



CONCHO

COG Operating L L C

Eddy County, NM (NAD 27 NME)

Sec. 21, T 26 S. , R 25 E

Caverns Federal Com 4H

30-015-43291

Wellbore #1

Design: Wellbore #1

Survey Report - Geographic

28 April, 2017

**Please provide signature
page for directional survey**





Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 21, T 26 S. , R 25 E
Well: Caverns Federal Com 4H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Caverns Federal Com 4H
TVD Reference: KB=25' @ 3752.20ft (Latshaw 44)
MD Reference: KB=25' @ 3752.20ft (Latshaw 44)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: EDM 5000.1 Multi User Db

Project	Eddy County, NM (NAD 27 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. 21, T 26 S. , R 25 E		
Site Position:		Northing:	376,102.8000 usft
From:	Map	Easting:	477,108.8000 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	32° 2' 2.399 N
		Longitude:	104° 24' 25.936 W
		Grid Convergence:	-0.04 °

Well	Caverns Federal Com 4H, ACTIVE		
Well Position	+N/-S	0.00 ft	Northing: 376,102.8000 usft
	+E/-W	0.00 ft	Easting: 477,108.8000 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	0.00 ft
		Latitude:	32° 2' 2.399 N
		Longitude:	104° 24' 25.936 W
		Ground Level:	3,727.20 ft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination
	IGRF2015	3/10/2017	(°)
			7.35
			Dip Angle (°)
			59.75
			Field Strength (nT)
			47,760

Design	Wellbore #1		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(ft)	(ft)	(ft)
	0.00	0.00	0.00
			Direction
			(°)
			180.47

Survey Program	Date 4/28/2017		
From	To	Survey (Wellbore)	Tool Name
(ft)	(ft)		
50.00	6,900.00	VES Gyros (Wellbore #1)	VESSI_GYROFLEX
6,950.00	19,315.00	IDS MWD Surveys (Wellbore #1)	MWD
			Description
			VESSI Gyroflex Gyro
			MWD - Standard

Survey									
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Map	Map	Latitude	Longitude
Depth	(°)	(°)	Depth	(ft)	(ft)	Northing	Easting		
(ft)			(ft)			(usft)	(usft)		
0.00	0.00	0.00	0.00	0.00	0.00	376,102.8000	477,108.8000	32° 2' 2.399 N	104° 24' 25.936 W
50.00	0.64	280.13	50.00	0.05	-0.27	376,102.8491	477,108.5251	32° 2' 2.399 N	104° 24' 25.939 W
100.00	0.97	287.39	99.99	0.22	-0.95	376,103.0247	477,107.8463	32° 2' 2.401 N	104° 24' 25.947 W
200.00	0.75	298.44	199.98	0.79	-2.34	376,103.5894	477,106.4630	32° 2' 2.406 N	104° 24' 25.963 W
300.00	1.13	268.00	299.97	1.07	-3.90	376,103.8667	477,104.9021	32° 2' 2.409 N	104° 24' 25.981 W
400.00	1.27	271.30	399.95	1.06	-5.99	376,103.8574	477,102.8087	32° 2' 2.409 N	104° 24' 26.006 W
500.00	1.23	241.39	499.92	0.57	-8.04	376,103.3686	477,100.7586	32° 2' 2.404 N	104° 24' 26.029 W
600.00	0.94	221.13	599.91	-0.56	-9.52	376,102.2368	477,099.2768	32° 2' 2.393 N	104° 24' 26.047 W
700.00	0.40	193.18	699.90	-1.52	-10.14	376,101.2791	477,098.6576	32° 2' 2.383 N	104° 24' 26.054 W
800.00	0.23	131.98	799.90	-2.00	-10.07	376,100.8050	477,098.7272	32° 2' 2.379 N	104° 24' 26.053 W
900.00	0.25	244.12	899.90	-2.22	-10.12	376,100.5755	477,098.6802	32° 2' 2.376 N	104° 24' 26.054 W



