.08	0.08	-0.36
8,850.00	0.33	92.51	8,848.29	-5.47	49.86	5.39	0.08	0.08	-1.76
8,875.00	0.36	91.05	8,873.29	-5.47	50.02	5.39	0.13	0.12	-5.84
8,900.00	0.37	90.60	8,898.29	-5.47	50.17	5.40	0.04	0.04	-1.80
8,925.00	0.41	94.49	8,923.28	-5.48	50.34	5.40	0.19	0.16	15.56
8,950.00	0.42	95.28	8,948.28	-5.50	50.52	5.42	0.05	0.04	3.16

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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
8,975.00	0.41	95.48	8,973.28	-5.51	50.71	5.44	0.04	-0.04	0.80
9,000.00	0.45	99.93	8,998.28	-5.54	50.89	5.46	0.21	0.16	17.80
9,025.00	0.47	96.68	9,023.28	-5.57	51.09	5.49	0.13	0.08	-13.00
9,050.00	0.49	101.82	9,048.28	-5.60	51.30	5.52	0.19	0.08	20.56
9,075.00	0.58	102.34	9,073.28	-5.65	51.52	5.57	0.36	0.36	2.08
9,100.00	0.59	109.29	9,098.28	-5.72	51.77	5.64	0.29	0.04	27.80
9,125.00	0.67	118.23	9,123.28	-5.83	52.02	5.75	0.51	0.32	35.76
9,150.00	0.75	122.83	9,148.28	-5.99	52.29	5.91	0.39	0.32	18.40
9,175.00	0.75	119.90	9,173.27	-6.16	52.57	6.08	0.15	0.00	-11.72
9,200.00	0.79	123.77	9,198.27	-6.34	52.85	6.26	0.26	0.16	15.48
9,225.00	0.75	121.99	9,223.27	-6.52	53.13	6.44	0.19	-0.16	-7.12
9,250.00	0.80	122.26	9,248.27	-6.70	53.42	6.62	0.20	0.20	1.08
9,275.00	0.79	118.98	9,273.26	-6.88	53.72	6.79	0.19	-0.04	-13.12
9,300.00	0.80	121.89	9,298.26	-7.05	54.02	6.97	0.17	0.04	11.64
9,325.00	0.79	122.39	9,323.26	-7.24	54.31	7.15	0.05	-0.04	2.00
9,350.00	0.82	120.24	9,348.26	-7.42	54.61	7.34	0.17	0.12	-8.60
9,375.00	0.84	126.00	9,373.25	-7.62	54.91	7.53	0.34	0.08	23.04
9,400.00	0.88	128.67	9,398.25	-7.85	55.21	7.76	0.23	0.16	10.68
9,425.00	0.73	135.58	9,423.25	-8.08	55.47	7.99	0.71	-0.60	27.64
9,450.00	0.69	142.97	9,448.25	-8.31	55.67	8.23	0.40	-0.16	29.56
9,475.00	0.71	150.46	9,473.24	-8.57	55.84	8.48	0.37	0.08	29.96
9,500.00	0.73	155.62	9,498.24	-8.85	55.98	8.76	0.27	0.08	20.64
9,525.00	0.74	151.86	9,523.24	-9.14	56.13	9.05	0.20	0.04	-15.04
9,550.00	0.71	151.91	9,548.24	-9.41	56.27	9.33	0.12	-0.12	0.20
9,575.00	0.75	155.10	9,573.24	-9.70	56.42	9.61	0.23	0.16	12.76
9,600.00	0.76	166.19	9,598.23	-10.01	56.52	9.92	0.58	0.04	44.36
9,625.00	0.71	166.29	9,623.23	-10.32	56.60	10.23	0.20	-0.20	0.40
9,650.00	0.83	165.62	9,648.23	-10.65	56.68	10.56	0.48	0.48	-2.68
9,675.00	0.76	164.64	9,673.23	-10.98	56.77	10.89	0.29	-0.28	-3.92
9,700.00	0.86	170.51	9,698.23	-11.33	56.85	11.24	0.52	0.40	23.48
