



CONCHO

COG Operating L L C

Lea County, NM (NAD27 NME)

Sec. 34, T 25 S. , R 33 E

Columbus Federal Com 23H

Wellbore #2

Design: Wellbore #2

Survey Report - Geographic

29 June, 2017

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Integrity Directional Services, LLC
Survey Report - Geographic



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Columbus Federal Com 23H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3352.00ft (Scandrift Freedom)
Site:	Sec. 34, T 25 S. , R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandrift Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	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. 34, T 25 S. , R 33 E		
Site Position:		Northing:	398,623.8000 usft
From:	Map	Easting:	739,904.9000 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	32.0935639
		Longitude:	-103.5556559
		Grid Convergence:	0.41 °

Well	Columbus Federal Com 23H, ACTIVE		
Well Position	+N/-S	0.00 ft	Northing: 398,630.3000 usft
	+E/-W	0.00 ft	Easting: 740,877.7000 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	0.00 ft
		Latitude:	32.0935625
		Longitude:	-103.5555148
		Ground Level:	3,326.00 ft

Wellbore	Wellbore #2				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	4/11/2017	6.85	59.80	47,990

Design	Wellbore #2				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	11,692.00
Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)	
	0.00	0.00	0.00	181.33	

Survey Program	Date 6/29/2017			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
176.00	11,692.00	IDS MWD Surveys (Wellbore #1)	MWD	MWD - Standard
11,791.00	22,256.00	IDS MWD Surveys (Wellbore #2)	MWD	MWD - Standard

Survey										
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
0.00	0.00	0.00	0.00	0.00	0.00	398,630.3000	740,877.7000	32.0935625	-103.5555148	
176.00	0.40	212.90	176.00	-0.52	-0.33	398,629.7841	740,877.3663	32.0935611	-103.5555159	
238.00	0.70	188.60	238.00	-1.07	-0.51	398,629.2280	740,877.1921	32.0935596	-103.5555164	
331.00	0.70	202.60	330.99	-2.16	-0.81	398,628.1418	740,876.8889	32.0935566	-103.5555174	
456.00	0.60	201.30	455.98	-3.47	-1.34	398,626.8271	740,876.3577	32.0935530	-103.5555192	
580.00	0.40	242.80	579.98	-4.28	-1.96	398,626.0243	740,875.7369	32.0935508	-103.5555212	
705.00	0.60	287.20	704.97	-4.28	-2.98	398,626.0184	740,874.7236	32.0935508	-103.5555245	
832.00	0.90	298.70	831.96	-3.61	-4.49	398,626.6940	740,873.2135	32.0935527	-103.5555293	
895.00	1.00	307.20	894.95	-3.04	-5.36	398,627.2640	740,872.3416	32.0935543	-103.5555321	
988.00	1.20	321.00	987.94	-1.79	-6.62	398,628.5115	740,871.0823	32.0935578	-103.5555362	
1,119.00	1.20	320.70	1,118.91	0.34	-8.35	398,630.6390	740,869.3502	32.0935636	-103.5555417	