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Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
1,000.00	0.26	235.04	999.90	-2.45	-10.50	376,100.3503	477,098.2979	32° 2' 2.374 N	104° 24' 26.058 W
1,100.00	0.42	281.18	1,099.90	-2.51	-11.05	376,100.2913	477,097.7524	32° 2' 2.374 N	104° 24' 26.064 W
1,200.00	1.01	249.59	1,199.89	-2.74	-12.23	376,100.0550	477,096.5668	32° 2' 2.371 N	104° 24' 26.078 W
1,300.00	0.82	247.43	1,299.88	-3.33	-13.72	376,099.4730	477,095.0800	32° 2' 2.366 N	104° 24' 26.095 W
1,400.00	0.81	247.01	1,399.87	-3.88	-15.03	376,098.9223	477,093.7686	32° 2' 2.360 N	104° 24' 26.111 W
1,500.00	0.24	309.27	1,499.86	-4.02	-15.84	376,098.7788	477,092.9558	32° 2' 2.359 N	104° 24' 26.120 W
1,600.00	0.56	246.21	1,599.86	-4.09	-16.45	376,098.7142	477,092.3465	32° 2' 2.358 N	104° 24' 26.127 W
1,700.00	0.48	262.50	1,699.85	-4.34	-17.32	376,098.4624	477,091.4840	32° 2' 2.356 N	104° 24' 26.137 W
1,800.00	0.07	227.76	1,799.85	-4.43	-17.78	376,098.3667	477,091.0235	32° 2' 2.355 N	104° 24' 26.142 W
1,900.00	0.10	288.68	1,899.85	-4.45	-17.90	376,098.3536	477,090.8956	32° 2' 2.354 N	104° 24' 26.144 W
2,000.00	0.29	248.23	1,999.85	-4.51	-18.22	376,098.2877	477,090.5779	32° 2' 2.354 N	104° 24' 26.148 W
2,100.00	0.44	57.85	2,099.85	-4.40	-18.13	376,098.3982	477,090.6680	32° 2' 2.355 N	104° 24' 26.147 W
2,200.00	0.75	75.41	2,199.85	-4.03	-17.17	376,098.7673	477,091.6264	32° 2' 2.359 N	104° 24' 26.135 W
2,300.00	0.68	66.22	2,299.84	-3.63	-16.00	376,099.1715	477,092.8028	32° 2' 2.363 N	104° 24' 26.122 W
2,400.00	0.89	64.46	2,399.83	-3.05	-14.75	376,099.7456	477,094.0466	32° 2' 2.368 N	104° 24' 26.107 W
2,500.00	0.42	79.05	2,499.82	-2.65	-13.69	376,100.1501	477,095.1072	32° 2' 2.372 N	104° 24' 26.095 W
2,600.00	0.37	79.85	2,599.82	-2.52	-13.02	376,100.2766	477,095.7849	32° 2' 2.373 N	104° 24' 26.087 W
2,700.00	0.24	31.23	2,699.82	-2.29	-12.59	376,100.5126	477,096.2113	32° 2' 2.376 N	104° 24' 26.082 W
2,800.00	0.04	119.98	2,799.82	-2.13	-12.45	376,100.6742	477,096.3501	32° 2' 2.377 N	104° 24' 26.081 W
2,900.00	0.09	129.19	2,899.82	-2.19	-12.36	376,100.6071	477,096.4412	32° 2' 2.377 N	104° 24' 26.080 W
3,000.00	0.28	260.61	2,999.82	-2.28	-12.54	376,100.5176	477,096.2610	32° 2' 2.376 N	104° 24' 26.082 W
3,100.00	0.45	294.14	3,099.82	-2.16	-13.14	376,100.6384	477,095.6616	32° 2' 2.377 N	104° 24' 26.089 W
3,200.00	0.50	270.91	3,199.81	-1.99	-13.93	376,100.8059	477,094.8670	32° 2' 2.379 N	104° 24' 26.098 W
3,300.00	1.00	272.30	3,299.80	-1.95	-15.24	376,100.8479	477,093.5588	32° 2' 2.379 N	104° 24' 26.113 W
3,400.00	1.05	262.66	3,399.79	-2.03	-17.02	376,100.7658	477,091.7781	32° 2' 2.378 N	104° 24' 26.134 W
3,500.00	0.65	239.34	3,499.78	-2.44	-18.42	376,100.3595	477,090.3814	32° 2' 2.374 N	104° 24' 26.150 W
3,600.00	0.66	243.20	3,599.77	-2.99	-19.42	376,099.8106	477,089.3794	32° 2' 2.369 N	104° 24' 26.162 W
