

30-015-44102

COG

POPULUS FEDERAL #2H

PATRIOT #2

4/17/2017

**Please provide signature
page for directional survey**

Scientific Drilling

The

In Wellbore Placement

CUSTOMER COG
PROJECT Eddy County, New Mexico
FIELD N/A

SDI JOB NO. OP.000722
SDI DISTRICT Midland
SDI KIT/UNIT

SITE INFORMATION

Site Name Eddy County, New Mexico
Lat/Long 32.1076511° N, 104.2109686° W
Northing 402,994.21 ft
Easting 579,224.61 ft

Section
Township
Range

MAP INFORMATION

North Reference Grid North
Grid Correction -0.07 deg
System US State Plane 1983
Datum North American Datum 1983 (GRS 1980)
Map Zone New Mexico East: 3001



WELL INFORMATION

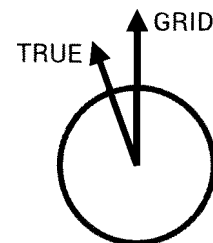
Lat/Long 32.1076511° N, 104.2109686° W
Northing 402,994.21 ft
Easting 579,224.61 ft
UWI 30-015-44102

DEPTH AND ELEVATION REFERENCE

Ground Level 3147 ft above Mean Sea Level
Reference Datum RKB
Reference Height 20 ft above G.L.
Reference Elevation 3167 ft

VERTICAL SECTION REFERENCE

+N/-S 0 ft
+E/-W 0 ft
Proposal Direction 1.66°
Calculation Method Minimum Curvature



LOCAL GRAVITY REFERENCE INFORMATION

Local Gravity 998.516 mG [computed]
True to Grid subtract 0.07°

WELL NOTES

Wireline Survey

OPERATORS

Jeffrey Loyd

SDI Operator Name (Printed)

SIGNATURE

DATE

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	"/100ft	ft	deg
0.00	0.00	0.00	0.00	0.00	0.00	0.00	Invalid	0.00	0.00
100.00	0.26	44.57	100.00	0.17	0.16	0.16	0.26	0.23	44.57
125.00	0.30	27.81	125.00	0.27	0.26	0.23	0.37	0.35	41.44
150.00	0.28	46.06	150.00	0.37	0.36	0.31	0.38	0.48	40.16
175.00	0.25	41.83	175.00	0.46	0.45	0.39	0.16	0.59	40.92
200.00	0.13	356.51	200.00	0.53	0.52	0.42	0.72	0.67	39.25
225.00	0.13	340.48	225.00	0.59	0.57	0.41	0.15	0.71	35.61
250.00	0.16	356.84	250.00	0.65	0.64	0.40	0.19	0.75	32.12
275.00	0.31	332.70	275.00	0.74	0.73	0.37	0.72	0.82	26.60
300.00	0.37	340.06	300.00	0.87	0.87	0.31	0.27	0.92	19.53
325.00	0.55	319.75	325.00	1.04	1.03	0.20	0.96	1.05	11.14
348.28	0.59	305.54	348.28	1.19	1.19	0.03	0.63	1.19	1.66



CONCHO

COG Operating L L C

Eddy County, NM (NAD 27 NME)

Sec. 29, T 25S. , R 27 E

Populus Federal 2H

Wellbore #1

Design: Wellbore #1

Survey Report - Geographic

28 April, 2017

NM OIL CONSERVATION
ARTESIA DISTRICT

SEP 05 2017

RECEIVED





Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S. , R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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. 29, T 25S. , R 27 E		
Site Position:		Northing:	402,936.9200 usft
From:	Map	Easting:	538,041.2700 usft
Position Uncertainty:	0.00 ft	Slot Radius:	13-3/16 "
		Latitude:	32° 6' 27.829 N
		Longitude:	104° 12' 37.705 W
		Grid Convergence:	0.07 °

Well	Populus Federal 2H		
Well Position	+N/-S	0.00 ft	Northing: 402,936.9200 usft
	+E/-W	0.00 ft	Easting: 538,041.2700 usft
Position Uncertainty	0.00 ft	Wellhead Elevation:	0.00 ft
		Latitude:	32° 6' 27.829 N
		Longitude:	104° 12' 37.705 W
		Ground Level:	3,147.60 ft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	4/7/2017	7.47	59.83	48,041

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	176.04	

Survey Program	Date 4/28/2017				
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description	
100.00	6,774.00	Phoenix Gyros (Wellbore #1)	NS-GYRO-MS	North sensing gyrocompassing m/s	
6,876.00	12,200.00	IDS MWD Surveys (Wellbore #1)	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	402,936.9200	538,041.2700	32° 6' 27.829 N	104° 12' 37.705 W
100.00	0.29	11.18	100.00	0.25	0.05	402,937.1682	538,041.3191	32° 6' 27.831 N	104° 12' 37.704 W
125.00	0.32	44.81	125.00	0.36	0.11	402,937.2798	538,041.3805	32° 6' 27.832 N	104° 12' 37.704 W
150.00	0.49	332.11	150.00	0.50	0.11	402,937.4239	538,041.3797	32° 6' 27.834 N	104° 12' 37.704 W
175.00	0.37	167.00	175.00	0.52	0.08	402,937.4397	538,041.3479	32° 6' 27.834 N	104° 12' 37.704 W
200.00	0.23	173.25	200.00	0.39	0.10	402,937.3112	538,041.3719	32° 6' 27.833 N	104° 12' 37.704 W
225.00	0.56	5.84	225.00	0.46	0.12	402,937.3829	538,041.3903	32° 6' 27.833 N	104° 12' 37.704 W
250.00	0.30	24.29	250.00	0.64	0.16	402,937.5641	538,041.4296	32° 6' 27.835 N	104° 12' 37.703 W
275.00	0.42	330.96	275.00	0.78	0.14	402,937.7039	538,041.4121	32° 6' 27.836 N	104° 12' 37.703 W
300.00	0.89	338.04	299.99	1.04	0.02	402,937.9641	538,041.2950	32° 6' 27.839 N	104° 12' 37.705 W
325.00	0.62	271.51	324.99	1.23	-0.18	402,938.1477	538,041.0871	32° 6' 27.841 N	104° 12' 37.707 W



Integrity Directional Services, LLC

Survey Report - Geographic



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Wellbore: Wellbore #1
Design: Wellbore #1