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Site:	Sec. 34, T 25 S., R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandrift Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	Database:	EDM 5000.1 Multi User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
1,148.00	1.00	322.90	1,147.90	0.78	-8.69	398,631.0758	740,869.0053	32.0935649	-103.5555428
1,277.00	0.70	316.30	1,276.89	2.24	-9.92	398,632.5434	740,867.7818	32.0935689	-103.5555467
1,371.00	0.60	315.00	1,370.88	3.01	-10.66	398,633.3065	740,867.0371	32.0935710	-103.5555491
1,558.00	0.80	312.30	1,557.87	4.58	-12.32	398,634.8774	740,865.3792	32.0935754	-103.5555544
1,744.00	0.80	309.20	1,743.85	6.27	-14.29	398,636.5720	740,863.4126	32.0935801	-103.5555608
1,931.00	1.00	306.80	1,930.83	8.07	-16.61	398,638.3746	740,861.0943	32.0935851	-103.5555682
2,118.00	1.10	313.80	2,117.79	10.29	-19.21	398,640.5944	740,858.4921	32.0935912	-103.5555766
2,305.00	1.40	321.70	2,304.75	13.33	-21.92	398,643.6296	740,855.7808	32.0935996	-103.5555852
2,493.00	1.80	346.50	2,492.68	18.00	-24.03	398,648.3030	740,853.6680	32.0936125	-103.5555919
2,681.00	2.40	0.40	2,680.55	24.81	-24.69	398,655.1103	740,853.0062	32.0936312	-103.5555939
2,869.00	1.80	354.30	2,868.43	31.68	-24.96	398,661.9846	740,852.7405	32.0936501	-103.5555946
2,962.00	1.30	330.40	2,961.39	34.06	-25.63	398,664.3553	740,852.0743	32.0936567	-103.5555967
3,150.00	1.50	352.80	3,149.34	38.35	-26.99	398,668.6509	740,850.7125	32.0936685	-103.5556010
3,337.00	1.30	356.60	3,336.28	42.90	-27.42	398,673.1966	740,850.2799	32.0936810	-103.5556023
3,431.00	1.00	8.40	3,430.26	44.77	-27.36	398,675.0725	740,850.3365	32.0936862	-103.5556021
3,618.00	0.60	284.10	3,617.25	46.63	-28.07	398,676.9254	740,849.6253	32.0936913	-103.5556043
3,712.00	1.10	257.20	3,711.24	46.55	-29.43	398,676.8454	740,848.2681	32.0936911	-103.5556087
3,807.00	0.60	246.40	3,806.23	46.14	-30.78	398,676.4442	740,846.9230	32.0936900	-103.5556131
3,902.00	0.40	63.70	3,901.23	46.09	-30.94	398,676.3920	740,846.7645	32.0936899	-103.5556136
3,995.00	0.20	64.90	3,994.23	46.30	-30.50	398,676.6047	740,847.2025	32.0936904	-103.5556122
4,089.00	0.10	41.70	4,088.23	46.44	-30.29	398,676.7356	740,847.4057	32.0936908	-103.5556115
4,182.00	0.60	291.60	4,181.22	46.68	-30.69	398,676.9754	740,847.0069	32.0936915	-103.5556128
4,275.00	0.70	291.40	4,274.22	47.06	-31.67	398,677.3620	740,846.0252	32.0936925	-103.5556159
4,462.00	0.50	98.20	4,461.21	47.36	-31.93	398,677.6624	740,845.7693	32.0936934	-103.5556168
4,556.00	0.80	188.60	4,555.21	46.66	-31.62	398,676.9550	740,846.0771	32.0936914	-103.5556158
4,649.00	1.80	190.80	4,648.18	44.58	-31.99	398,674.8783	740,845.7063	32.0936857	-103.5556170
4,742.00	2.50	174.60	4,741.12	41.12	-32.08	398,671.4242	740,845.6235	32.0936762	-103.5556174
4,836.00	1.70	183.30	4,835.06	37.69	-31.96	398,667.9911	740,845.7362	32.0936668	-103.5556171
4,929.00	1.20	257.90	4,928.03	36.11	-33.00	398,666.4097	740,844.7045	32.0936625	-103.5556205
5,023.00	2.00	283.50	5,022.00	36.29	-35.55	398,666.5863	740,842.1471	32.0936630	-103.5556287
5,116.00	2.40	283.50	5,114.93	37.12	-39.02	398,667.4197	740,838.6757	32.0936654	-103.5556399
5,210.00	2.60	282.90	5,208.84	38.06	-43.02	398,668.3551	740,834.6836	32.0936680	-103.5556528
5,303.00	2.70	284.90	5,301.74	39.09	-47.19	398,669.3893	740,830.5107	32.0936709	-103.5556662
5,396.00	3.10	284.40	5,394.62	40.28	-51.74	398,670.5779	740,825.9582	32.0936743	-103.5556809
5,490.00	3.30	285.10	5,488.47	41.61	-56.82	398,671.9148	740,820.8843	32.0936781	-103.5556973
5,585.00	3.40	286.90	5,583.31	43.15	-62.15	398,673.4460	740,815.5490	32.0936824	-103.5557144
5,679.00	3.10	283.10	5,677.16	44.53	-67.29	398,674.8324	740,810.4064	32.0936863	-103.5557310
5,772.00	3.20	278.60	5,770.02	45.49	-72.31	398,675.7905	740,805.3907	32.0936890	-103.5557472
5,866.00	2.60	271.80	5,863.90	45.95	-77.03	398,676.2498	740,800.6655	32.0936904	-103.5557624
5,959.00	2.40	264.20	5,956.81	45.82	-81.08	398,676.1193	740,796.6199	32.0936901	-103.5557755
6,053.00	2.50	264.80	6,050.72	45.43	-85.08	398,675.7346	740,792.6202	32.0936891	-103.5557884
6,147.00	2.80	264.30	6,144.62	45.02	-89.41	398,675.3207	740,788.2939	32.0936881	-103.5558024
6,242.00	3.10	264.90	6,239.50	44.56	-94.27	398,674.8619	740,783.4264	32.0936869	-103.5558181
6,335.00	3.20	266.20	6,332.36	44.17	-99.37	398,674.4664	740,778.3318	32.0936859	-103.5558346
6,429.00	2.60	263.90	6,426.24	43.77	-104.11	398,674.0659	740,773.5939	32.0936849	-103.5558499
6,523.00	2.50	261.20	6,520.14	43.23	-108.25	398,673.5257	740,769.4479	32.0936835	-103.5558633
6,616.00	2.60	261.80	6,613.05	42.61	-112.34	398,672.9146	740,765.3557	32.0936819	-103.5558765
6,709.00	2.90	260.00	6,705.94	41.91	-116.75	398,672.2052	740,760.9510	32.0936800	-103.5558908
6,802.00	2.50	255.50	6,798.84	40.99	-121.03	398,671.2888	740,756.6705	32.0936776	-103.5559046
6,896.00	2.40	251.40	6,892.75	39.85	-124.88	398,670.1477	740,752.8203	32.0936746	-103.5559171
6,989.00	2.40	250.40	6,985.67	38.57	-128.56	398,668.8735	740,749.1405	32.0936711	-103.5559290
7,083.00	2.50	249.30	7,079.59	37.19	-132.33	398,667.4886	740,745.3686	32.0936674	-103.5559412
7,176.00	2.20	247.70	7,172.51	35.79	-135.88	398,666.0943	740,741.8197	32.0936636	-103.5559527
7,269.00	1.90	250.30	7,265.45	34.60	-138.98	398,664.8972	740,738.7167	32.0936604	-103.5559627
7,363.00	2.00	256.50	7,359.39	33.69	-142.05	398,663.9890	740,735.6546	32.0936580	-103.5559726