3,700.00	0.77	196.64	3,699.76	-3.89	-20.13	376,098.9071	477,088.6729	32° 2' 2.360 N	104° 24' 26.170 W
3,800.00	0.49	138.21	3,799.76	-4.86	-20.03	376,097.9445	477,088.7655	32° 2' 2.350 N	104° 24' 26.169 W
3,900.00	0.30	131.06	3,899.76	-5.35	-19.55	376,097.4537	477,089.2478	32° 2' 2.346 N	104° 24' 26.163 W
4,000.00	0.76	140.13	3,999.75	-6.03	-18.93	376,096.7727	477,089.8704	32° 2' 2.339 N	104° 24' 26.156 W
4,100.00	0.55	116.79	4,099.75	-6.75	-18.08	376,096.0474	477,090.7240	32° 2' 2.332 N	104° 24' 26.146 W
4,200.00	0.72	137.54	4,199.74	-7.43	-17.22	376,095.3675	477,091.5766	32° 2' 2.325 N	104° 24' 26.136 W
4,300.00	0.65	130.54	4,299.73	-8.26	-16.37	376,094.5353	477,092.4318	32° 2' 2.317 N	104° 24' 26.126 W
4,400.00	0.49	153.41	4,399.73	-9.02	-15.75	376,093.7843	477,093.0542	32° 2' 2.309 N	104° 24' 26.119 W
4,500.00	0.78	171.81	4,499.72	-10.07	-15.46	376,092.7282	477,093.3426	32° 2' 2.299 N	104° 24' 26.115 W
4,600.00	0.75	175.04	4,599.71	-11.40	-15.30	376,091.4024	477,093.4961	32° 2' 2.286 N	104° 24' 26.114 W
4,700.00	0.55	172.13	4,699.71	-12.53	-15.18	376,090.2750	477,093.6185	32° 2' 2.274 N	104° 24' 26.112 W
4,800.00	0.67	188.85	4,799.70	-13.58	-15.21	376,089.2218	477,093.5942	32° 2' 2.264 N	104° 24' 26.113 W
4,900.00	0.79	211.19	4,899.69	-14.75	-15.65	376,088.0544	477,093.1473	32° 2' 2.253 N	104° 24' 26.118 W
5,000.00	0.98	224.94	4,999.68	-15.94	-16.61	376,086.8593	477,092.1862	32° 2' 2.241 N	104° 24' 26.129 W
5,100.00	1.20	232.38	5,099.66	-17.19	-18.05	376,085.6148	477,090.7527	32° 2' 2.228 N	104° 24' 26.146 W
5,200.00	1.46	247.11	5,199.64	-18.32	-20.05	376,084.4801	477,088.7497	32° 2' 2.217 N	104° 24' 26.169 W
5,300.00	1.71	250.89	5,299.60	-19.30	-22.63	376,083.4961	477,086.1662	32° 2' 2.207 N	104° 24' 26.199 W
5,400.00	1.72	254.04	5,399.55	-20.21	-25.49	376,082.5950	477,083.3135	32° 2' 2.198 N	104° 24' 26.232 W
5,500.00	1.91	257.34	5,499.50	-20.98	-28.56	376,081.8171	477,080.2446	32° 2' 2.191 N	104° 24' 26.268 W
5,600.00	1.81	248.69	5,599.45	-21.92	-31.65	376,080.8779	477,077.1474	32° 2' 2.181 N	104° 24' 26.304 W
5,700.00	2.10	246.65	5,699.39	-23.22	-34.81	376,079.5778	477,073.9940	32° 2' 2.168 N	104° 24' 26.340 W
5,800.00	2.01	254.18	5,799.33	-24.43	-38.18	376,078.3736	477,070.6246	32° 2' 2.157 N	104° 24' 26.379 W
5,900.00	2.38	244.89	5,899.25	-25.79	-41.74	376,077.0144	477,067.0572	32° 2' 2.143 N	104° 24' 26.421 W
6,000.00	2.22	228.89	5,999.17	-27.94	-45.08	376,074.8597	477,063.7177	32° 2' 2.122 N	104° 24' 26.460 W
6,100.00	2.07	224.91	6,099.10	-30.49	-47.82	376,072.3072	477,060.9834	32° 2' 2.096 N	104° 24' 26.491 W
6,200.00	0.83	215.18	6,199.07	-32.36	-49.51	376,070.4361	477,059.2910	32° 2' 2.078 N	104° 24' 26.511 W
6,300.00	0.76	202.81	6,299.06	-33.57	-50.18	376,069.2328	477,058.6166	32° 2' 2.066 N	104° 24' 26.519 W
6,400.00	0.60	171.46	6,399.05	-34.70	-50.36	376,068.1036	477,058.4372	32° 2' 2.055 N	104° 24' 26.521 W