9,725.00	0.90	174.37	9,723.22	-11.71	56.90	11.62	0.29	0.16	15.44
9,750.00	0.90	174.53	9,748.22	-12.10	56.93	12.01	0.01	0.00	0.64
9,775.00	0.96	173.79	9,773.22	-12.50	56.98	12.41	0.24	0.24	-2.96
9,800.00	1.00	175.49	9,798.21	-12.93	57.02	12.84	0.20	0.16	6.80
9,825.00	1.05	172.18	9,823.21	-13.37	57.06	13.28	0.31	0.20	-13.24
9,850.00	0.99	174.24	9,848.20	-13.81	57.12	13.72	0.28	-0.24	8.24
9,875.00	0.96	170.79	9,873.20	-14.23	57.17	14.15	0.26	-0.12	-13.80
9,900.00	1.00	176.71	9,898.20	-14.66	57.22	14.57	0.44	0.16	23.68
9,925.00	0.98	176.47	9,923.19	-15.09	57.24	15.00	0.08	-0.08	-0.96
9,950.00	0.92	181.59	9,948.19	-15.50	57.25	15.42	0.42	-0.24	20.48
9,975.00	0.77	202.12	9,973.19	-15.86	57.18	15.77	1.34	-0.60	82.12
10,000.00	0.78	205.12	9,998.19	-16.17	57.05	16.08	0.17	0.04	12.00
10,025.00	0.79	207.28	10,023.18	-16.48	56.90	16.39	0.12	0.04	8.64
10,050.00	0.67	212.45	10,048.18	-16.75	56.74	16.67	0.55	-0.48	20.68



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
10,075.00	0.60	226.19	10,073.18	-16.97	56.57	16.88	0.67	-0.28	54.96
10,100.00	0.61	226.93	10,098.18	-17.15	56.37	17.06	0.05	0.04	2.96
10,125.00	0.60	229.02	10,123.18	-17.33	56.18	17.24	0.10	-0.04	8.36
10,150.00	0.73	235.26	10,148.17	-17.50	55.95	17.42	0.59	0.52	24.96
10,175.00	0.86	243.78	10,173.17	-17.68	55.65	17.59	0.70	0.52	34.08
10,200.00	0.95	248.62	10,198.17	-17.83	55.29	17.75	0.47	0.36	19.36
10,225.00	1.09	254.21	10,223.17	-17.98	54.87	17.89	0.69	0.56	22.36
10,250.00	1.14	253.59	10,248.16	-18.11	54.40	18.03	0.21	0.20	-2.48
10,275.00	1.19	257.09	10,273.16	-18.24	53.91	18.15	0.35	0.20	14.00
10,300.00	1.28	262.15	10,298.15	-18.33	53.38	18.25	0.57	0.36	20.24
10,325.00	1.29	260.88	10,323.14	-18.42	52.82	18.34	0.12	0.04	-5.08
10,350.00	1.30	260.67	10,348.14	-18.51	52.27	18.43	0.04	0.04	-0.84
10,375.00	1.32	260.26	10,373.13	-18.60	51.70	18.52	0.09	0.08	-1.64
10,400.00	1.34	262.40	10,398.12	-18.69	51.13	18.61	0.21	0.08	8.56
10,425.00	1.37	262.88	10,423.12	-18.77	50.54	18.69	0.13	0.12	1.92
10,450.00	1.44	261.91	10,448.11	-18.85	49.93	18.77	0.30	0.28	-3.88
10,475.00	1.43	262.16	10,473.10	-18.93	49.31	18.86	0.05	-0.04	1.00
10,500.00	1.48	266.37	10,498.09	-19.00	48.68	18.92	0.47	0.20	16.84
10,525.00	1.60	278.43	10,523.08	-18.97	48.02	18.89	1.38	0.48	48.24
10,550.00	1.88	293.44	10,548.07	-18.75	47.29	18.68	2.13	1.12	60.04
10,575.00	2.05	299.94	10,573.06	-18.37	46.53	18.29	1.12	0.68	26.00