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Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Site:	Sec. 34, T 25 S. , R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	Database:	EDM 5000.1 Multi User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
7,456.00	1.90	258.00	7,452.34	32.99	-145.13	398,663.2896	740,732.5686	32.0936561	-103.5559826
7,551.00	2.10	256.10	7,547.28	32.24	-148.36	398,662.5441	740,729.3386	32.0936541	-103.5559931
7,644.00	1.80	261.70	7,640.23	31.62	-151.46	398,661.9239	740,726.2392	32.0936525	-103.5560031
7,738.00	1.50	253.70	7,734.19	31.07	-154.10	398,661.3655	740,723.5975	32.0936510	-103.5560116
7,832.00	1.10	248.20	7,828.17	30.39	-156.12	398,660.6851	740,721.5789	32.0936492	-103.5560182
7,926.00	1.00	245.80	7,922.15	29.71	-157.71	398,660.0138	740,719.9930	32.0936473	-103.5560233
8,019.00	0.50	232.60	8,015.14	29.13	-158.77	398,659.4346	740,718.9304	32.0936458	-103.5560267
8,113.00	0.50	247.20	8,109.14	28.73	-159.47	398,659.0266	740,718.2264	32.0936447	-103.5560290
8,206.00	0.50	228.90	8,202.13	28.30	-160.15	398,658.6026	740,717.5466	32.0936435	-103.5560312
8,299.00	0.60	232.70	8,295.13	27.74	-160.85	398,658.0408	740,716.8535	32.0936420	-103.5560335
8,393.00	0.80	228.60	8,389.12	27.01	-161.73	398,657.3085	740,715.9697	32.0936400	-103.5560363
8,487.00	0.90	242.60	8,483.11	26.23	-162.88	398,656.5348	740,714.8220	32.0936379	-103.5560401
8,580.00	0.90	215.90	8,576.10	25.31	-163.96	398,655.6071	740,713.7453	32.0936354	-103.5560436
8,674.00	1.00	218.50	8,670.09	24.07	-164.90	398,654.3671	740,712.8018	32.0936320	-103.5560466
8,770.00	1.00	210.70	8,766.07	22.69	-165.85	398,652.9912	740,711.8526	32.0936282	-103.5560497
8,863.00	0.90	221.00	8,859.06	21.44	-166.74	398,651.7422	740,710.9591	32.0936248	-103.5560527
9,033.00	1.10	226.10	9,029.04	19.30	-168.79	398,649.6030	740,708.9074	32.0936190	-103.5560593
9,126.00	1.10	222.90	9,122.02	18.03	-170.04	398,648.3301	740,707.6565	32.0936155	-103.5560634
9,221.00	1.20	227.50	9,217.00	16.69	-171.40	398,646.9901	740,706.3024	32.0936118	-103.5560678
9,314.00	1.10	237.40	9,309.98	15.55	-172.87	398,645.8512	740,704.8324	32.0936087	-103.5560726
9,408.00	1.50	237.90	9,403.96	14.41	-174.67	398,644.7113	740,703.0300	32.0936056	-103.5560784
9,502.00	1.50	240.10	9,497.92	13.14	-176.78	398,643.4442	740,700.9212	32.0936022	-103.5560853
9,595.00	1.30	240.40	9,590.90	12.02	-178.75	398,642.3164	740,698.9487	32.0935991	-103.5560917
9,688.00	1.30	241.90	9,683.87	11.00	-180.60	398,641.2984	740,697.1008	32.0935964	-103.5560976
9,782.00	1.10	248.50	9,777.85	10.17	-182.38	398,640.4655	740,695.3207	32.0935941	-103.5561034
9,876.00	1.40	254.40	9,871.83	9.53	-184.33	398,639.8260	740,693.3752	32.0935924	-103.5561097
9,970.00	2.00	261.90	9,965.79	8.99	-187.06	398,639.2860	740,690.6453	32.0935910	-103.5561185
10,063.00	2.40	264.10	10,058.72	8.56	-190.60	398,638.8572	740,687.1017	32.0935898	-103.5561300
10,157.00	1.40	250.40	10,152.67	7.97	-193.64	398,638.2697	740,684.0621	32.0935883	-103.5561398
10,251.00	1.00	228.00	10,246.65	7.04	-195.33	398,637.3356	740,682.3708	32.0935858	-103.5561453
10,344.00	1.20	208.70	10,339.63	5.64	-196.40	398,635.9384	740,681.3000	32.0935819	-103.5561488
10,438.00	1.70	193.10	10,433.60	3.42	-197.19	398,633.7170	740,680.5113	32.0935758	-103.5561514
10,532.00	2.00	195.40	10,527.55	0.48	-197.94	398,630.7776	740,679.7597	32.0935678	-103.5561539
10,626.00	1.80	193.70	10,621.50	-2.54	-198.73	398,627.7619	740,678.9745	32.0935595	-103.5561565
10,719.00	2.10	203.30	10,714.45	-5.52	-199.75	398,624.7779	740,677.9546	32.0935513	-103.5561598
10,812.00	2.40	207.30	10,807.37	-8.82	-201.31	398,621.4826	740,676.3875	32.0935423	-103.5561650
10,906.00	2.70	200.60	10,901.28	-12.64	-202.99	398,617.6612	740,674.7058	32.0935318	-103.5561705
10,999.00	2.80	198.50	10,994.17	-16.84	-204.49	398,613.4567	740,673.2144	32.0935203	-103.5561754
11,092.00	2.70	206.40	11,087.07	-20.96	-206.18	398,609.3405	740,671.5196	32.0935090	-103.5561810
11,186.00	2.80	209.60	11,180.96	-24.94	-208.30	398,605.3611	740,669.4012	32.0934981	-103.5561879
11,279.00	3.20	215.30	11,273.83	-29.03	-210.92	398,601.2676	740,666.7792	32.0934869	-103.5561965
11,373.00	3.40	218.50	11,367.68	-33.36	-214.17	398,596.9449	740,663.5279	32.0934751	-103.5562071
11,467.00	4.10	224.70	11,461.47	-37.93	-218.27	398,592.3748	740,659.4290	32.0934626	-103.5562204
11,559.00	4.00	230.70	11,553.24	-42.30	-223.07	398,588.0047	740,654.6325	32.0934507	-103.5562360
11,653.00	4.40	240.10	11,646.99	-46.17	-228.73	398,584.1306	740,648.9695	32.0934402	-103.5562544
11,692.00	4.40	241.40	11,685.88	-47.63	-231.34	398,582.6687	740,646.3591	32.0934362	-103.5562628
11,791.00	4.83	243.64	11,784.56	-51.30	-238.41	398,579.0003	740,639.2904	32.0934263	-103.5562858
11,821.00	4.82	245.07	11,814.45	-52.39	-240.68	398,577.9082	740,637.0158	32.0934233	-103.5562931
11,852.00	4.81	241.47	11,845.34	-53.56	-243.01	398,576.7385	740,634.6928	32.0934201	-103.5563007
11,883.00	4.62	238.08	11,876.24	-54.84	-245.21	398,575.4576	740,632.4913	32.0934167	-103.5563078
11,914.00	5.60	223.01	11,907.11	-56.61	-247.30	398,573.6914	740,630.3997	32.0934118	-103.5563146
11,946.00	9.62	208.25	11,938.83	-60.11	-249.63	398,570.1926	740,628.0680	32.0934023	-103.5563222
11,977.00	15.44	200.61	11,969.08	-66.26	-252.31	398,564.0427	740,625.3869	32.0933854	-103.5563310
12,024.00	20.93	201.58	12,013.71	-79.93	-257.61	398,550.3699	740,620.0929	32.0933479	-103.5563484
12,071.00	24.55	197.81	12,057.06	-97.04	-263.68	398,533.2609	740,614.0166	32.0933010	-103.5563684