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Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
6,500.00	1.06	138.70	6,499.04	-35.91	-49.67	376,066.8909	477,059.1255	32° 2' 2.043 N	104° 24' 26.513 W
6,600.00	0.93	149.76	6,599.03	-37.31	-48.66	376,065.4949	477,060.1446	32° 2' 2.029 N	104° 24' 26.501 W
6,700.00	1.22	172.80	6,699.01	-39.06	-48.11	376,063.7376	477,060.6868	32° 2' 2.012 N	104° 24' 26.495 W
6,800.00	0.93	177.66	6,798.99	-40.93	-47.95	376,061.8706	477,060.8533	32° 2' 1.993 N	104° 24' 26.493 W
6,900.00	2.41	186.85	6,898.95	-43.83	-48.16	376,058.9721	477,060.6357	32° 2' 1.964 N	104° 24' 26.495 W
6,950.00	3.88	194.96	6,948.87	-46.51	-48.73	376,056.2938	477,060.0736	32° 2' 1.938 N	104° 24' 26.502 W
First IDS MWD Survey									
6,997.00	8.22	206.88	6,995.60	-51.04	-50.66	376,051.7584	477,058.1430	32° 2' 1.893 N	104° 24' 26.524 W
7,045.00	15.00	187.26	7,042.61	-60.28	-53.00	376,042.5218	477,055.8031	32° 2' 1.802 N	104° 24' 26.551 W
7,092.00	22.88	176.49	7,087.04	-75.46	-53.21	376,027.3402	477,055.5934	32° 2' 1.651 N	104° 24' 26.554 W
7,139.00	24.93	166.51	7,130.03	-94.22	-50.34	376,008.5785	477,058.4650	32° 2' 1.466 N	104° 24' 26.520 W
7,186.00	28.60	167.81	7,171.98	-114.86	-45.65	375,987.9435	477,063.1527	32° 2' 1.262 N	104° 24' 26.465 W
7,234.00	33.03	170.54	7,213.20	-139.00	-41.07	375,963.7968	477,067.7312	32° 2' 1.023 N	104° 24' 26.412 W
7,282.00	39.96	175.95	7,251.77	-167.32	-37.83	375,935.4754	477,070.9747	32° 2' 0.742 N	104° 24' 26.374 W
7,329.00	46.24	181.38	7,286.09	-199.39	-37.17	375,903.4091	477,071.6328	32° 2' 0.425 N	104° 24' 26.366 W
7,376.00	49.45	181.80	7,317.62	-234.22	-38.14	375,868.5848	477,070.6630	32° 2' 0.080 N	104° 24' 26.377 W
7,424.00	55.19	181.80	7,346.95	-272.17	-39.33	375,830.6305	477,069.4702	32° 1' 59.705 N	104° 24' 26.391 W
7,471.00	62.15	181.31	7,371.38	-312.28	-40.41	375,790.5233	477,068.3878	32° 1' 59.308 N	104° 24' 26.403 W
7,519.00	68.97	180.15	7,391.22	-355.95	-40.96	375,746.8546	477,067.8433	32° 1' 58.876 N	104° 24' 26.409 W
7,566.00	72.41	180.03	7,406.76	-400.30	-41.03	375,702.5055	477,067.7742	32° 1' 58.437 N	104° 24' 26.409 W
7,614.00	74.07	179.61	7,420.61	-446.25	-40.88	375,656.5465	477,067.9193	32° 1' 57.982 N	104° 24' 26.407 W
7,661.00	79.13	180.08	7,431.49	-491.96	-40.76	375,610.8413	477,068.0410	32° 1' 57.530 N	104° 24' 26.406 W
7,709.00	84.14	179.12	7,438.47	-539.43	-40.43	375,563.3689	477,068.3749	32° 1' 57.060 N	104° 24' 26.401 W
7,756.00	85.23	178.69	7,442.83	-586.22	-39.53	375,516.5805	477,069.2694	32° 1' 56.597 N	104° 24' 26.391 W
7,804.00	88.21	178.27	7,445.57	-634.12	-38.26	375,468.6816	477,070.5407	32° 1' 56.123 N	104° 24' 26.375 W
7,864.00	87.90	177.60	7,447.61	-694.05	-36.10	375,408.7556	477,072.7014	32° 1' 55.530 N	104° 24' 26.350 W
7,927.00	89.66	178.33	7,448.95	-756.99	-33.86	375,345.8126	477,074.9377	32° 1' 54.907 N	104° 24' 26.323 W
8,022.00	90.82	179.20	7,448.55	-851.96	-31.81	375,250.8383	477,076.9852	32° 1' 53.967 N	104° 24' 26.299 W
8,117.00	90.99	180.54	7,447.05	-946.95	-31.60	375,155.8528	477,077.2008	32° 1' 53.027 N	104° 24' 26.296 W
8,212.00	88.85	180.63	7,447.19	-1,041.94	-32.57	375,060.8635	477,076.2309	32° 1' 52.087 N	104° 24' 26.306 W
8,307.00	87.68	180.07	7,450.06	-1,136.89	-33.15	374,965.9111	477,075.6507	32° 1' 51.147 N	104° 24' 26.312 W
8,402.00	87.82	182.56	7,453.79	-1,231.79	-35.33	374,871.0170	477,073.4723	32° 1' 50.208 N	104° 24' 26.337 W
