

30-015-44208

COG

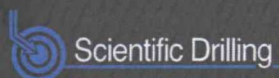
SURVEY REPORT

CRAIG FEDERAL #12H

ENSIGN #155

7/30/2017

**Please provide signature
page for directional survey**



The **Ultimate Partner** In Wellbore Placement

SURVEY REPORT

CRAIG FEDERAL #12H

COMPUTED KEEPER GYRO WIRELINE SURVEY

CUSTOMER
PROJECT
FIELD

COG
Craig Federal #12H
Eddy County, New Mexico

SDI JOB NO.
SDI DISTRICT
SDI KIT/UNIT

OP.003180
Midland

SITE INFORMATION

Site Name
Lat/Long
Northing
Easting

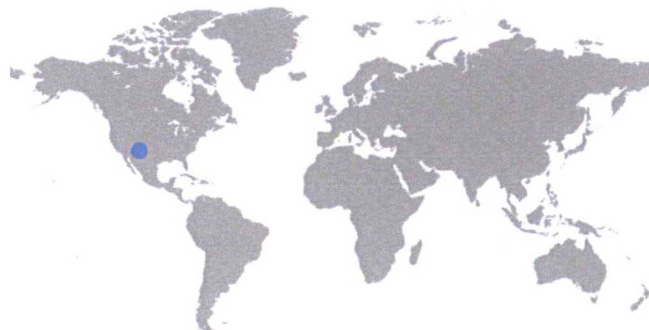
Eddy County, New Mexico
32.0770332° N, 104.2521798° W
391,758.3 ft
525,136.1 ft

Section
Township
Range

MAP INFORMATION

North Reference
Grid Correction
System
Datum
Map Zone

Grid North
-0.04 deg
US State Plane 1927
North American Datum 1927 (Clarke 1866)
New Mexico East: 3001

**WELL INFORMATION**

Lat/Long
Northing
Easting
UWI

32.0770332° N, 104.2521798° W
391,758.3 ft
525,136.1 ft
30-015-44208

DEPTH AND ELEVATION REFERENCE

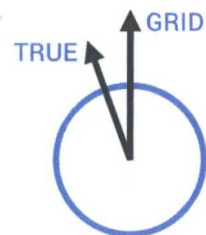
Ground Level
Level
Reference Datum
Reference Height
Reference Elevation