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MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
350.00	0.53	244.26	349.99	1.18	-0.42	402,938.1010	538,040.8478	32° 6' 27.840 N	104° 12' 37.710 W
375.00	0.71	320.10	374.99	1.25	-0.63	402,938.1697	538,040.6443	32° 6' 27.841 N	104° 12' 37.712 W
400.00	0.91	313.26	399.99	1.50	-0.87	402,938.4245	538,040.4003	32° 6' 27.844 N	104° 12' 37.715 W
425.00	1.04	306.23	424.98	1.77	-1.20	402,938.6947	538,040.0728	32° 6' 27.846 N	104° 12' 37.719 W
450.00	0.64	302.56	449.98	1.98	-1.50	402,938.9039	538,039.7721	32° 6' 27.848 N	104° 12' 37.722 W
475.00	0.90	313.66	474.98	2.19	-1.76	402,939.1146	538,039.5123	32° 6' 27.850 N	104° 12' 37.725 W
500.00	1.14	297.10	499.98	2.44	-2.12	402,939.3634	538,039.1489	32° 6' 27.853 N	104° 12' 37.730 W
525.00	1.09	290.32	524.97	2.64	-2.57	402,939.5593	538,038.7045	32° 6' 27.855 N	104° 12' 37.735 W
550.00	1.03	280.44	549.97	2.76	-3.01	402,939.6826	538,038.2606	32° 6' 27.856 N	104° 12' 37.740 W
575.00	0.91	302.25	574.96	2.91	-3.40	402,939.8293	538,037.8717	32° 6' 27.858 N	104° 12' 37.745 W
600.00	0.91	289.84	599.96	3.08	-3.75	402,940.0026	538,037.5170	32° 6' 27.859 N	104° 12' 37.749 W
625.00	0.98	292.07	624.96	3.23	-4.14	402,940.1503	538,037.1322	32° 6' 27.861 N	104° 12' 37.753 W
650.00	1.34	297.30	649.95	3.44	-4.60	402,940.3647	538,036.6743	32° 6' 27.863 N	104° 12' 37.758 W
675.00	1.53	283.60	674.94	3.66	-5.18	402,940.5772	538,036.0901	32° 6' 27.865 N	104° 12' 37.765 W
700.00	1.44	265.79	699.94	3.71	-5.82	402,940.6326	538,035.4525	32° 6' 27.866 N	104° 12' 37.773 W
725.00	1.22	276.52	724.93	3.72	-6.40	402,940.6398	538,034.8748	32° 6' 27.866 N	104° 12' 37.779 W
750.00	1.16	272.25	749.92	3.76	-6.91	402,940.6800	538,034.3575	32° 6' 27.866 N	104° 12' 37.785 W
775.00	1.49	266.11	774.92	3.75	-7.49	402,940.6678	538,033.7803	32° 6' 27.866 N	104° 12' 37.792 W
800.00	1.61	259.59	799.91	3.66	-8.16	402,940.5823	538,033.1106	32° 6' 27.865 N	104° 12' 37.800 W
825.00	1.48	234.14	824.90	3.41	-8.77	402,940.3297	538,032.5036	32° 6' 27.863 N	104° 12' 37.807 W
850.00	1.52	256.30	849.89	3.14	-9.35	402,940.0621	538,031.9198	32° 6' 27.860 N	104° 12' 37.814 W
875.00	1.53	241.26	874.88	2.90	-9.97	402,939.8231	538,031.3050	32° 6' 27.858 N	104° 12' 37.821 W
900.00	1.54	209.92	899.87	2.45	-10.43	402,939.3714	538,030.8448	32° 6' 27.853 N	104° 12' 37.826 W
925.00	1.37	223.25	924.87	1.94	-10.80	402,938.8626	538,030.4724	32° 6' 27.848 N	104° 12' 37.831 W
950.00	1.41	221.50	949.86	1.49	-11.21	402,938.4145	538,030.0639	32° 6' 27.844 N	104° 12' 37.835 W
975.00	1.54	224.72	974.85	1.03	-11.65	402,937.9455	538,029.6237	32° 6' 27.839 N	104° 12' 37.840 W
1,000.00	1.62	227.42	999.84	0.55	-12.14	402,937.4677	538,029.1271	32° 6' 27.834 N	104° 12' 37.846 W
1,025.00	1.91	217.30	1,024.83	-0.02	-12.66	402,936.8972	538,028.6144	32° 6' 27.829 N	104° 12' 37.852 W
1,050.00	1.66	205.99	1,049.82	-0.68	-13.07	402,936.2403	538,028.2033	32° 6' 27.822 N	104° 12' 37.857 W
1,075.00	1.56	212.18	1,074.81	-1.29	-13.41	402,935.6267	538,027.8633	32° 6' 27.816 N	104° 12' 37.861 W
1,100.00	1.01	226.74	1,099.80	-1.73	-13.75	402,935.1877	538,027.5216	32° 6' 27.812 N	104° 12' 37.865 W
1,125.00	0.88	218.88	1,124.80	-2.03	-14.03	402,934.8873	538,027.2407	32° 6' 27.809 N	104° 12' 37.868 W
1,150.00	0.54	156.75	1,149.80	-2.29	-14.10	402,934.6296	538,027.1667	32° 6' 27.806 N	104° 12' 37.869 W
1,175.00	0.81	234.36	1,174.79	-2.50	-14.20	402,934.4184	538,027.0696	32° 6' 27.804 N	104° 12' 37.870 W
1,200.00	0.92	220.40	1,199.79	-2.76	-14.47	402,934.1626	538,026.7959	32° 6' 27.802 N	104° 12' 37.873 W
1,225.00	0.65	201.26	1,224.79	-3.04	-14.66	402,933.8776	538,026.6144	32° 6' 27.799 N	104° 12' 37.876 W
1,250.00	0.39	171.10	1,249.79	-3.26	-14.69	402,933.6614	538,026.5761	32° 6' 27.797 N	104° 12' 37.876 W
1,275.00	0.48	114.94	1,274.79	-3.39	-14.59	402,933.5331	538,026.6842	32° 6' 27.795 N	104° 12' 37.875 W
1,300.00	0.91	202.43	1,299.79	-3.61	-14.57	402,933.3055	538,026.7034	32° 6' 27.793 N	104° 12' 37.874 W
1,325.00	0.95	176.36	1,324.78	-4.00	-14.63	402,932.9151	538,026.6409	32° 6' 27.789 N	104° 12' 37.875 W
1,350.00	0.83	152.83	1,349.78	-4.37	-14.53	402,932.5472	538,026.7367	32° 6' 27.786 N	104° 12' 37.874 W
1,375.00	0.79	157.02	1,374.78	-4.69	-14.38	402,932.2275	538,026.8867	32° 6' 27.782 N	104° 12' 37.872 W
1,400.00	0.96	161.40	1,399.77	-5.05	-14.25	402,931.8703	538,027.0208	32° 6' 27.779 N	104° 12' 37.871 W
1,425.00	1.37	146.21	1,424.77	-5.50	-14.02	402,931.4234	538,027.2538	32° 6' 27.774 N	104° 12' 37.868 W
1,450.00	1.11	144.16	1,449.76	-5.94	-13.71	402,930.9787	538,027.5618	32° 6' 27.770 N	104° 12' 37.865 W
1,475.00	1.32	141.78	1,474.76	-6.36	-13.39	402,930.5562	538,027.8817	32° 6' 27.766 N	104° 12' 37.861 W
1,500.00	1.32	132.32	1,499.75	-6.78	-13.00	402,930.1361	538,028.2728	32° 6' 27.762 N	104° 12' 37.856 W
1,525.00	1.30	149.13	1,524.74	-7.22	-12.64	402,929.6988	538,028.6312	32° 6' 27.757 N	104° 12' 37.852 W
1,550.00	0.96	142.78	1,549.74	-7.63	-12.37	402,929.2886	538,028.9034	32° 6' 27.753 N	104° 12' 37.849 W
1,575.00	1.09	144.32	1,574.74	-7.99	-12.10	402,928.9287	538,029.1687	32° 6' 27.750 N	104° 12' 37.846 W
1,600.00	1.02	138.64	1,599.73	-8.35	-11.82	402,928.5686	538,029.4545	32° 6' 27.746 N	104° 12' 37.843 W
1,625.00	1.36	125.37	1,624.73	-8.69	-11.43	402,928.2298	538,029.8434	32° 6' 27.743 N	104° 12' 37.838 W
1,650.00	1.27	98.30	1,649.72	-8.90	-10.91	402,928.0181	538,030.3595	32° 6' 27.741 N	104° 12' 37.832 W
1,675.00	1.31	102.28	1,674.71	-9.00	-10.36	402,927.9173	538,030.9129	32° 6' 27.740 N	104° 12' 37.826 W
1,700.00	1.74	104.42	1,699.70	-9.16	-9.71	402,927.7620	538,031.5597	32° 6' 27.738 N	104° 12' 37.818 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