8,496.00	89.45	181.66	7,456.03	-1,325.69	-38.79	374,777.1117	477,070.0128	32° 1' 49.278 N	104° 24' 26.376 W
8,591.00	89.95	181.55	7,456.53	-1,420.65	-41.45	374,682.1508	477,067.3520	32° 1' 48.339 N	104° 24' 26.406 W
8,685.00	90.33	180.02	7,456.30	-1,514.64	-42.74	374,588.1630	477,066.0642	32° 1' 47.408 N	104° 24' 26.420 W
8,780.00	90.87	182.23	7,455.30	-1,609.61	-44.60	374,493.1930	477,064.1993	32° 1' 46.468 N	104° 24' 26.441 W
8,874.00	90.05	180.41	7,454.55	-1,703.58	-46.77	374,399.2259	477,062.0342	32° 1' 45.539 N	104° 24' 26.466 W
8,969.00	88.91	178.89	7,455.41	-1,798.57	-46.19	374,304.2361	477,062.6143	32° 1' 44.598 N	104° 24' 26.458 W
9,064.00	89.14	178.67	7,457.03	-1,893.53	-44.16	374,209.2717	477,064.6367	32° 1' 43.659 N	104° 24' 26.434 W
9,158.00	89.92	178.96	7,457.80	-1,987.51	-42.22	374,115.2960	477,066.5806	32° 1' 42.729 N	104° 24' 26.411 W
9,253.00	89.13	179.48	7,458.59	-2,082.49	-40.93	374,020.3094	477,067.8738	32° 1' 41.789 N	104° 24' 26.395 W
9,347.00	90.17	180.21	7,459.16	-2,176.49	-40.67	373,926.3136	477,068.1281	32° 1' 40.858 N	104° 24' 26.391 W
9,441.00	89.46	180.84	7,459.47	-2,270.49	-41.53	373,832.3193	477,067.2668	32° 1' 39.928 N	104° 24' 26.400 W
9,536.00	88.68	181.11	7,461.01	-2,365.46	-43.15	373,737.3466	477,065.6505	32° 1' 38.988 N	104° 24' 26.418 W
9,631.00	88.15	180.46	7,463.63	-2,460.41	-44.45	373,642.3929	477,064.3494	32° 1' 38.048 N	104° 24' 26.433 W
9,726.00	88.57	179.87	7,466.35	-2,555.37	-44.72	373,547.4330	477,064.0760	32° 1' 37.109 N	104° 24' 26.435 W
9,820.00	89.14	179.69	7,468.23	-2,649.35	-44.36	373,453.4531	477,064.4369	32° 1' 36.179 N	104° 24' 26.430 W
9,915.00	88.22	179.76	7,470.42	-2,744.32	-43.91	373,358.4806	477,064.8927	32° 1' 35.239 N	104° 24' 26.424 W
10,010.00	88.92	179.86	7,472.79	-2,839.29	-43.59	373,263.5115	477,065.2076	32° 1' 34.299 N	104° 24' 26.420 W
10,105.00	90.03	180.33	7,473.66	-2,934.29	-43.75	373,168.5176	477,065.0501	32° 1' 33.359 N	104° 24' 26.421 W
10,200.00	90.86	180.19	7,472.92	-3,029.28	-44.18	373,073.5225	477,064.6190	32° 1' 32.418 N	104° 24' 26.425 W
10,294.00	91.50	179.56	7,470.99	-3,123.26	-43.98	372,979.5438	477,064.8240	32° 1' 31.488 N	104° 24' 26.422 W
10,389.00	91.38	179.94	7,468.60	-3,218.23	-43.56	372,884.5751	477,065.2384	32° 1' 30.549 N	104° 24' 26.416 W
10,484.00	91.61	178.64	7,466.12	-3,313.19	-42.38	372,789.6170	477,066.4151	32° 1' 29.609 N	104° 24' 26.402 W
10,579.00	92.15	180.57	7,463.01	-3,408.13	-41.73	372,694.6754	477,067.0699	32° 1' 28.669 N	104° 24' 26.394 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 21, T 26 S. , R 25 E
Well: Caverns Federal Com 4H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Caverns Federal Com 4H
TVD Reference: KB=25' @ 3752.20ft (Latshaw 44)
MD Reference: KB=25' @ 3752.20ft (Latshaw 44)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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
10,673.00	91.98	181.70	7,459.62	-3,502.05	-43.59	372,600.7566	477,065.2091	32° 1' 27.740 N	104° 24' 26.415 W
10,768.00	91.17	181.80	7,457.01	-3,596.97	-46.49	372,505.8378	477,062.3090	32° 1' 26.800 N	104° 24' 26.447 W
10,863.00	89.65	181.61	7,456.33	-3,691.92	-49.32	372,410.8853	477,059.4826	32° 1' 25.861 N	104° 24' 26.480 W
10,957.00	88.96	181.20	7,457.47	-3,785.89	-51.62	372,316.9214	477,057.1780	32° 1' 24.931 N	104° 24' 26.506 W
11,052.00	88.67	178.71	7,459.43	-3,880.86	-51.55	372,221.9496	477,057.2525	32° 1' 23.991 N	104° 24' 26.504 W