10,600.00	2.06	303.43	10,598.04	-17.89	45.77	17.82	0.50	0.04	13.96
10,625.00	1.75	315.09	10,623.03	-17.38	45.12	17.31	1.98	-1.24	46.64
10,650.00	1.54	334.17	10,648.02	-16.80	44.71	16.73	2.33	-0.84	76.32
10,675.00	1.42	340.95	10,673.01	-16.21	44.46	16.14	0.85	-0.48	27.12
10,700.00	1.28	343.03	10,698.00	-15.65	44.28	15.58	0.59	-0.56	8.32
10,725.00	0.75	357.44	10,723.00	-15.22	44.19	15.15	2.34	-2.12	57.64
10,750.00	0.30	19.89	10,748.00	-14.99	44.20	14.92	1.95	-1.80	89.80
10,775.00	0.21	18.94	10,773.00	-14.89	44.24	14.82	0.36	-0.36	-3.80
10,800.00	0.21	25.16	10,798.00	-14.80	44.27	14.74	0.09	0.00	24.88
10,825.00	0.21	0.61	10,823.00	-14.72	44.29	14.65	0.36	0.00	-98.20
10,850.00	0.22	1.39	10,848.00	-14.62	44.30	14.55	0.04	0.04	3.12
10,875.00	0.21	345.87	10,873.00	-14.53	44.29	14.46	0.24	-0.04	-62.08
10,900.00	0.18	352.54	10,898.00	-14.45	44.27	14.38	0.15	-0.12	26.68
10,925.00	0.18	344.66	10,923.00	-14.37	44.25	14.30	0.10	0.00	-31.52
10,950.00	0.23	349.16	10,948.00	-14.28	44.23	14.21	0.21	0.20	18.00
10,975.00	0.33	5.89	10,973.00	-14.16	44.23	14.09	0.51	0.40	66.92
11,000.00	0.48	12.45	10,998.00	-13.99	44.26	13.92	0.63	0.60	26.24
11,025.00	0.53	11.67	11,022.99	-13.77	44.31	13.70	0.20	0.20	-3.12
11,050.00	0.59	5.68	11,047.99	-13.53	44.34	13.46	0.34	0.24	-23.96
11,075.00	0.63	2.53	11,072.99	-13.27	44.36	13.20	0.21	0.16	-12.60
11,100.00	0.63	4.05	11,097.99	-12.99	44.38	12.92	0.07	0.00	6.08
11,125.00	0.81	0.95	11,122.99	-12.68	44.39	12.61	0.74	0.72	-12.40

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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
11,150.00	0.96	352.37	11,147.99	-12.29	44.37	12.22	0.80	0.60	-34.32
11,175.00	1.11	352.47	11,172.98	-11.85	44.31	11.78	0.60	0.60	0.40
11,200.00	1.16	350.84	11,197.98	-11.36	44.24	11.29	0.24	0.20	-6.52
11,225.00	1.20	352.07	11,222.97	-10.85	44.16	10.78	0.19	0.16	4.92
11,250.00	1.25	352.13	11,247.97	-10.32	44.09	10.25	0.20	0.20	0.24
11,275.00	1.18	353.91	11,272.96	-9.79	44.02	9.72	0.32	-0.28	7.12
11,300.00	1.30	351.37	11,297.95	-9.26	43.95	9.19	0.53	0.48	-10.16
11,325.00	1.34	352.34	11,322.95	-8.68	43.87	8.62	0.18	0.16	3.88
11,350.00	1.35	356.25	11,347.94	-8.10	43.81	8.03	0.37	0.04	15.64
11,375.00	1.49	355.36	11,372.93	-7.48	43.77	7.42	0.57	0.56	-3.56
11,400.00	1.24	357.65	11,397.93	-6.89	43.73	6.82	1.02	-1.00	9.16