Integrity Directional Services, LLC

Survey Report - Geographic



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Columbus Federal Com 23H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Site:	Sec. 34, T 25 S., R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	Database:	EDM 5000.1 Multi User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
12,118.00	28.39	192.35	12,099.13	-117.26	-269.06	398,513.0393	740,608.6375	32.0932456	-103.5563863
12,127.61	29.12	192.02	12,107.55	-121.78	-270.04	398,508.5205	740,607.6618	32.0932331	-103.5563895
North HardLine Crossing 12127.61' MD / 128.03' VS									
12,164.00	31.89	190.91	12,138.90	-139.88	-273.70	398,490.4182	740,603.9973	32.0931835	-103.5564018
12,211.00	36.11	191.75	12,177.86	-165.64	-278.88	398,464.6568	740,598.8249	32.0931128	-103.5564191
12,258.00	41.31	189.68	12,214.52	-194.52	-284.31	398,435.7844	740,593.3922	32.0930335	-103.5564373
12,305.00	44.54	188.57	12,248.93	-226.12	-289.37	398,404.1844	740,588.3261	32.0929467	-103.5564544
12,351.00	48.25	186.56	12,280.66	-259.13	-293.74	398,371.1719	740,583.9600	32.0928561	-103.5564692
12,382.00	51.43	184.91	12,300.65	-282.70	-296.10	398,347.6026	740,581.6009	32.0927913	-103.5564774
12,414.00	54.39	182.75	12,319.94	-308.16	-297.79	398,322.1384	740,579.9056	32.0927214	-103.5564835
12,445.00	57.06	181.40	12,337.40	-333.76	-298.72	398,296.5417	740,578.9830	32.0926510	-103.5564870
12,476.00	59.92	180.96	12,353.60	-360.18	-299.26	398,270.1212	740,578.4404	32.0925784	-103.5564894
12,508.00	63.29	180.51	12,368.82	-388.32	-299.62	398,241.9776	740,578.0811	32.0925011	-103.5564912
12,539.00	66.28	179.92	12,382.02	-416.37	-299.72	398,213.9350	740,577.9776	32.0924240	-103.5564922
12,570.00	68.56	180.32	12,393.93	-444.99	-299.78	398,185.3134	740,577.9168	32.0923453	-103.5564931
12,601.00	70.71	181.01	12,404.71	-474.05	-300.12	398,156.2550	740,577.5783	32.0922654	-103.5564948
12,632.00	74.11	181.76	12,414.08	-503.58	-300.84	398,126.7178	740,576.8624	32.0921843	-103.5564978
12,662.00	76.99	181.54	12,421.56	-532.62	-301.67	398,097.6820	740,576.0263	32.0921045	-103.5565012
12,693.00	79.31	181.91	12,427.93	-562.94	-302.59	398,067.3586	740,575.1127	32.0920211	-103.5565049
12,725.00	81.50	182.20	12,433.26	-594.47	-303.72	398,035.8286	740,573.9811	32.0919345	-103.5565093
12,756.00	84.23	181.95	12,437.11	-625.21	-304.83	398,005.0918	740,572.8677	32.0918500	-103.5565136
12,787.00	86.85	182.06	12,439.52	-656.09	-305.91	397,974.2074	740,571.7864	32.0917651	-103.5565178
12,818.00	87.80	181.30	12,440.97	-687.05	-306.82	397,943.2551	740,570.8786	32.0916801	-103.5565214
12,849.00	87.97	181.40	12,442.12	-718.02	-307.55	397,912.2849	740,570.1488	32.0915950	-103.5565245
12,942.00	89.85	181.95	12,443.88	-810.96	-310.27	397,819.3463	740,567.4309	32.0913395	-103.5565354
13,036.00	90.18	179.90	12,443.86	-904.94	-311.79	397,725.3638	740,565.9135	32.0910812	-103.5565425