11,147.00	89.61	178.04	7,460.86	-3,975.81	-48.85	372,127.0002	477,059.9462	32° 1' 23.051 N	104° 24' 26.472 W
11,242.00	90.08	178.13	7,461.12	-4,070.75	-45.68	372,032.0541	477,063.1207	32° 1' 22.111 N	104° 24' 26.434 W
11,337.00	91.53	177.43	7,459.78	-4,165.67	-42.00	371,937.1381	477,066.8001	32° 1' 21.172 N	104° 24' 26.391 W
11,432.00	91.44	177.74	7,457.32	-4,260.55	-38.00	371,842.2547	477,070.8018	32° 1' 20.233 N	104° 24' 26.344 W
11,527.00	90.72	180.51	7,455.53	-4,355.52	-36.55	371,747.2927	477,072.2519	32° 1' 19.293 N	104° 24' 26.326 W
11,622.00	90.46	181.18	7,454.55	-4,450.50	-37.95	371,652.3089	477,070.8509	32° 1' 18.353 N	104° 24' 26.341 W
11,716.00	88.84	181.51	7,455.12	-4,544.47	-40.16	371,558.3400	477,068.6446	32° 1' 17.423 N	104° 24' 26.366 W
11,811.00	88.70	182.13	7,457.16	-4,639.40	-43.17	371,463.4104	477,065.6282	32° 1' 16.484 N	104° 24' 26.401 W
11,906.00	89.06	182.16	7,459.02	-4,734.31	-46.73	371,368.4955	477,062.0732	32° 1' 15.544 N	104° 24' 26.441 W
12,001.00	89.47	182.64	7,460.24	-4,829.22	-50.70	371,273.5873	477,058.0953	32° 1' 14.605 N	104° 24' 26.487 W
12,096.00	89.17	181.20	7,461.37	-4,924.16	-53.89	371,178.6501	477,054.9127	32° 1' 13.665 N	104° 24' 26.523 W
12,190.00	88.73	180.56	7,463.09	-5,018.13	-55.33	371,084.6779	477,053.4693	32° 1' 12.735 N	104° 24' 26.539 W
12,284.00	88.84	179.69	7,465.08	-5,112.11	-55.54	370,990.7003	477,053.2643	32° 1' 11.805 N	104° 24' 26.540 W
12,379.00	89.66	178.75	7,466.33	-5,207.09	-54.24	370,895.7193	477,054.5574	32° 1' 10.865 N	104° 24' 26.525 W
12,474.00	90.15	177.71	7,466.48	-5,302.04	-51.31	370,800.7666	477,057.4917	32° 1' 9.926 N	104° 24' 26.490 W
12,569.00	89.88	177.27	7,466.46	-5,396.95	-47.15	370,705.8582	477,061.6521	32° 1' 8.986 N	104° 24' 26.441 W
12,663.00	89.56	176.42	7,466.92	-5,490.81	-41.97	370,612.0030	477,066.8255	32° 1' 8.058 N	104° 24' 26.380 W
12,764.00	90.77	177.60	7,466.63	-5,591.67	-36.71	370,511.1448	477,072.0936	32° 1' 7.059 N	104° 24' 26.318 W
12,859.00	89.85	178.59	7,466.11	-5,686.61	-33.55	370,416.2011	477,075.2515	32° 1' 6.120 N	104° 24' 26.281 W
12,954.00	89.26	178.26	7,466.85	-5,781.57	-30.94	370,321.2406	477,077.8625	32° 1' 5.180 N	104° 24' 26.249 W
13,048.00	90.66	181.01	7,466.92	-5,875.56	-30.34	370,227.2540	477,078.4612	32° 1' 4.250 N	104° 24' 26.242 W
13,143.00	90.64	180.01	7,465.84	-5,970.55	-31.18	370,132.2653	477,077.6157	32° 1' 3.310 N	104° 24' 26.251 W
13,238.00	90.41	182.13	7,464.97	-6,065.52	-32.96	370,037.2916	477,075.8418	32° 1' 2.370 N	104° 24' 26.271 W
13,333.00	89.87	180.80	7,464.74	-6,160.49	-35.39	369,942.3256	477,073.4131	32° 1' 1.430 N	104° 24' 26.298 W
13,427.00	89.59	180.90	7,465.18	-6,254.48	-36.78	369,848.3373	477,072.0186	32° 1' 0.500 N	104° 24' 26.314 W
13,522.00	89.43	180.51	7,465.99	-6,349.46	-37.95	369,753.3484	477,070.8498	32° 0' 59.560 N	104° 24' 26.326 W
13,617.00	89.65	180.50	7,466.75	-6,444.46	-38.79	369,658.3554	477,070.0125	32° 0' 58.620 N	104° 24' 26.335 W
13,712.00	89.18	180.96	7,467.72	-6,539.44	-40.00	369,563.3687	477,068.8022	32° 0' 57.680 N	104° 24' 26.349 W
13,807.00	89.43	179.92	7,468.88	-6,634.43	-40.73	369,468.3801	477,068.0728	32° 0' 56.739 N	104° 24' 26.356 W
13,902.00	91.08	180.79	7,468.45	-6,729.43	-41.32	369,373.3872	477,067.4842	32° 0' 55.799 N	104° 24' 26.362 W
13,996.00	90.99	180.32	7,466.76	-6,823.41	-42.23	369,279.4075	477,066.5739	32° 0' 54.869 N	104° 24' 26.372 W
14,091.00	90.57	179.38	7,465.46	-6,918.40	-41.98	369,184.4180	477,066.8226	32° 0' 53.929 N	104° 24' 26.369 W