11,425.00	1.30	352.60	11,422.92	-6.34	43.68	6.27	0.51	0.24	-20.20
11,450.00	1.34	0.60	11,447.91	-5.76	43.65	5.70	0.75	0.16	32.00
11,475.00	1.26	357.85	11,472.91	-5.20	43.64	5.13	0.41	-0.32	-11.00
11,500.00	1.18	2.01	11,497.90	-4.67	43.64	4.60	0.48	-0.32	16.64
11,525.00	1.05	7.85	11,522.90	-4.18	43.68	4.11	0.69	-0.52	23.36
11,550.00	1.00	10.81	11,547.89	-3.74	43.75	3.67	0.29	-0.20	11.84
11,575.00	1.00	15.72	11,572.89	-3.32	43.85	3.25	0.34	0.00	19.64
11,600.00	0.93	24.22	11,597.88	-2.92	43.99	2.85	0.64	-0.28	34.00
11,625.00	1.08	23.73	11,622.88	-2.52	44.17	2.45	0.60	0.60	-1.96
11,650.00	1.17	23.15	11,647.88	-2.07	44.37	2.00	0.36	0.36	-2.32
11,675.00	1.14	25.79	11,672.87	-1.61	44.58	1.54	0.24	-0.12	10.56
11,700.00	1.38	32.24	11,697.87	-1.13	44.84	1.06	1.11	0.96	25.80
11,725.00	1.33	35.83	11,722.86	-0.64	45.17	0.57	0.39	-0.20	14.36
11,750.00	1.44	28.51	11,747.85	-0.13	45.49	0.06	0.83	0.44	-29.28
11,761.00	1.37	34.69	11,758.85	0.10	45.64	-0.17	1.52	-0.64	56.18
11,913.00	1.25	47.40	11,910.81	2.71	47.89	-2.79	0.21	-0.08	8.36
First IDS MWD Survey									
11,962.00	0.88	139.70	11,959.80	2.79	48.53	-2.86	3.18	-0.76	188.37
12,010.00	8.98	183.82	12,007.59	-1.24	48.52	1.16	17.44	16.88	91.92
12,060.00	18.42	186.15	12,056.11	-13.01	47.41	12.94	18.91	18.88	4.66
12,106.00	23.23	188.62	12,099.10	-29.22	45.27	29.15	10.63	10.46	5.37
12,153.00	27.37	191.96	12,141.58	-48.96	41.64	48.89	9.31	8.81	7.11
12,201.00	30.10	193.35	12,183.67	-71.47	36.57	71.41	5.86	5.69	2.90
12,243.00	32.94	193.34	12,219.47	-92.83	31.50	92.78	6.76	6.76	-0.02
12,297.00	38.99	193.26	12,263.15	-123.68	24.21	123.64	11.20	11.20	-0.15
12,344.00	46.12	193.46	12,297.75	-154.59	16.87	154.56	15.17	15.17	0.43
12,393.00	49.48	194.19	12,330.66	-189.83	8.19	189.81	6.95	6.86	1.49
12,440.00	51.96	193.12	12,360.42	-225.18	-0.39	225.18	5.56	5.28	-2.28
12,488.00	56.28	190.60	12,388.54	-263.23	-8.36	263.24	9.95	9.00	-5.25
12,535.00	63.19	188.53	12,412.22	-303.23	-15.07	303.26	15.19	14.70	-4.40
12,584.00	70.05	189.47	12,431.65	-347.63	-22.12	347.66	14.11	14.00	1.92
12,631.00	72.97	190.93	12,446.56	-391.49	-30.01	391.54	6.88	6.21	3.11



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
12,680.00	75.10	190.80	12,460.03	-437.75	-38.89	437.81	4.35	4.35	-0.27
12,727.00	78.14	189.07	12,470.91	-482.79	-46.77	482.86	7.39	6.47	-3.68
12,775.00	80.68	189.19	12,479.73	-529.37	-54.26	529.45	5.30	5.29	0.25