1,725.00	1.39	100.58	1,724.69	-9.31	-9.04	402,927.6118	538,032.2254	32° 6' 27.737 N	104° 12' 37.810 W
1,750.00	1.49	97.19	1,749.69	-9.40	-8.42	402,927.5155	538,032.8459	32° 6' 27.736 N	104° 12' 37.803 W
1,775.00	1.54	81.46	1,774.68	-9.40	-7.77	402,927.5247	538,033.5006	32° 6' 27.736 N	104° 12' 37.796 W
1,800.00	1.47	69.06	1,799.67	-9.23	-7.14	402,927.6892	538,034.1323	32° 6' 27.737 N	104° 12' 37.788 W
1,825.00	1.39	78.50	1,824.66	-9.06	-6.54	402,927.8642	538,034.7289	32° 6' 27.739 N	104° 12' 37.781 W
1,850.00	0.99	70.20	1,849.66	-8.92	-6.04	402,927.9978	538,035.2293	32° 6' 27.740 N	104° 12' 37.775 W
1,875.00	0.90	97.37	1,874.65	-8.87	-5.64	402,928.0458	538,035.6272	32° 6' 27.741 N	104° 12' 37.771 W
1,900.00	0.46	59.48	1,899.65	-8.85	-5.36	402,928.0716	538,035.9084	32° 6' 27.741 N	104° 12' 37.768 W
1,925.00	0.42	111.38	1,924.65	-8.83	-5.19	402,928.0891	538,036.0801	32° 6' 27.741 N	104° 12' 37.766 W
1,950.00	0.57	98.85	1,949.65	-8.88	-4.98	402,928.0366	538,036.2883	32° 6' 27.741 N	104° 12' 37.763 W
1,975.00	0.20	33.36	1,974.65	-8.87	-4.83	402,928.0539	538,036.4352	32° 6' 27.741 N	104° 12' 37.761 W
2,000.00	0.73	135.52	1,999.65	-8.94	-4.70	402,927.9767	538,036.5708	32° 6' 27.740 N	104° 12' 37.760 W
2,025.00	0.58	112.90	2,024.65	-9.11	-4.47	402,927.8139	538,036.7989	32° 6' 27.739 N	104° 12' 37.757 W
2,050.00	0.34	69.32	2,049.65	-9.13	-4.29	402,927.7908	538,036.9849	32° 6' 27.738 N	104° 12' 37.755 W
2,075.00	0.48	137.37	2,074.65	-9.18	-4.14	402,927.7400	538,037.1252	32° 6' 27.738 N	104° 12' 37.753 W
2,100.00	0.50	139.76	2,099.65	-9.34	-4.00	402,927.5796	538,037.2666	32° 6' 27.736 N	104° 12' 37.752 W
2,125.00	0.59	110.94	2,124.64	-9.47	-3.81	402,927.4504	538,037.4573	32° 6' 27.735 N	104° 12' 37.750 W
2,150.00	0.58	118.04	2,149.64	-9.58	-3.58	402,927.3449	538,037.6892	32° 6' 27.734 N	104° 12' 37.747 W
2,175.00	0.46	67.10	2,174.64	-9.60	-3.38	402,927.3245	538,037.8933	32° 6' 27.734 N	104° 12' 37.744 W
2,200.00	0.40	128.37	2,199.64	-9.61	-3.22	402,927.3093	538,038.0542	32° 6' 27.734 N	104° 12' 37.743 W
2,225.00	0.63	103.97	2,224.64	-9.70	-3.01	402,927.2220	538,038.2560	32° 6' 27.733 N	104° 12' 37.740 W
2,250.00	0.77	93.77	2,249.64	-9.74	-2.71	402,927.1778	538,038.5569	32° 6' 27.732 N	104° 12' 37.737 W
2,275.00	0.51	313.20	2,274.64	-9.68	-2.63	402,927.2429	538,038.6435	32° 6' 27.733 N	104° 12' 37.736 W
2,300.00	0.58	63.29	2,299.64	-9.54	-2.59	402,927.3759	538,038.6754	32° 6' 27.734 N	104° 12' 37.735 W
2,325.00	0.32	88.40	2,324.64	-9.49	-2.41	402,927.4348	538,038.8582	32° 6' 27.735 N	104° 12' 37.733 W
2,350.00	0.51	76.22	2,349.64	-9.46	-2.23	402,927.4632	538,039.0361	32° 6' 27.735 N	104° 12' 37.731 W
2,375.00	0.33	65.72	2,374.63	-9.40	-2.06	402,927.5193	538,039.2097	32° 6' 27.736 N	104° 12' 37.729 W
2,400.00	0.43	238.59	2,399.63	-9.42	-2.07	402,927.5000	538,039.1953	32° 6' 27.736 N	104° 12' 37.729 W
2,425.00	0.42	65.22	2,424.63	-9.43	-2.07	402,927.4895	538,039.1984	32° 6' 27.735 N	104° 12' 37.729 W
2,450.00	0.39	186.83	2,449.63	-9.48	-2.00	402,927.4435	538,039.2715	32° 6' 27.735 N	104° 12' 37.728 W
2,475.00	0.56	75.50	2,474.63	-9.53	-1.89	402,927.3896	538,039.3797	32° 6' 27.734 N	104° 12' 37.727 W
2,500.00	0.64	127.72	2,499.63	-9.59	-1.66	402,927.3347	538,039.6084	32° 6' 27.734 N	104° 12' 37.725 W
2,525.00	1.73	115.32	2,524.63	-9.83	-1.21	402,927.0879	538,040.0600	32° 6' 27.731 N	104° 12' 37.719 W
2,550.00	2.30	106.62	2,549.61	-10.14	-0.39	402,926.7830	538,040.8818	32° 6' 27.728 N	104° 12' 37.710 W
2,575.00	2.43	112.14	2,574.59	-10.48	0.58	402,926.4398	538,041.8534	32° 6' 27.725 N	104° 12' 37.698 W
2,600.00	3.11	111.22	2,599.56	-10.93	1.71	402,925.9946	538,042.9765	32° 6' 27.721 N	104° 12' 37.685 W
2,625.00	3.44	107.95	2,624.52	-11.40	3.05	402,925.5180	538,044.3222	32° 6' 27.716 N	104° 12' 37.670 W
2,650.00	3.43	109.46	2,649.47	-11.88	4.47	402,925.0377	538,045.7409	32° 6' 27.711 N	104° 12' 37.653 W
2,675.00	3.46	113.48	2,674.43	-12.43	5.87	402,924.4880	538,047.1379	32° 6' 27.706 N	104° 12' 37.637 W
2,700.00	3.63	112.04	2,699.38	-13.03	7.29	402,923.8904	538,048.5634	32° 6' 27.700 N	104° 12' 37.620 W
2,725.00	3.69	108.90	2,724.33	-13.59	8.79	402,923.3329	538,050.0581	32° 6' 27.694 N	104° 12' 37.603 W
2,750.00	3.43	106.64	2,749.28	-14.06	10.27	402,922.8581	538,051.5358	32° 6' 27.689 N	104° 12' 37.586 W
2,775.00	3.05	110.25	2,774.24	-14.51	11.61	402,922.4138	538,052.8763	32° 6' 27.685 N	104° 12' 37.570 W
2,800.00	3.22	112.20	2,799.21	-15.00	12.88	402,921.9183	538,054.1504	32° 6' 27.680 N	104° 12' 37.556 W
2,825.00	3.23	109.87	2,824.17	-15.51	14.19	402,921.4136	538,055.4628	32° 6' 27.675 N	104° 12' 37.540 W
2,850.00	3.25	103.11	2,849.13	-15.91	15.55	402,921.0135	538,056.8154	32° 6' 27.671 N	104° 12' 37.525 W
2,875.00	2.74	103.07	2,874.09	-16.20	16.82	402,920.7176	538,058.0876	32° 6' 27.668 N	104° 12' 37.510 W
2,900.00	3.05	89.35	2,899.06	-16.33	18.06	402,920.5900	538,059.3348	32° 6' 27.667 N	104° 12' 37.495 W
2,925.00	2.85	91.30	2,924.03	-16.34	19.35	402,920.5835	538,060.6212	32° 6' 27.667 N	104° 12' 37.480 W
2,950.00	3.03	92.70	2,948.99	-16.38	20.63	402,920.5382	538,061.9025	32° 6' 27.666 N	104° 12' 37.465 W
2,975.00	3.21	91.61	2,973.96	-16.43	21.99	402,920.4875	538,063.2622	32° 6' 27.666 N	104° 12' 37.450 W
3,000.00	2.83	86.34	2,998.92	-16.41	23.31	402,920.5072	538,064.5778	32° 6' 27.666 N	104° 12' 37.434 W
3,025.00	3.06	93.40	3,023.89	-16.41	24.59	402,920.5070	538,065.8598	32° 6' 27.666 N	104° 12' 37.419 W
3,050.00	3.09	91.33	3,048.85	-16.47	25.93	402,920.4518	538,067.1995	32° 6' 27.665 N	104° 12' 37.404 W
3,075.00	3.58	92.48	3,073.81	-16.52	27.38	402,920.4024	538,068.6529	32° 6' 27.665 N	104° 12' 37.387 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S. , R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