14,177.00	90.66	180.55	7,464.54	-7,004.39	-41.92	369,098.4247	477,066.8751	32° 0' 53.078 N	104° 24' 26.367 W
14,272.00	90.97	178.23	7,463.19	-7,099.37	-40.91	369,003.4465	477,067.8863	32° 0' 52.138 N	104° 24' 26.355 W
14,368.00	89.26	179.24	7,462.99	-7,195.34	-38.79	368,907.4751	477,070.0055	32° 0' 51.188 N	104° 24' 26.329 W
14,462.00	88.73	180.35	7,464.64	-7,289.32	-38.46	368,813.4921	477,070.3418	32° 0' 50.258 N	104° 24' 26.325 W
14,557.00	90.32	181.19	7,465.43	-7,384.31	-39.73	368,718.5080	477,069.0652	32° 0' 49.318 N	104° 24' 26.339 W
14,652.00	89.82	181.26	7,465.31	-7,479.28	-41.77	368,623.5303	477,067.0342	32° 0' 48.378 N	104° 24' 26.362 W
14,747.00	90.41	181.96	7,465.12	-7,574.25	-44.43	368,528.5692	477,064.3651	32° 0' 47.438 N	104° 24' 26.392 W
14,841.00	90.74	182.10	7,464.18	-7,668.18	-47.76	368,434.6333	477,061.0356	32° 0' 46.509 N	104° 24' 26.430 W
14,936.00	89.45	181.67	7,464.02	-7,763.13	-50.89	368,339.6872	477,057.9108	32° 0' 45.569 N	104° 24' 26.465 W
15,031.00	89.17	183.01	7,465.17	-7,858.04	-54.77	368,244.7758	477,054.0324	32° 0' 44.630 N	104° 24' 26.510 W
15,126.00	89.31	181.91	7,466.43	-7,952.94	-58.84	368,149.8733	477,049.9553	32° 0' 43.690 N	104° 24' 26.556 W
15,224.00	91.50	183.04	7,465.73	-8,050.84	-63.08	368,051.9749	477,045.7239	32° 0' 42.722 N	104° 24' 26.605 W
15,319.00	90.94	181.80	7,463.71	-8,145.73	-67.09	367,957.0836	477,041.7137	32° 0' 41.782 N	104° 24' 26.650 W
15,414.00	89.76	180.89	7,463.13	-8,240.70	-69.32	367,862.1144	477,039.4839	32° 0' 40.843 N	104° 24' 26.676 W
15,508.00	90.71	181.79	7,462.75	-8,334.67	-71.51	367,768.1431	477,037.2858	32° 0' 39.913 N	104° 24' 26.700 W
15,603.00	90.74	181.77	7,461.54	-8,429.62	-74.46	367,673.1968	477,034.3352	32° 0' 38.973 N	104° 24' 26.734 W
15,698.00	90.43	181.19	7,460.57	-8,524.58	-76.92	367,578.2341	477,031.8817	32° 0' 38.033 N	104° 24' 26.762 W
15,793.00	90.46	180.12	7,459.84	-8,619.57	-78.00	367,483.2448	477,030.7957	32° 0' 37.093 N	104° 24' 26.774 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 21, T 26 S., R 25 E
Well: Caverns Federal Com 4H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Caverns Federal Com 4H
TVD Reference: KB=25' @ 3752.20ft (Latshaw 44)
MD Reference: KB=25' @ 3752.20ft (Latshaw 44)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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
15,888.00	90.57	179.36	7,458.98	-8,714.57	-77.57	367,388.2505	477,031.2268	32° 0' 36.153 N	104° 24' 26.768 W
15,982.00	90.38	178.84	7,458.20	-8,808.55	-76.10	367,294.2658	477,032.7032	32° 0' 35.223 N	104° 24' 26.750 W
16,077.00	89.96	179.21	7,457.92	-8,903.54	-74.48	367,199.2806	477,034.3197	32° 0' 34.283 N	104° 24' 26.730 W
16,172.00	89.76	178.66	7,458.15	-8,998.52	-72.71	367,104.2979	477,036.0855	32° 0' 33.343 N	104° 24' 26.709 W
16,267.00	89.40	178.57	7,458.85	-9,093.49	-70.42	367,009.3285	477,038.3816	32° 0' 32.403 N	104° 24' 26.682 W
16,362.00	89.31	179.52	7,459.92	-9,188.47	-68.84	366,914.3490	477,039.9648	32° 0' 31.463 N	104° 24' 26.663 W
16,457.00	88.47	179.17	7,461.76	-9,283.44	-67.75	366,819.3743	477,041.0506	32° 0' 30.523 N	104° 24' 26.649 W
16,552.00	88.64	178.78	7,464.16	-9,378.40	-66.05	366,724.4201	477,042.7495	32° 0' 29.583 N	104° 24' 26.629 W
16,646.00	88.89	180.67	7,466.18	-9,472.37	-65.60	366,630.4475	477,043.2004	32° 0' 28.653 N	104° 24' 26.623 W
16,741.00	89.65	181.92	7,467.39	-9,567.34	-67.75	366,535.4823	477,041.0536	32° 0' 27.713 N	104° 24' 26.647 W