12,786.26	81.30	188.83	12,481.49	-540.35	-56.00	540.44	6.36	5.53	-3.19
North 330' Hardline Crossing @ 12786.26' MD / 540.44' VS									
12,822.00	83.28	187.70	12,486.29	-575.40	-61.09	575.49	6.36	5.53	-3.17
12,873.00	88.50	184.74	12,489.94	-625.94	-66.60	626.05	11.76	10.24	-5.80
12,968.00	88.98	180.28	12,492.03	-720.81	-70.76	720.92	4.72	0.51	-4.69
13,064.00	89.65	180.56	12,493.18	-816.80	-71.46	816.91	0.76	0.70	0.29
13,159.00	92.84	180.95	12,491.12	-911.75	-72.71	911.87	3.38	3.36	0.41
13,255.00	90.13	180.01	12,488.63	-1,007.71	-73.51	1,007.82	2.99	-2.82	-0.98
13,350.00	89.17	179.42	12,489.21	-1,102.70	-73.04	1,102.82	1.19	-1.01	-0.62
13,441.00	90.32	180.33	12,489.61	-1,193.70	-72.84	1,193.81	1.61	1.26	1.00
13,534.00	89.37	179.30	12,489.87	-1,286.70	-72.54	1,286.81	1.51	-1.02	-1.11
13,636.00	91.02	179.52	12,489.52	-1,388.69	-71.49	1,388.80	1.63	1.62	0.22
13,732.00	88.75	179.02	12,489.71	-1,484.67	-70.27	1,484.78	2.42	-2.36	-0.52
13,828.00	89.20	181.34	12,491.43	-1,580.65	-70.57	1,580.76	2.46	0.47	2.42
13,923.00	88.36	179.81	12,493.45	-1,675.62	-71.52	1,675.73	1.84	-0.88	-1.61
14,018.00	88.08	176.49	12,496.40	-1,770.51	-68.46	1,770.62	3.51	-0.29	-3.49
14,136.00	88.11	176.23	12,500.33	-1,888.21	-60.97	1,888.30	0.22	0.03	-0.22
14,231.00	89.09	179.28	12,502.65	-1,983.09	-57.25	1,983.18	3.37	1.03	3.21
14,326.00	90.74	179.73	12,502.79	-2,078.09	-56.43	2,078.17	1.80	1.74	0.47
14,421.00	90.88	180.00	12,501.45	-2,173.08	-56.21	2,173.16	0.32	0.15	0.28
14,516.00	87.69	176.43	12,502.63	-2,268.00	-53.25	2,268.08	5.04	-3.36	-3.76
14,611.00	86.74	175.54	12,507.25	-2,362.65	-46.61	2,362.72	1.37	-1.00	-0.94
14,707.00	88.53	177.85	12,511.21	-2,458.40	-41.08	2,458.46	3.04	1.86	2.41
14,802.00	89.57	178.39	12,512.78	-2,553.33	-37.96	2,553.39	1.23	1.09	0.57
14,897.00	89.85	178.93	12,513.27	-2,648.30	-35.74	2,648.36	0.64	0.29	0.57
14,992.00	91.02	179.28	12,512.54	-2,743.29	-34.26	2,743.34	1.29	1.23	0.37
15,086.00	88.25	177.01	12,513.14	-2,837.22	-31.22	2,837.27	3.81	-2.95	-2.41
15,181.00	86.82	177.84	12,517.23	-2,932.03	-26.95	2,932.07	1.74	-1.51	0.87
15,272.00	89.40	180.20	12,520.23	-3,022.96	-25.40	3,022.99	3.84	2.84	2.59
15,367.00	89.79	179.68	12,520.90	-3,117.95	-25.30	3,117.99	0.68	0.41	-0.55
15,464.00	88.84	182.71	12,522.06	-3,214.91	-27.32	3,214.95	3.27	-0.98	3.12