3,100.00	3.68	93.01	3,098.76	-16.59	28.96	402,920.3265	538,070.2339	32° 6' 27.664 N	104° 12' 37.369 W
3,125.00	4.01	101.31	3,123.70	-16.81	30.62	402,920.1129	538,071.8923	32° 6' 27.662 N	104° 12' 37.349 W
3,150.00	4.00	91.08	3,148.64	-16.99	32.35	402,919.9250	538,073.6213	32° 6' 27.660 N	104° 12' 37.329 W
3,175.00	3.49	90.78	3,173.59	-17.02	33.98	402,919.8983	538,075.2539	32° 6' 27.660 N	104° 12' 37.310 W
3,200.00	3.76	98.11	3,198.54	-17.15	35.56	402,919.7723	538,076.8263	32° 6' 27.659 N	104° 12' 37.292 W
3,225.00	3.77	110.14	3,223.49	-17.55	37.14	402,919.3736	538,078.4095	32° 6' 27.655 N	104° 12' 37.273 W
3,250.00	3.70	118.50	3,248.43	-18.21	38.62	402,918.7057	538,079.8900	32° 6' 27.648 N	104° 12' 37.256 W
3,275.00	3.70	107.26	3,273.38	-18.84	40.10	402,918.0815	538,081.3693	32° 6' 27.642 N	104° 12' 37.239 W
3,300.00	3.39	113.70	3,298.33	-19.37	41.55	402,917.5450	538,082.8164	32° 6' 27.637 N	104° 12' 37.222 W
3,325.00	3.59	111.75	3,323.29	-19.96	42.95	402,916.9579	538,084.2202	32° 6' 27.631 N	104° 12' 37.206 W
3,350.00	3.13	109.79	3,348.25	-20.48	44.32	402,916.4368	538,085.5894	32° 6' 27.626 N	104° 12' 37.190 W
3,375.00	3.46	106.60	3,373.20	-20.93	45.68	402,915.9902	538,086.9546	32° 6' 27.621 N	104° 12' 37.174 W
3,400.00	2.95	110.80	3,398.16	-21.37	47.01	402,915.5462	538,088.2789	32° 6' 27.617 N	104° 12' 37.159 W
3,425.00	2.85	109.11	3,423.13	-21.81	48.20	402,915.1143	538,089.4676	32° 6' 27.612 N	104° 12' 37.145 W
3,450.00	3.91	108.78	3,448.09	-22.28	49.59	402,914.6364	538,090.8619	32° 6' 27.608 N	104° 12' 37.129 W
3,475.00	3.83	100.20	3,473.03	-22.71	51.22	402,914.2141	538,092.4906	32° 6' 27.603 N	104° 12' 37.110 W
3,500.00	3.28	93.80	3,497.98	-22.90	52.76	402,914.0189	538,094.0260	32° 6' 27.601 N	104° 12' 37.092 W
3,525.00	3.56	52.53	3,522.94	-22.48	54.09	402,914.4437	538,095.3559	32° 6' 27.606 N	104° 12' 37.077 W
3,550.00	4.01	57.64	3,547.89	-21.54	55.44	402,915.3838	538,096.7103	32° 6' 27.615 N	104° 12' 37.061 W
3,575.00	3.76	61.76	3,572.83	-20.68	56.90	402,916.2395	538,098.1708	32° 6' 27.623 N	104° 12' 37.044 W
3,600.00	3.74	71.53	3,597.78	-20.03	58.40	402,916.8857	538,099.6663	32° 6' 27.630 N	104° 12' 37.026 W
3,625.00	3.92	54.48	3,622.72	-19.28	59.87	402,917.6405	538,101.1353	32° 6' 27.637 N	104° 12' 37.009 W
3,650.00	3.66	63.23	3,647.67	-18.42	61.27	402,918.4964	538,102.5432	32° 6' 27.646 N	104° 12' 36.993 W
3,675.00	3.52	64.12	3,672.62	-17.73	62.68	402,919.1908	538,103.9462	32° 6' 27.653 N	104° 12' 36.977 W
3,700.00	3.38	67.37	3,697.57	-17.11	64.05	402,919.8093	538,105.3169	32° 6' 27.659 N	104° 12' 36.961 W
3,725.00	3.64	66.82	3,722.53	-16.51	65.46	402,920.4053	538,106.7266	32° 6' 27.665 N	104° 12' 36.944 W
3,750.00	3.40	62.79	3,747.48	-15.86	66.85	402,921.0566	538,108.1155	32° 6' 27.671 N	104° 12' 36.928 W
3,775.00	3.65	64.00	3,772.43	-15.18	68.22	402,921.7444	538,109.4900	32° 6' 27.678 N	104° 12' 36.912 W
3,800.00	3.24	61.92	3,797.39	-14.49	69.56	402,922.4258	538,110.8285	32° 6' 27.684 N	104° 12' 36.897 W
3,825.00	3.84	68.22	3,822.34	-13.85	70.96	402,923.0690	538,112.2292	32° 6' 27.691 N	104° 12' 36.880 W
3,850.00	3.50	65.19	3,847.29	-13.22	72.43	402,923.6998	538,113.6993	32° 6' 27.697 N	104° 12' 36.863 W
3,875.00	3.26	70.49	3,872.24	-12.66	73.79	402,924.2574	538,115.0620	32° 6' 27.703 N	104° 12' 36.847 W
3,900.00	3.53	67.76	3,897.20	-12.13	75.17	402,924.7861	538,116.4444	32° 6' 27.708 N	104° 12' 36.831 W
3,925.00	3.20	65.59	3,922.16	-11.55	76.52	402,925.3658	538,117.7922	32° 6' 27.714 N	104° 12' 36.816 W
3,950.00	2.96	69.68	3,947.12	-11.04	77.76	402,925.8783	538,119.0329	32° 6' 27.719 N	104° 12' 36.801 W
3,975.00	3.35	65.12	3,972.08	-10.51	79.03	402,926.4098	538,120.3009	32° 6' 27.724 N	104° 12' 36.786 W
4,000.00	2.87	72.19	3,997.05	-10.01	80.29	402,926.9085	538,121.5594	32° 6' 27.729 N	104° 12' 36.772 W
4,025.00	3.66	69.10	4,022.01	-9.54	81.63	402,927.3846	538,122.9008	32° 6' 27.733 N	104° 12' 36.756 W
4,050.00	3.96	71.81	4,046.95	-8.98	83.20	402,927.9387	538,124.4663	32° 6' 27.739 N	104° 12' 36.738 W
4,075.00	3.91	72.32	4,071.89	-8.45	84.83	402,928.4671	538,126.0985	32° 6' 27.744 N	104° 12' 36.719 W
4,100.00	4.35	80.71	4,096.83	-8.04	86.58	402,928.8790	538,127.8463	32° 6' 27.748 N	104° 12' 36.699 W
4,125.00	3.89	80.45	4,121.76	-7.75	88.35	402,929.1728	538,129.6183	32° 6' 27.751 N	104° 12' 36.678 W
4,150.00	3.74	81.50	4,146.71	-7.49	89.99	402,929.4340	538,131.2609	32° 6' 27.754 N	104° 12' 36.659 W
4,175.00	3.71	85.51	4,171.65	-7.30	91.60	402,929.6178	538,132.8737	32° 6' 27.755 N	104° 12' 36.640 W
4,200.00	3.40	89.73	4,196.61	-7.24	93.15	402,929.6846	538,134.4214	32° 6' 27.756 N	104° 12' 36.622 W
4,225.00	3.75	83.51	4,221.56	-7.14	94.71	402,929.7805	538,135.9750	32° 6' 27.757 N	104° 12' 36.604 W
4,250.00	2.95	84.79	4,246.51	-6.99	96.16	402,929.9313	538,137.4280	32° 6' 27.758 N	104° 12' 36.587 W
4,275.00	2.91	81.24	4,271.48	-6.83	97.43	402,930.0864	538,138.6958	32° 6' 27.760 N	104° 12' 36.572 W
4,300.00	2.82	78.72	4,296.45	-6.62	98.66	402,930.3033	538,139.9261	32° 6' 27.762 N	104° 12' 36.558 W
4,325.00	2.59	79.10	4,321.42	-6.39	99.81	402,930.5304	538,141.0839	32° 6' 27.764 N	104° 12' 36.545 W
4,350.00	2.80	77.79	4,346.40	-6.15	100.97	402,930.7664	538,142.2353	32° 6' 27.767 N	104° 12' 36.531 W
4,375.00	2.76	82.63	4,371.37	-5.95	102.16	402,930.9728	538,143.4291	32° 6' 27.769 N	104° 12' 36.517 W
4,400.00	3.04	75.28	4,396.33	-5.70	103.40	402,931.2184	538,144.6672	32° 6' 27.771 N	104° 12' 36.503 W
4,425.00	3.64	86.77	4,421.29	-5.49	104.83	402,931.4316	538,146.1007	32° 6' 27.773 N	104° 12' 36.486 W
4,450.00	3.65	84.42	4,446.24	-5.37	106.42	402,931.5537	538,147.6850	32° 6' 27.774 N	104° 12' 36.468 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S., R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