16,836.00	90.18	182.31	7,467.53	-9,662.27	-71.25	366,440.5478	477,037.5476	32° 0' 26.774 N	104° 24' 26.687 W
16,931.00	89.65	182.98	7,467.67	-9,757.17	-75.64	366,345.6502	477,033.1636	32° 0' 25.834 N	104° 24' 26.737 W
17,026.00	91.19	183.00	7,466.98	-9,852.03	-80.59	366,250.7851	477,028.2086	32° 0' 24.896 N	104° 24' 26.794 W
17,120.00	92.06	183.19	7,464.31	-9,945.86	-85.66	366,156.9612	477,023.1355	32° 0' 23.967 N	104° 24' 26.852 W
17,215.00	92.84	180.10	7,460.25	-10,040.72	-88.39	366,062.0996	477,020.4105	32° 0' 23.028 N	104° 24' 26.883 W
17,310.00	92.99	178.19	7,455.42	-10,135.58	-86.97	365,967.2377	477,021.8260	32° 0' 22.089 N	104° 24' 26.866 W
17,405.00	88.92	177.90	7,453.84	-10,230.49	-83.73	365,872.3265	477,025.0659	32° 0' 21.150 N	104° 24' 26.827 W
17,500.00	89.23	177.80	7,455.37	-10,325.41	-80.17	365,777.4060	477,028.6295	32° 0' 20.211 N	104° 24' 26.785 W
17,594.00	87.10	178.21	7,458.38	-10,419.30	-76.90	365,683.5170	477,031.9001	32° 0' 19.282 N	104° 24' 26.746 W
17,689.00	86.96	179.78	7,463.30	-10,514.16	-75.24	365,588.6624	477,033.5642	32° 0' 18.343 N	104° 24' 26.726 W
17,784.00	88.22	180.09	7,467.30	-10,609.07	-75.13	365,493.7487	477,033.6717	32° 0' 17.403 N	104° 24' 26.724 W
17,879.00	88.47	180.77	7,470.04	-10,704.03	-75.84	365,398.7918	477,032.9591	32° 0' 16.464 N	104° 24' 26.732 W
17,974.00	90.01	183.78	7,471.30	-10,798.93	-79.61	365,303.8890	477,029.1884	32° 0' 15.524 N	104° 24' 26.775 W
18,069.00	89.87	182.65	7,471.40	-10,893.78	-84.94	365,209.0403	477,023.8606	32° 0' 14.586 N	104° 24' 26.836 W
18,164.00	89.59	181.53	7,471.85	-10,988.72	-88.40	365,114.1064	477,020.3961	32° 0' 13.646 N	104° 24' 26.875 W
18,259.00	88.56	180.35	7,473.38	-11,083.69	-89.96	365,019.1347	477,018.8377	32° 0' 12.706 N	104° 24' 26.893 W
18,354.00	87.38	179.46	7,476.75	-11,178.63	-89.81	364,924.1973	477,018.9949	32° 0' 11.767 N	104° 24' 26.890 W
18,449.00	86.06	179.09	7,482.18	-11,273.46	-88.61	364,829.3629	477,020.1947	32° 0' 10.828 N	104° 24' 26.876 W
18,544.00	85.83	178.78	7,488.90	-11,368.21	-86.84	364,734.6175	477,021.9560	32° 0' 9.890 N	104° 24' 26.854 W
18,639.00	86.20	179.27	7,495.50	-11,462.96	-85.23	364,639.8615	477,023.5685	32° 0' 8.953 N	104° 24' 26.835 W
18,734.00	88.78	181.18	7,499.66	-11,557.86	-85.61	364,544.9660	477,023.1943	32° 0' 8.014 N	104° 24' 26.838 W
18,829.00	89.59	183.42	7,501.01	-11,652.76	-89.42	364,450.0592	477,019.3823	32° 0' 7.074 N	104° 24' 26.882 W
18,923.00	89.03	182.80	7,502.15	-11,746.62	-94.52	364,356.2055	477,014.2829	32° 0' 6.145 N	104° 24' 26.940 W
19,018.00	90.01	182.63	7,502.94	-11,841.51	-99.02	364,261.3168	477,009.7832	32° 0' 5.206 N	104° 24' 26.992 W
19,113.00	89.68	182.54	7,503.20	-11,936.41	-103.30	364,166.4141	477,005.4985	32° 0' 4.267 N	104° 24' 27.041 W
19,207.00	91.39	181.58	7,502.32	-12,030.34	-106.68	364,072.4838	477,002.1198	32° 0' 3.337 N	104° 24' 27.079 W
19,266.00	91.00	180.58	7,501.09	-12,089.32	-107.79	364,013.5081	477,001.0081	32° 0' 2.754 N	104° 24' 27.092 W
Final IDS MWD Survey									
19,315.00	91.00	180.58	7,500.23	-12,138.31	-108.29	363,964.5181	477,000.5121	32° 0' 2.269 N	104° 24' 27.097 W
Projection to TD									

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
6,950.00	6,948.87	-46.51	-48.73	First IDS MWD Survey
19,266.00	7,501.09	-12,089.32	-107.79	Final IDS MWD Survey
19,315.00	7,500.23	-12,138.31	-108.29	Projection to TD

Checked By: _____ Approved By: _____ Date: _____