15,559.00	88.81	185.79	12,524.01	-3,309.62	-34.36	3,309.67	3.24	-0.03	3.24
15,654.00	90.60	185.86	12,524.50	-3,404.13	-44.00	3,404.19	1.89	1.88	0.07
15,749.00	89.15	183.46	12,524.71	-3,498.80	-51.72	3,498.88	2.95	-1.53	-2.53
15,844.00	89.99	180.70	12,525.42	-3,593.73	-55.17	3,593.81	3.04	0.88	-2.91
15,939.00	87.24	176.59	12,527.72	-3,688.64	-52.92	3,688.72	5.20	-2.89	-4.33
16,035.00	88.81	175.00	12,531.02	-3,784.32	-45.89	3,784.39	2.33	1.64	-1.66
16,130.00	89.71	172.86	12,532.25	-3,878.77	-35.84	3,878.83	2.44	0.95	-2.25
16,225.00	87.44	176.93	12,534.62	-3,973.34	-27.39	3,973.38	4.90	-2.39	4.28
16,321.00	84.12	178.32	12,541.68	-4,068.98	-23.42	4,069.02	3.75	-3.46	1.45
16,416.00	86.03	178.97	12,549.83	-4,163.60	-21.19	4,163.63	2.12	2.01	0.68



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)
16,512.00	90.60	179.09	12,552.66	-4,259.52	-19.56	4,259.55	4.76	4.76	0.13
16,607.00	92.03	180.23	12,550.48	-4,354.49	-19.00	4,354.51	1.92	1.51	1.20
16,703.00	92.17	179.97	12,546.96	-4,450.43	-19.17	4,450.45	0.31	0.15	-0.27
16,799.00	93.60	181.18	12,542.13	-4,546.29	-20.13	4,546.32	1.95	1.49	1.26
16,893.00	92.37	180.11	12,537.23	-4,640.16	-21.18	4,640.19	1.73	-1.31	-1.14
16,988.00	91.92	179.78	12,533.68	-4,735.09	-21.09	4,735.12	0.59	-0.47	-0.35
17,083.00	89.20	176.63	12,532.75	-4,830.02	-18.12	4,830.04	4.38	-2.86	-3.32
17,177.00	88.50	176.29	12,534.63	-4,923.82	-12.31	4,923.83	0.83	-0.74	-0.36
17,271.00	86.51	178.18	12,538.73	-5,017.61	-7.78	5,017.62	2.92	-2.12	2.01
17,366.00	85.47	179.25	12,545.37	-5,112.35	-5.66	5,112.36	1.57	-1.09	1.13
17,461.00	86.43	180.12	12,552.08	-5,207.11	-5.14	5,207.11	1.36	1.01	0.92
17,556.00	86.76	180.19	12,557.72	-5,301.94	-5.39	5,301.95	0.36	0.35	0.07
17,651.00	86.71	179.95	12,563.13	-5,396.79	-5.51	5,396.79	0.26	-0.05	-0.25
17,745.00	87.58	181.46	12,567.81	-5,490.66	-6.66	5,490.67	1.85	0.93	1.61
17,839.00	89.06	182.14	12,570.57	-5,584.57	-9.62	5,584.58	1.73	1.57	0.72
17,934.00	88.25	181.03	12,572.80	-5,679.51	-12.24	5,679.52	1.45	-0.85	-1.17
18,029.00	87.69	181.13	12,576.17	-5,774.43	-14.03	5,774.45	0.60	-0.59	0.11
18,123.00	87.35	180.71	12,580.23	-5,868.33	-15.54	5,868.35	0.57	-0.36	-0.45
18,219.00	90.29	181.19	12,582.21	-5,964.29	-17.13	5,964.31	3.10	3.06	0.50
18,314.00	90.18	181.94	12,581.82	-6,059.25	-19.73	6,059.27	0.80	-0.12	0.79
18,409.00	87.86	179.85	12,583.44	-6,154.21	-21.21	6,154.24	3.29	-2.44	-2.20