13,129.00	89.59	178.83	12,444.05	-997.93	-310.76	397,632.3717	740,566.9441	32.0908256	-103.5565414
13,223.00	89.34	178.58	12,444.92	-1,091.90	-308.63	397,538.4001	740,569.0684	32.0905672	-103.5565367
13,316.00	90.99	180.96	12,444.66	-1,184.89	-308.26	397,445.4113	740,569.4418	32.0903116	-103.5565376
13,410.00	90.55	180.25	12,443.39	-1,278.88	-309.25	397,351.4261	740,568.4494	32.0900533	-103.5565430
13,503.00	89.65	178.94	12,443.23	-1,371.87	-308.59	397,258.4317	740,569.1067	32.0897977	-103.5565431
13,597.00	89.40	179.38	12,444.01	-1,465.86	-307.22	397,164.4455	740,570.4847	32.0895393	-103.5565408
13,691.00	91.67	181.23	12,443.13	-1,559.84	-307.72	397,070.4614	740,569.9847	32.0892810	-103.5565446
13,785.00	91.98	181.18	12,440.14	-1,653.77	-309.69	396,976.5301	740,568.0089	32.0890228	-103.5565532
13,880.00	90.10	179.63	12,438.41	-1,748.75	-310.36	396,881.5555	740,567.3380	32.0887617	-103.5565576
13,973.00	89.62	179.21	12,438.64	-1,841.74	-309.42	396,788.5612	740,568.2794	32.0885061	-103.5565567
14,067.00	90.80	179.98	12,438.30	-1,935.74	-308.76	396,694.5668	740,568.9438	32.0882477	-103.5565567
14,161.00	89.68	178.37	12,437.90	-2,029.72	-307.40	396,600.5821	740,570.2972	32.0879893	-103.5565545
14,255.00	91.22	179.80	12,437.17	-2,123.70	-305.90	396,506.6024	740,571.7983	32.0877310	-103.5565519
14,348.00	89.99	178.38	12,436.18	-2,216.68	-304.43	396,413.6237	740,573.2753	32.0874754	-103.5565493
14,442.00	87.21	177.27	12,438.48	-2,310.57	-300.86	396,319.7303	740,576.8408	32.0872172	-103.5565399
14,536.00	87.44	177.97	12,442.87	-2,404.39	-296.96	396,225.9146	740,580.7400	32.0869593	-103.5565295
14,629.00	86.99	178.56	12,447.39	-2,497.24	-294.15	396,133.0678	740,583.5524	32.0867040	-103.5565226
14,722.00	88.81	179.40	12,450.79	-2,590.16	-292.49	396,040.1499	740,585.2064	32.0864485	-103.5565194
14,815.00	93.07	180.98	12,449.27	-2,683.12	-292.80	395,947.1875	740,584.8989	32.0861930	-103.5565226
14,909.00	92.17	180.52	12,444.97	-2,777.01	-294.03	395,853.2952	740,583.6699	32.0859349	-103.5565287
15,003.00	90.94	180.54	12,442.42	-2,870.97	-294.90	395,759.3358	740,582.8007	32.0856767	-103.5565337
15,096.00	88.56	179.91	12,442.83	-2,963.96	-295.27	395,666.3448	740,582.4355	32.0854211	-103.5565371
15,190.00	88.81	180.03	12,444.98	-3,057.94	-295.22	395,572.3698	740,582.4847	32.0851628	-103.5565391
15,283.00	89.93	180.75	12,446.01	-3,150.93	-295.85	395,479.3799	740,581.8517	32.0849072	-103.5565433
15,377.00	89.79	180.14	12,446.24	-3,244.92	-296.58	395,385.3836	740,581.1216	32.0846488	-103.5565478
15,470.00	89.76	179.85	12,446.60	-3,337.92	-296.57	395,292.3846	740,581.1297	32.0843932	-103.5565500
15,563.00	90.74	180.23	12,446.19	-3,430.92	-296.64	395,199.3870	740,581.0648	32.0841375	-103.5565524
15,657.00	91.30	181.84	12,444.52	-3,524.89	-298.33	395,105.4209	740,579.3673	32.0838793	-103.5565600
15,750.00	90.18	180.68	12,443.32	-3,617.85	-300.38	395,012.4544	740,577.3227	32.0836238	-103.5565688