4,475.00	3.57	82.44	4,471.19	-5.19	107.98	402,931.7334	538,149.2486	32° 6' 27.776 N	104° 12' 36.450 W
4,500.00	3.49	83.02	4,496.14	-4.99	109.51	402,931.9283	538,150.7755	32° 6' 27.778 N	104° 12' 36.432 W
4,525.00	3.87	81.02	4,521.09	-4.77	111.09	402,932.1525	538,152.3641	32° 6' 27.780 N	104° 12' 36.413 W
4,550.00	3.49	80.90	4,546.04	-4.52	112.68	402,932.4045	538,153.9487	32° 6' 27.783 N	104° 12' 36.395 W
4,575.00	3.54	82.23	4,570.99	-4.29	114.20	402,932.6292	538,155.4648	32° 6' 27.785 N	104° 12' 36.377 W
4,600.00	3.46	88.50	4,595.95	-4.17	115.71	402,932.7533	538,156.9837	32° 6' 27.786 N	104° 12' 36.360 W
4,625.00	3.61	87.37	4,620.90	-4.11	117.25	402,932.8092	538,158.5241	32° 6' 27.787 N	104° 12' 36.342 W
4,650.00	3.30	90.93	4,645.85	-4.09	118.76	402,932.8336	538,160.0297	32° 6' 27.787 N	104° 12' 36.324 W
4,675.00	3.48	87.63	4,670.81	-4.07	120.24	402,932.8533	538,161.5073	32° 6' 27.787 N	104° 12' 36.307 W
4,700.00	2.92	91.29	4,695.77	-4.05	121.63	402,932.8703	538,162.9020	32° 6' 27.787 N	104° 12' 36.291 W
4,725.00	3.23	91.54	4,720.74	-4.08	122.97	402,932.8371	538,164.2427	32° 6' 27.787 N	104° 12' 36.275 W
4,750.00	3.31	85.43	4,745.69	-4.04	124.40	402,932.8756	538,165.6662	32° 6' 27.787 N	104° 12' 36.259 W
4,775.00	3.34	82.94	4,770.65	-3.90	125.84	402,933.0227	538,167.1083	32° 6' 27.789 N	104° 12' 36.242 W
4,800.00	3.36	95.93	4,795.61	-3.88	127.29	402,933.0365	538,168.5598	32° 6' 27.789 N	104° 12' 36.225 W
4,825.00	3.74	93.38	4,820.56	-4.01	128.83	402,932.9127	538,170.1024	32° 6' 27.788 N	104° 12' 36.207 W
4,850.00	3.84	93.98	4,845.51	-4.11	130.48	402,932.8065	538,171.7515	32° 6' 27.787 N	104° 12' 36.188 W
4,875.00	3.77	89.34	4,870.45	-4.16	132.14	402,932.7579	538,173.4084	32° 6' 27.786 N	104° 12' 36.169 W
4,900.00	3.02	119.55	4,895.41	-4.48	133.53	402,932.4426	538,174.8033	32° 6' 27.783 N	104° 12' 36.153 W
4,925.00	3.64	125.33	4,920.37	-5.26	134.75	402,931.6588	538,176.0237	32° 6' 27.775 N	104° 12' 36.138 W
4,950.00	3.92	122.52	4,945.31	-6.18	136.12	402,930.7405	538,177.3916	32° 6' 27.766 N	104° 12' 36.123 W
4,975.00	3.61	113.72	4,970.26	-6.96	137.56	402,929.9645	538,178.8328	32° 6' 27.758 N	104° 12' 36.106 W
5,000.00	3.77	115.64	4,995.21	-7.63	139.02	402,929.2922	538,180.2943	32° 6' 27.752 N	104° 12' 36.089 W
5,025.00	3.60	110.11	5,020.16	-8.25	140.50	402,928.6667	538,181.7723	32° 6' 27.745 N	104° 12' 36.072 W
5,050.00	3.58	113.13	5,045.11	-8.83	141.96	402,928.0903	538,183.2271	32° 6' 27.740 N	104° 12' 36.055 W
5,075.00	3.70	101.49	5,070.06	-9.30	143.47	402,927.6230	538,184.7354	32° 6' 27.735 N	104° 12' 36.037 W
5,100.00	3.37	104.12	5,095.01	-9.64	144.97	402,927.2830	538,186.2385	32° 6' 27.732 N	104° 12' 36.020 W
5,125.00	3.74	106.06	5,119.96	-10.04	146.46	402,926.8782	538,187.7346	32° 6' 27.728 N	104° 12' 36.002 W
5,150.00	4.03	109.22	5,144.90	-10.56	148.08	402,926.3635	538,189.3477	32° 6' 27.723 N	104° 12' 35.984 W
5,175.00	4.36	102.72	5,169.84	-11.05	149.83	402,925.8650	538,191.1042	32° 6' 27.718 N	104° 12' 35.963 W
5,200.00	4.67	97.37	5,194.76	-11.39	151.77	402,925.5252	538,193.0405	32° 6' 27.714 N	104° 12' 35.941 W
5,225.00	4.55	102.22	5,219.68	-11.74	153.75	402,925.1848	538,195.0189	32° 6' 27.711 N	104° 12' 35.918 W
5,250.00	4.66	101.43	5,244.60	-12.15	155.71	402,924.7737	538,196.9835	32° 6' 27.707 N	104° 12' 35.895 W
5,275.00	4.39	104.38	5,269.52	-12.59	157.64	402,924.3348	538,198.9057	32° 6' 27.702 N	104° 12' 35.872 W
5,300.00	4.38	107.67	5,294.45	-13.11	159.47	402,923.8074	538,200.7421	32° 6' 27.697 N	104° 12' 35.851 W
5,325.00	4.23	109.38	5,319.38	-13.71	161.25	402,923.2117	538,202.5215	32° 6' 27.691 N	104° 12' 35.830 W
5,350.00	3.90	102.55	5,344.31	-14.20	162.95	402,922.7210	538,204.2211	32° 6' 27.686 N	104° 12' 35.811 W
5,375.00	3.72	86.65	5,369.26	-14.34	164.59	402,922.5836	538,205.8607	32° 6' 27.685 N	104° 12' 35.792 W
5,400.00	4.01	94.07	5,394.20	-14.35	166.27	402,922.5690	538,207.5422	32° 6' 27.685 N	104° 12' 35.772 W
5,425.00	3.89	84.17	5,419.14	-14.33	167.99	402,922.5931	538,209.2578	32° 6' 27.685 N	104° 12' 35.752 W
5,450.00	3.79	83.81	5,444.09	-14.15	169.65	402,922.7683	538,210.9229	32° 6' 27.687 N	104° 12' 35.733 W
5,475.00	3.74	85.97	5,469.03	-14.01	171.29	402,922.9147	538,212.5576	32° 6' 27.688 N	104° 12' 35.714 W
5,500.00	3.40	86.01	5,493.99	-13.90	172.84	402,923.0236	538,214.1105	32° 6' 27.689 N	104° 12' 35.696 W
5,525.00	3.55	83.70	5,518.94	-13.76	174.35	402,923.1601	538,215.6194	32° 6' 27.691 N	104° 12' 35.678 W
5,550.00	3.57	84.20	5,543.89	-13.60	175.89	402,923.3237	538,217.1631	32° 6' 27.692 N	104° 12' 35.660 W
5,575.00	3.64	86.06	5,568.84	-13.46	177.46	402,923.4569	538,218.7291	32° 6' 27.693 N	104° 12' 35.642 W
5,600.00	3.73	85.48	5,593.79	-13.34	179.06	402,923.5755	538,220.3315	32° 6' 27.695 N	104° 12' 35.623 W
5,625.00	3.68	83.16	5,618.74	-13.18	180.67	402,923.7351	538,221.9387	32° 6' 27.696 N	104° 12' 35.605 W
5,650.00	3.69	84.31	5,643.69	-13.01	182.27	402,923.9104	538,223.5358	32° 6' 27.698 N	104° 12' 35.586 W
5,675.00	3.69	85.65	5,668.63	-12.87	183.87	402,924.0512	538,225.1385	32° 6' 27.699 N	104° 12' 35.567 W
5,700.00	3.81	88.52	5,693.58	-12.79	185.50	402,924.1337	538,226.7710	32° 6' 27.700 N	104° 12' 35.548 W
5,725.00	3.80	84.39	5,718.53	-12.68	187.16	402,924.2361	538,228.4258	32° 6' 27.701 N	104° 12' 35.529 W
5,750.00	4.56	86.78	5,743.46	-12.55	188.97	402,924.3729	538,230.2425	32° 6' 27.702 N	104° 12' 35.508 W
5,775.00	4.87	87.13	5,768.37	-12.44	191.02	402,924.4819	538,232.2946	32° 6' 27.703 N	104° 12' 35.484 W
5,800.00	4.95	89.61	5,793.28	-12.38	193.16	402,924.5424	538,234.4330	32° 6' 27.704 N	104° 12' 35.459 W
5,825.00	4.75	88.27	5,818.19	-12.34	195.28	402,924.5810	538,236.5461	32° 6' 27.704 N	104° 12' 35.435 W

Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S., R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
5,850.00	4.63	87.68	5,843.11	-12.27	197.32	402,924.6530	538,238.5890	32° 6' 27.705 N	104° 12' 35.411 W
5,875.00	4.60	87.08	5,868.03	-12.18	199.33	402,924.7450	538,240.5983	32° 6' 27.706 N	104° 12' 35.388 W
5,900.00	4.50	86.14	5,892.95	-12.06	201.31	402,924.8621	538,242.5780	32° 6' 27.707 N	104° 12' 35.365 W
5,925.00	4.26	83.74	5,917.88	-11.89	203.21	402,925.0293	538,244.4795	32° 6' 27.709 N	104° 12' 35.343 W
5,950.00	4.19	81.28	5,942.81	-11.65	205.04	402,925.2690	538,246.3053	32° 6' 27.711 N	104° 12' 35.321 W
5,975.00	4.05	84.31	5,967.74	-11.42	206.82	402,925.4950	538,248.0865	32° 6' 27.713 N	104° 12' 35.301 W
6,000.00	3.92	86.13	5,992.68	-11.28	208.55	402,925.6402	538,249.8176	32° 6' 27.715 N	104° 12' 35.281 W
6,025.00	3.78	87.46	6,017.63	-11.19	210.22	402,925.7344	538,251.4934	32° 6' 27.716 N	104° 12' 35.261 W
6,050.00	3.87	86.11	6,042.57	-11.09	211.89	402,925.8282	538,253.1584	32° 6' 27.717 N	104° 12' 35.242 W
6,075.00	3.42	82.85	6,067.52	-10.94	213.47	402,925.9782	538,254.7400	32° 6' 27.718 N	104° 12' 35.223 W
6,100.00	3.29	84.07	6,092.48	-10.77	214.92	402,926.1452	538,256.1934	32° 6' 27.720 N	104° 12' 35.206 W
6,125.00	3.60	85.38	6,117.43	-10.64	216.42	402,926.2825	538,257.6893	32° 6' 27.721 N	104° 12' 35.189 W
6,150.00	3.30	90.21	6,142.39	-10.58	217.92	402,926.3431	538,259.1912	32° 6' 27.722 N	104° 12' 35.172 W
6,175.00	3.37	99.43	6,167.35	-10.70	219.37	402,926.2200	538,260.6356	32° 6' 27.720 N	104° 12' 35.155 W
6,200.00	3.41	104.39	6,192.30	-11.01	220.81	402,925.9149	538,262.0807	32° 6' 27.717 N	104° 12' 35.138 W
6,225.00	3.49	100.08	6,217.26	-11.32	222.28	402,925.5969	538,263.5500	32° 6' 27.714 N	104° 12' 35.121 W
6,250.00	3.42	89.55	6,242.21	-11.45	223.78	402,925.4696	538,265.0449	32° 6' 27.713 N	104° 12' 35.103 W
6,275.00	3.62	77.67	6,267.16	-11.28	225.29	402,925.6440	538,266.5616	32° 6' 27.715 N	104° 12' 35.086 W
6,300.00	3.75	76.77	6,292.11	-10.92	226.86	402,925.9996	538,268.1285	32° 6' 27.718 N	104° 12' 35.068 W
6,325.00	3.89	68.55	6,317.06	-10.42	228.44	402,926.4968	538,269.7136	32° 6' 27.723 N	104° 12' 35.049 W
6,350.00	4.64	67.11	6,341.99	-9.72	230.16	402,927.2003	538,271.4344	32° 6' 27.730 N	104° 12' 35.029 W
6,375.00	4.77	66.67	6,366.90	-8.91	232.05	402,928.0052	538,273.3205	32° 6' 27.738 N	104° 12' 35.007 W
6,400.00	4.73	66.09	6,391.82	-8.09	233.95	402,928.8346	538,275.2172	32° 6' 27.746 N	104° 12' 34.985 W
6,425.00	4.66	64.48	6,416.73	-7.23	235.81	402,929.6899	538,277.0760	32° 6' 27.755 N	104° 12' 34.964 W
6,450.00	4.54	63.05	6,441.65	-6.34	237.60	402,930.5759	538,278.8744	32° 6' 27.763 N	104° 12' 34.943 W
6,475.00	4.37	62.91	6,466.58	-5.46	239.33	402,931.4580	538,280.6044	32° 6' 27.772 N	104° 12' 34.922 W
6,500.00	4.17	62.91	6,491.51	-4.61	240.99	402,932.3057	538,282.2616	32° 6' 27.780 N	104° 12' 34.903 W
6,525.00	3.74	62.50	6,516.45	-3.82	242.52	402,933.0961	538,283.7940	32° 6' 27.788 N	104° 12' 34.885 W
6,550.00	3.58	71.57	6,541.40	-3.20	243.99	402,933.7194	538,285.2578	32° 6' 27.794 N	104° 12' 34.868 W
6,575.00	3.43	71.30	6,566.35	-2.71	245.44	402,934.2059	538,286.7067	32° 6' 27.799 N	104° 12' 34.851 W
6,600.00	3.85	74.90	6,591.30	-2.26	246.96	402,934.6643	538,288.2254	32° 6' 27.804 N	104° 12' 34.834 W
6,625.00	3.64	71.88	6,616.25	-1.79	248.52	402,935.1298	538,289.7899	32° 6' 27.808 N	104° 12' 34.816 W
6,650.00	3.73	74.78	6,641.20	-1.33	250.06	402,935.5901	538,291.3288	32° 6' 27.813 N	104° 12' 34.798 W
6,675.00	3.78	75.19	6,666.14	-0.91	251.64	402,936.0142	538,292.9102	32° 6' 27.817 N	104° 12' 34.779 W
6,700.00	3.55	76.15	6,691.09	-0.51	253.19	402,936.4101	538,294.4584	32° 6' 27.821 N	104° 12' 34.761 W
6,725.00	3.73	78.60	6,716.04	-0.16	254.74	402,936.7562	538,296.0070	32° 6' 27.824 N	104° 12' 34.743 W
6,750.00	3.52	71.32	6,740.99	0.24	256.26	402,937.1627	538,297.5312	32° 6' 27.828 N	104° 12' 34.726 W
6,774.00	3.77	67.44	6,764.94	0.78	257.69	402,937.7014	538,298.9578	32° 6' 27.834 N	104° 12' 34.709 W
6,876.00	3.80	78.30	6,866.72	2.75	264.09	402,939.6733	538,305.3643	32° 6' 27.853 N	104° 12' 34.634 W