18,505.00	87.27	179.61	12,587.52	-6,250.12	-20.76	6,250.15	0.66	-0.61	-0.25
18,627.00	84.82	176.88	12,595.94	-6,371.76	-17.04	6,371.77	3.00	-2.01	-2.24
18,690.00	87.94	177.52	12,599.92	-6,434.55	-13.97	6,434.56	5.06	4.95	1.02
18,786.00	91.64	178.11	12,600.27	-6,530.46	-10.31	6,530.47	3.90	3.85	0.61
18,882.00	94.61	178.58	12,595.04	-6,626.27	-7.54	6,626.27	3.13	3.09	0.49
18,976.00	96.95	178.34	12,585.57	-6,719.75	-5.02	6,719.75	2.50	2.49	-0.26
19,071.00	96.13	179.51	12,574.75	-6,814.11	-3.26	6,814.11	1.50	-0.86	1.23
19,166.00	94.42	181.76	12,566.01	-6,908.69	-4.31	6,908.69	2.97	-1.80	2.37
19,260.00	92.79	181.10	12,560.10	-7,002.47	-6.65	7,002.48	1.87	-1.73	-0.70
19,355.00	89.34	179.55	12,558.34	-7,097.44	-7.18	7,097.44	3.98	-3.63	-1.63
19,450.00	88.89	180.27	12,559.81	-7,192.43	-7.04	7,192.43	0.89	-0.47	0.76
19,546.00	90.32	180.17	12,560.47	-7,288.42	-7.40	7,288.42	1.49	1.49	-0.10
19,641.00	91.92	181.65	12,558.61	-7,383.38	-8.91	7,383.39	2.29	1.68	1.56
19,737.00	88.19	182.09	12,558.52	-7,479.32	-12.04	7,479.33	3.91	-3.89	0.46
19,831.00	87.35	183.24	12,562.18	-7,573.14	-16.41	7,573.16	1.51	-0.89	1.22
19,926.00	87.18	182.92	12,566.71	-7,667.90	-21.51	7,667.92	0.38	-0.18	-0.34
20,021.00	87.74	182.22	12,570.92	-7,762.71	-25.76	7,762.74	0.94	0.59	-0.74
20,060.35	88.41	182.00	12,572.24	-7,802.01	-27.21	7,802.04	1.79	1.70	-0.55
South 330' Hardline Crossing @20060.35 / 7802.04'VS									
20,117.00	89.37	181.69	12,573.34	-7,858.62	-29.04	7,858.65	1.79	1.70	-0.55
Final IDS MWD Survey									
20,176.00	89.37	181.69	12,573.99	-7,917.59	-30.78	7,917.62	0.00	0.00	0.00
Projection to TD									



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:	Wellbore #1	Database:	EDM 5000.1 Multi User Db

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)

Design Annotations					
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates			
		+N/-S (ft)	+E/-W (ft)	Comment	
11,913.00	11,910.81	2.71	47.89	First IDS MWD Survey	
12,786.26	12,481.49	-540.35	-56.00	North 330' Hardline Crossing @ 12786.26' MD / 540.44' VS	
20,060.35	12,572.24	-7,802.01	-27.21	South 330' Hardline Crossing @20060.35 / 7802.04'VS	
20,117.00	12,573.34	-7,858.62	-29.04	Final IDS MWD Survey	
20,176.00	12,573.99	-7,917.59	-30.78	Projection to TD	

Checked By: _____	Approved By: _____	Date: _____
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