Integrity Directional Services, LLC
Survey Report - Geographic



Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Columbus Federal Com 23H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3352.00ft (Scandriil Freedom)
Site:	Sec. 34, T 25 S. , R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandriil Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	Database:	EDM 5000.1 Multi User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
15,844.00	89.65	180.99	12,443.46	-3,711.84	-301.75	394,918.4651	740,575.9528	32.0833654	-103.5565754
15,937.00	89.99	180.05	12,443.75	-3,804.84	-302.59	394,825.4708	740,575.1088	32.0831098	-103.5565803
16,031.00	89.51	180.61	12,444.16	-3,898.83	-303.13	394,731.4741	740,574.5674	32.0828515	-103.5565842
16,125.00	89.34	178.75	12,445.11	-3,992.82	-302.61	394,637.4846	740,575.0924	32.0825931	-103.5565847
16,218.00	88.81	178.59	12,446.61	-4,085.79	-300.45	394,544.5223	740,577.2507	32.0823375	-103.5565799
16,338.00	88.39	177.76	12,449.54	-4,205.69	-296.63	394,424.6206	740,581.0710	32.0820078	-103.5565703
16,432.00	89.17	176.42	12,451.54	-4,299.54	-291.86	394,330.7661	740,585.8421	32.0817498	-103.5565571
16,525.00	89.93	176.69	12,452.27	-4,392.37	-286.27	394,237.9380	740,591.4302	32.0814945	-103.5565412
16,618.00	90.94	177.10	12,451.56	-4,485.23	-281.23	394,145.0788	740,596.4674	32.0812391	-103.5565271
16,711.00	91.02	176.74	12,449.97	-4,578.08	-276.24	394,052.2270	740,601.4636	32.0809838	-103.5565132
16,805.00	90.63	176.35	12,448.62	-4,671.90	-270.57	393,958.4082	740,607.1279	32.0807258	-103.5564971
16,898.00	90.60	177.12	12,447.62	-4,764.74	-265.28	393,865.5655	740,612.4243	32.0804705	-103.5564821
16,991.00	90.97	177.49	12,446.35	-4,857.63	-260.90	393,772.6775	740,616.7966	32.0802151	-103.5564702
17,084.00	90.97	177.19	12,444.77	-4,950.52	-256.59	393,679.7914	740,621.1120	32.0799597	-103.5564584
17,177.00	89.87	178.46	12,444.09	-5,043.45	-253.06	393,586.8644	740,624.6413	32.0797042	-103.5564492
17,271.00	89.85	178.51	12,444.32	-5,137.41	-250.57	393,492.8977	740,627.1265	32.0794458	-103.5564433
17,365.00	88.87	178.32	12,445.37	-5,231.37	-247.97	393,398.9409	740,629.7263	32.0791875	-103.5564371
17,458.00	87.77	179.14	12,448.10	-5,324.30	-245.91	393,306.0061	740,631.7868	32.0789320	-103.5564326
17,552.00	87.91	179.29	12,451.64	-5,418.23	-244.63	393,212.0820	740,633.0737	32.0786738	-103.5564306
17,646.00	89.57	180.42	12,453.71	-5,512.20	-244.39	393,118.1100	740,633.3112	32.0784155	-103.5564321
17,739.00	89.85	182.25	12,454.18	-5,605.17	-246.56	393,025.1406	740,631.1446	32.0781600	-103.5564412
17,832.00	91.86	179.23	12,452.79	-5,698.14	-247.76	392,932.1745	740,629.9432	32.0779044	-103.5564473
17,925.00	91.25	180.65	12,450.27	-5,791.10	-247.66	392,839.2118	740,630.0404	32.0776489	-103.5564491
18,020.00	90.35	179.20	12,448.94	-5,886.09	-247.54	392,744.2248	740,630.1649	32.0773878	-103.5564509
18,114.00	90.55	179.01	12,448.20	-5,980.07	-246.07	392,650.2395	740,631.6331	32.0771294	-103.5564484