First IDS MWD Survey

6,908.00	3.80	98.30	6,898.65	2.82	266.18	402,939.7353	538,307.4520	32° 6' 27.854 N	104° 12' 34.610 W
6,939.00	6.10	142.70	6,929.54	1.36	268.20	402,938.2761	538,309.4676	32° 6' 27.839 N	104° 12' 34.587 W
6,970.00	9.50	159.30	6,960.26	-2.35	270.10	402,934.5712	538,311.3707	32° 6' 27.802 N	104° 12' 34.565 W
7,002.00	13.00	164.40	6,991.64	-8.29	272.00	402,928.6323	538,313.2727	32° 6' 27.744 N	104° 12' 34.543 W
7,033.00	15.30	167.00	7,021.70	-15.63	273.86	402,921.2878	538,315.1307	32° 6' 27.671 N	104° 12' 34.521 W
7,064.00	18.20	169.90	7,051.38	-24.39	275.63	402,912.5344	538,316.9001	32° 6' 27.584 N	104° 12' 34.501 W
7,096.00	21.60	173.80	7,081.46	-35.16	277.14	402,901.7553	538,318.4131	32° 6' 27.478 N	104° 12' 34.483 W
7,127.00	24.40	179.80	7,110.00	-47.24	277.78	402,889.6756	538,319.0519	32° 6' 27.358 N	104° 12' 34.476 W
7,159.00	26.70	180.50	7,138.87	-61.04	277.74	402,875.8753	538,319.0123	32° 6' 27.221 N	104° 12' 34.477 W
7,191.00	29.40	182.00	7,167.11	-76.09	277.41	402,860.8339	538,318.6754	32° 6' 27.073 N	104° 12' 34.481 W
7,222.00	32.20	184.80	7,193.74	-91.93	276.45	402,844.9949	538,317.7184	32° 6' 26.916 N	104° 12' 34.492 W
7,254.00	33.40	188.70	7,220.64	-109.13	274.40	402,827.7899	538,315.6724	32° 6' 26.746 N	104° 12' 34.516 W
7,285.00	36.70	187.90	7,246.01	-126.74	271.84	402,810.1754	538,313.1079	32° 6' 26.571 N	104° 12' 34.546 W
7,317.00	40.00	187.80	7,271.10	-146.41	269.13	402,790.5093	538,310.3971	32° 6' 26.377 N	104° 12' 34.578 W
7,349.00	43.20	188.90	7,295.03	-167.43	266.04	402,769.4933	538,307.3060	32° 6' 26.169 N	104° 12' 34.614 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S., R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
7,380.00	46.30	190.30	7,317.04	-188.94	262.39	402,747.9794	538,303.6598	32° 6' 25.956 N	104° 12' 34.657 W
7,411.00	50.40	190.30	7,337.64	-211.73	258.25	402,725.1939	538,299.5190	32° 6' 25.730 N	104° 12' 34.705 W
7,443.00	54.80	190.70	7,357.07	-236.72	253.62	402,700.2050	538,294.8849	32° 6' 25.483 N	104° 12' 34.760 W
7,474.00	58.90	191.20	7,374.02	-262.19	248.68	402,674.7292	538,289.9533	32° 6' 25.231 N	104° 12' 34.817 W
7,506.00	63.50	191.50	7,389.43	-289.68	243.17	402,647.2436	538,284.4345	32° 6' 24.959 N	104° 12' 34.882 W
7,537.00	68.20	192.70	7,402.11	-317.33	237.23	402,619.5949	538,278.5016	32° 6' 24.686 N	104° 12' 34.951 W
7,569.00	72.80	191.70	7,412.79	-346.80	230.86	402,590.1192	538,272.1326	32° 6' 24.394 N	104° 12' 35.026 W
7,600.00	77.10	190.20	7,420.84	-376.19	225.18	402,560.7347	538,266.4514	32° 6' 24.103 N	104° 12' 35.092 W
7,632.00	80.10	188.50	7,427.16	-407.13	220.09	402,529.7872	538,261.3583	32° 6' 23.797 N	104° 12' 35.152 W
7,663.00	83.30	185.60	7,431.64	-437.57	216.33	402,499.3509	538,257.5974	32° 6' 23.496 N	104° 12' 35.196 W
7,695.00	86.60	182.40	7,434.46	-469.36	214.11	402,467.5612	538,255.3768	32° 6' 23.181 N	104° 12' 35.222 W
7,726.00	88.90	180.30	7,435.67	-500.32	213.38	402,436.5976	538,254.6475	32° 6' 22.875 N	104° 12' 35.231 W
7,851.00	89.20	177.30	7,437.75	-625.26	216.00	402,311.6569	538,257.2648	32° 6' 21.638 N	104° 12' 35.202 W
7,946.00	88.20	176.90	7,439.90	-720.12	220.80	402,216.8045	538,262.0697	32° 6' 20.700 N	104° 12' 35.147 W
8,040.00	86.70	176.10	7,444.08	-813.85	226.53	402,123.0764	538,267.8020	32° 6' 19.772 N	104° 12' 35.082 W
8,135.00	87.40	176.10	7,448.97	-908.50	232.99	402,028.4227	538,274.2549	32° 6' 18.835 N	104° 12' 35.008 W
8,229.00	87.60	176.40	7,453.07	-1,002.21	239.13	401,934.7136	538,280.3969	32° 6' 17.908 N	104° 12' 34.938 W
8,324.00	87.30	175.40	7,457.30	-1,096.87	245.91	401,840.0520	538,287.1822	32° 6' 16.971 N	104° 12' 34.861 W
8,418.00	88.30	175.40	7,460.91	-1,190.50	253.45	401,746.4254	538,294.7152	32° 6' 16.044 N	104° 12' 34.774 W
8,512.00	89.20	176.60	7,462.96	-1,284.24	260.00	401,652.6795	538,301.2704	32° 6' 15.116 N	104° 12' 34.699 W
8,607.00	89.80	177.10	7,463.79	-1,379.10	265.22	401,557.8276	538,306.4904	32° 6' 14.177 N	104° 12' 34.640 W
8,701.00	90.40	177.10	7,463.62	-1,472.97	269.98	401,463.9487	538,311.2461	32° 6' 13.248 N	104° 12' 34.586 W
8,796.00	90.80	176.90	7,462.63	-1,567.84	274.95	401,369.0845	538,316.2177	32° 6' 12.309 N	104° 12' 34.529 W
8,890.00	91.30	176.90	7,460.91	-1,661.69	280.03	401,275.2383	538,321.3002	32° 6' 11.381 N	104° 12' 34.471 W
8,984.00	90.00	176.30	7,459.84	-1,755.51	285.61	401,181.4125	538,326.8746	32° 6' 10.452 N	104° 12' 34.408 W
9,079.00	90.40	176.50	7,459.51	-1,850.32	291.57	401,086.6009	538,332.8396	32° 6' 9.514 N	104° 12' 34.340 W
9,173.00	91.00	176.90	7,458.36	-1,944.16	296.98	400,992.7646	538,338.2502	32° 6' 8.585 N	104° 12' 34.278 W
9,268.00	89.80	176.40	7,457.70	-2,038.99	302.53	400,897.9315	538,343.8013	32° 6' 7.646 N	104° 12' 34.215 W
9,362.00	90.60	176.70	7,457.37	-2,132.82	308.19	400,804.1035	538,349.4579	32° 6' 6.718 N	104° 12' 34.150 W
9,457.00	89.80	178.10	7,457.04	-2,227.72	312.50	400,709.2052	538,353.7672	32° 6' 5.778 N	104° 12' 34.102 W
9,551.00	88.40	178.30	7,458.51	-2,321.66	315.45	400,615.2657	538,356.7194	32° 6' 4.849 N	104° 12' 34.068 W
9,645.00	88.90	178.70	7,460.73	-2,415.60	317.91	400,521.3247	538,359.1793	32° 6' 3.919 N	104° 12' 34.041 W
9,740.00	89.50	179.50	7,462.05	-2,510.58	319.40	400,426.3470	538,360.6713	32° 6' 2.979 N	104° 12' 34.025 W
9,834.00	90.20	179.90	7,462.30	-2,604.58	319.89	400,332.3496	538,361.1634	32° 6' 2.049 N	104° 12' 34.021 W
9,928.00	88.80	179.40	7,463.12	-2,698.57	320.47	400,238.3578	538,361.7376	32° 6' 1.119 N	104° 12' 34.015 W
10,023.00	89.20	179.80	7,464.78	-2,793.55	321.13	400,143.3751	538,362.4007	32° 6' 0.179 N	104° 12' 34.009 W
10,117.00	89.70	179.40	7,465.68	-2,887.54	321.79	400,049.3824	538,363.0569	32° 5' 59.248 N	104° 12' 34.002 W
10,212.00	90.20	179.90	7,465.76	-2,982.54	322.37	399,954.3850	538,363.6372	32° 5' 58.308 N	104° 12' 33.997 W
10,306.00	89.40	179.00	7,466.09	-3,076.53	323.27	399,860.3918	538,364.5395	32° 5' 57.378 N	104° 12' 33.988 W
10,401.00	90.00	179.10	7,466.59	-3,171.52	324.85	399,765.4068	538,366.1145	32° 5' 56.438 N	104° 12' 33.971 W
10,495.00	90.90	180.00	7,465.85	-3,265.51	325.58	399,671.4148	538,366.8528	32° 5' 55.508 N	104° 12' 33.963 W
10,589.00	89.60	179.10	7,465.44	-3,359.51	326.32	399,577.4217	538,367.5911	32° 5' 54.578 N	104° 12' 33.956 W
10,683.00	90.20	179.10	7,465.61	-3,453.49	327.80	399,483.4341	538,369.0675	32° 5' 53.647 N	104° 12' 33.940 W
10,778.00	88.50	178.90	7,466.68	-3,548.47	329.46	399,388.4584	538,370.7253	32° 5' 52.707 N	104° 12' 33.922 W
10,872.00	88.00	178.20	7,469.55	-3,642.39	331.83	399,294.5334	538,373.1027	32° 5' 51.778 N	104° 12' 33.896 W
10,966.00	88.60	178.40	7,472.34	-3,736.31	334.62	399,200.6168	538,375.8901	32° 5' 50.848 N	104° 12' 33.864 W
11,061.00	88.10	177.50	7,475.08	-3,831.21	338.02	399,105.7184	538,379.2868	32° 5' 49.909 N	104° 12' 33.826 W
11,155.00	88.70	178.60	7,477.70	-3,925.12	341.21	399,011.8115	538,382.4840	32° 5' 48.980 N	104° 12' 33.790 W
11,250.00	90.10	179.00	7,478.70	-4,020.09	343.20	398,916.8403	538,384.4733	32° 5' 48.040 N	104° 12' 33.768 W
11,344.00	90.50	179.10	7,478.21	-4,114.07	344.76	398,822.8549	538,386.0318	32° 5' 47.110 N	104° 12' 33.752 W
11,438.00	90.80	179.10	7,477.14	-4,208.06	346.24	398,728.8728	538,387.5082	32° 5' 46.180 N	104° 12' 33.736 W
11,533.00	91.40	179.30	7,475.32	-4,303.03	347.57	398,633.9003	538,388.8343	32° 5' 45.240 N	104° 12' 33.722 W
11,627.00	89.80	178.70	7,474.33	-4,397.01	349.21	398,539.9234	538,390.4748	32° 5' 44.310 N	104° 12' 33.704 W
11,721.00	90.00	178.60	7,474.50	-4,490.98	351.42	398,445.9499	538,392.6894	32° 5' 43.380 N	104° 12' 33.679 W
11,815.00	90.30	178.60	7,474.25	-4,584.95	353.72	398,351.9786	538,394.9860	32° 5' 42.450 N	104° 12' 33.654 W



Integrity Directional Services, LLC

Survey Report - Geographic



Company: COG Operating L L C
Project: Eddy County, NM (NAD 27 NME)
Site: Sec. 29, T 25S. , R 27 E
Well: Populus Federal 2H
Wellbore: Wellbore #1
Design: Wellbore #1

Local Co-ordinate Reference: Well Populus Federal 2H
TVD Reference: KB=20' @ 3167.60ft (Patriot 2)
MD Reference: KB=20' @ 3167.60ft (Patriot 2)
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
11,910.00	91.00	178.30	7,473.17	-4,679.91	356.29	398,257.0203	538,397.5555	32° 5' 41.510 N	104° 12' 33.625 W
12,004.00	89.70	178.50	7,472.60	-4,773.87	358.91	398,163.0610	538,400.1800	32° 5' 40.580 N	104° 12' 33.596 W
12,099.00	90.20	178.70	7,472.68	-4,868.84	361.23	398,068.0899	538,402.5010	32° 5' 39.640 N	104° 12' 33.570 W
12,145.00	90.20	178.40	7,472.52	-4,914.82	362.40	398,022.1050	538,403.6650	32° 5' 39.185 N	104° 12' 33.557 W
Final IDS MWD Survey									
12,200.00	90.20	178.40	7,472.33	-4,969.80	363.93	397,967.1269	538,405.2007	32° 5' 38.641 N	104° 12' 33.540 W
Projection to TD									

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
6,876.00	6,866.72	2.75	264.09	First IDS MWD Survey
12,145.00	7,472.52	-4,914.82	362.40	Final IDS MWD Survey
12,200.00	7,472.33	-4,969.80	363.93	Projection to TD

Checked By: _____ Approved By: _____ Date: _____