18,207.00	91.61	179.84	12,446.45	-6,073.05	-245.13	392,557.2630	740,632.5663	32.0768738	-103.5564475
18,302.00	91.30	179.48	12,444.04	-6,168.02	-244.57	392,462.2958	740,633.1299	32.0766128	-103.5564479
18,397.00	91.22	179.73	12,441.95	-6,262.99	-243.92	392,367.3213	740,633.7847	32.0763517	-103.5564480
18,489.00	91.58	180.67	12,439.70	-6,354.96	-244.24	392,274.3506	740,633.4637	32.0760989	-103.5564512
18,584.00	91.33	181.07	12,437.29	-6,449.92	-245.68	392,180.3927	740,632.0217	32.0758379	-103.5564580
18,678.00	92.14	181.32	12,434.44	-6,543.86	-247.64	392,086.4572	740,630.0622	32.0755797	-103.5564665
18,772.00	91.67	181.53	12,431.32	-6,637.77	-249.97	391,992.5388	740,627.7259	32.0753216	-103.5564763
18,867.00	91.89	182.00	12,428.37	-6,732.68	-252.90	391,897.6302	740,624.8013	32.0750608	-103.5564879
18,961.00	91.50	181.86	12,425.59	-6,826.59	-256.06	391,803.7250	740,621.6370	32.0748027	-103.5565003
19,056.00	91.08	182.15	12,423.45	-6,921.51	-259.39	391,708.8077	740,618.3141	32.0745419	-103.5565132
19,150.00	90.55	182.57	12,422.11	-7,015.42	-263.26	391,614.8977	740,614.4437	32.0742838	-103.5565279
19,246.00	90.89	181.27	12,420.90	-7,111.35	-266.47	391,518.9615	740,611.2276	32.0740202	-103.5565405
19,340.00	90.01	182.72	12,420.17	-7,205.29	-269.75	391,425.0250	740,607.9554	32.0737620	-103.5565533
19,435.00	89.51	181.66	12,420.56	-7,300.22	-273.38	391,330.0971	740,604.3252	32.0735011	-103.5565672
19,530.00	89.23	180.41	12,421.61	-7,395.19	-275.09	391,235.1205	740,602.6094	32.0732401	-103.5565749
19,623.00	88.84	180.42	12,423.17	-7,488.18	-275.76	391,142.1365	740,601.9359	32.0729845	-103.5565793
19,717.00	87.83	179.97	12,425.91	-7,582.14	-276.08	391,048.1784	740,601.6160	32.0727263	-103.5565825
19,810.00	87.66	179.84	12,429.56	-7,675.06	-275.93	390,955.2507	740,601.7701	32.0724708	-103.5565842
19,904.00	90.10	182.33	12,431.40	-7,769.02	-277.71	390,861.3003	740,599.9899	32.0722126	-103.5565921
19,997.00	89.82	180.04	12,431.47	-7,861.99	-279.63	390,768.3266	740,598.0667	32.0719571	-103.5566005
20,092.00	91.08	181.24	12,430.72	-7,956.98	-280.69	390,673.3393	740,597.0057	32.0716960	-103.5566061
20,186.00	90.00	180.51	12,429.83	-8,050.96	-282.13	390,579.3567	740,595.5704	32.0714377	-103.5566129
20,279.00	89.12	178.86	12,430.55	-8,143.95	-281.62	390,486.3651	740,596.0816	32.0711820	-103.5566134
20,372.00	89.26	179.10	12,431.86	-8,236.93	-279.96	390,393.3894	740,597.7369	32.0709264	-103.5566102
20,466.00	89.57	179.46	12,432.82	-8,330.91	-278.78	390,299.4022	740,598.9181	32.0706681	-103.5566086
20,560.00	89.40	180.14	12,433.67	-8,424.91	-278.45	390,205.4074	740,599.2462	32.0704097	-103.5566097
20,654.00	88.39	178.74	12,435.48	-8,518.88	-277.54	390,111.4331	740,600.1645	32.0701513	-103.5566090
20,747.00	87.63	178.43	12,438.71	-8,611.80	-275.24	390,018.5185	740,602.4596	32.0698959	-103.5566037
20,840.00	88.31	178.49	12,442.01	-8,704.71	-272.74	389,925.6111	740,604.9573	32.0696405	-103.5565978
20,933.00	89.76	180.21	12,443.57	-8,797.68	-271.69	389,832.6366	740,606.0118	32.0693849	-103.5565966

Company:	COG Operating L L C	Local Co-ordinate Reference:	Well Columbus Federal Com 23H
Project:	Lea County, NM (NAD27 NME)	TVD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Site:	Sec. 34, T 25 S. , R 33 E	MD Reference:	KB=26' @ 3352.00ft (Scandril Freedom)
Well:	Columbus Federal Com 23H	North Reference:	Grid
Wellbore:	Wellbore #2	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #2	Database:	EDM 5000.1 Multi User Db

Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
21,027.00	89.31	179.91	12,444.33	-8,891.68	-271.79	389,738.6402	740,605.9134	32.0691265	-103.5565991
21,120.00	89.45	179.75	12,445.34	-8,984.67	-271.51	389,645.6463	740,606.1893	32.0688709	-103.5566003
21,213.00	87.77	177.55	12,447.60	-9,077.61	-269.32	389,552.7087	740,608.3789	32.0686154	-103.5565954
21,306.00	87.89	178.80	12,451.12	-9,170.49	-266.36	389,459.8246	740,611.3384	32.0683600	-103.5565880
21,400.00	87.66	178.57	12,454.77	-9,264.40	-264.21	389,365.9205	740,613.4940	32.0681018	-103.5565832
21,493.00	87.52	178.15	12,458.68	-9,357.28	-261.55	389,273.0413	740,616.1532	32.0678465	-103.5565768
21,587.00	86.82	178.53	12,463.32	-9,451.12	-258.83	389,179.1962	740,618.8730	32.0675884	-103.5565702
21,680.00	86.23	177.66	12,468.96	-9,543.90	-255.74	389,086.4200	740,621.9586	32.0673333	-103.5565624
21,774.00	85.39	177.03	12,475.82	-9,637.55	-251.40	388,992.7734	740,626.3008	32.0670758	-103.5565506
21,867.00	86.26	176.90	12,482.60	-9,730.17	-246.49	388,900.1514	740,631.2117	32.0668211	-103.5565369
21,961.00	85.33	176.59	12,489.49	-9,823.76	-241.17	388,806.5570	740,636.5345	32.0665638	-103.5565219
22,055.00	85.44	176.32	12,497.05	-9,917.28	-235.37	388,713.0413	740,642.3279	32.0663066	-103.5565053
22,156.00	85.87	176.63	12,504.70	-10,017.80	-229.18	388,612.5227	740,648.5198	32.0660302	-103.5564877
Final MWD Survey @ 22156'MD									
22,156.42	85.87	176.63	12,504.73	-10,018.22	-229.16	388,612.1045	740,648.5444	32.0660290	-103.5564876
South HardLine Crossing 22156.42' / 10020.84'VS									
22,256.00	85.87	176.63	12,511.90	-10,117.37	-223.32	388,512.9550	740,654.3829	32.0657564	-103.5564711
Projection to TD @ 22256'MD									

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
12,127.61	12,107.55	-121.78	-270.04	North HardLine Crossing 12127.61'MD / 128.03'VS
22,156.00	12,504.70	-10,017.80	-229.18	Final MWD Survey @ 22156'MD
22,156.42	12,504.73	-10,018.22	-229.16	South HardLine Crossing 22156.42' / 10020.84'VS
22,256.00	12,511.90	-10,117.37	-223.32	Projection to TD @ 22256'MD

Checked By: _____ Approved By: _____ Date: _____