3370.1 ft above Mean Sea
Level
RKB
24 ft above G.L.
3394.1 ft

VERTICAL SECTION REFERENCE

+N/-S
+E/-W
Proposal Direction
Calculation Method

0 ft
0 ft
334.84°
Minimum Curvature

**LOCAL GRAVITY REFERENCE INFORMATION**

Local Gravity
True to Grid

998.492 mG [computed]
subtract 0.04°

WELL NOTES

Keeper Ghyro Wireline Survey in 4 1/2 IF

OPERATORS

Nathan Yerby

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	1.53	208.43	99.99	-0.79	-1.17	-0.64	1.53	1.33	208.43
125.00	1.49	209.07	124.98	-1.18	-1.75	-0.95	0.17	1.99	208.53
150.00	1.45	209.75	149.97	-1.55	-2.31	-1.27	0.17	2.64	208.75
175.00	1.41	210.47	174.96	-1.91	-2.85	-1.58	0.17	3.26	209.01
200.00	1.39	210.97	199.96	-2.25	-3.38	-1.89	0.10	3.87	209.28
225.00	1.64	207.91	224.95	-2.64	-3.95	-2.22	1.04	4.53	209.28
250.00	1.35	208.84	249.94	-3.02	-4.53	-2.53	1.17	5.18	209.16
275.00	1.54	207.21	274.93	-3.40	-5.08	-2.82	0.80	5.81	209.03
300.00	1.59	205.85	299.92	-3.83	-5.70	-3.13	0.24	6.50	208.77
325.00	1.56	204.37	324.91	-4.27	-6.32	-3.42	0.20	7.18	208.42
350.00	1.49	206.21	349.90	-4.69	-6.92	-3.70	0.36	7.85	208.15
375.00	1.46	203.25	374.89	-5.10	-7.50	-3.97	0.32	8.49	207.89
400.00	1.38	201.92	399.89	-5.52	-8.08	-4.21	0.37	9.11	207.53
425.00	1.30	203.24	424.88	-5.91	-8.62	-4.43	0.34	9.69	207.24
450.00	1.30	205.12	449.87	-6.28	-9.13	-4.67	0.17	10.26	207.07
475.00	1.24	205.69	474.87	-6.63	-9.63	-4.90	0.26	10.81	206.98
500.00	1.17	208.78	499.86	-6.95	-10.10	-5.14	0.38	11.33	206.99
525.00	1.04	203.58	524.86	-7.25	-10.53	-5.36	0.65	11.81	206.96
550.00	0.90	203.54	549.85	-7.53	-10.92	-5.53	0.55	12.24	206.85
575.00	0.89	203.49	574.85	-7.79	-11.28	-5.68	0.04	12.63	206.74
600.00	0.81	202.63	599.85	-8.04	-11.62	-5.83	0.31	13.00	206.64
625.00	0.71	197.34	624.85	-8.27	-11.93	-5.94	0.51	13.33	206.48
650.00	0.46	189.43	649.84	-8.47	-12.17	-6.00	1.03	13.57	206.25
675.00	0.38	91.17	674.84	-8.58	-12.27	-5.94	2.53	13.64	205.82
700.00	0.73	66.60	699.84	-8.63	-12.21	-5.71	1.68	13.48	205.06
725.00	1.11	51.91	724.84	-8.58	-12.00	-5.37	1.77	13.15	204.12
750.00	1.36	52.35	749.83	-8.46	-11.67	-4.95	1.02	12.67	202.98
775.00	1.41	52.45	774.83	-8.33	-11.30	-4.47	0.19	12.15	201.57
800.00	1.48	53.58	799.82	-8.20	-10.92	-3.96	0.30	11.62	199.95
825.00	1.51	52.41	824.81	-8.07	-10.53	-3.44	0.18	11.08	198.11
850.00	1.48	51.80	849.80	-7.92	-10.13	-2.93	0.15	10.54	196.13

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	°/100ft	ft	deg
875.00	1.62	49.61	874.79	-7.76	-9.70	-2.41	0.62	9.99	193.94
900.00	1.49	51.37	899.78	-7.59	-9.27	-1.89	0.57	9.46	191.50
925.00	1.19	50.85	924.78	-7.45	-8.90	-1.43	1.19	9.02	189.13
950.00	0.81	46.62	949.77	-7.33	-8.62	-1.10	1.54	8.69	187.29
975.00	0.42	359.47	974.77	-7.19	-8.40	-0.97	2.43	8.46	186.61
1000.00	0.56	294.29	999.77	-7.02	-8.26	-1.09	2.17	8.33	187.49
1025.00	0.75	275.84	1024.77	-6.84	-8.19	-1.36	1.13	8.31	189.43
1050.00	0.81	275.68	1049.77	-6.66	-8.16	-1.70	0.22	8.34	191.76
1075.00	0.84	269.88	1074.76	-6.50	-8.14	-2.06	0.37	8.40	194.19
1100.00	0.87	266.18	1099.76	-6.35	-8.16	-2.43	0.24	8.51	196.60
1125.00	0.98	257.74	1124.76	-6.23	-8.21	-2.83	0.71	8.69	199.00
1150.00	1.00	260.61	1149.75	-6.13	-8.30	-3.25	0.22	8.91	201.42
1175.00	0.95	257.26	1174.75	-6.02	-8.38	-3.67	0.31	9.15	203.67
1200.00	1.01	237.92	1199.75	-6.00	-8.54	-4.06	1.34	9.46	205.43
1225.00	0.68	205.63	1224.74	-6.12	-8.79	-4.31	2.27	9.79	206.13
1250.00	0.83	151.47	1249.74	-6.40	-9.08	-4.29	2.81	10.05	205.27
1275.00	1.24	139.60	1274.74	-6.84	-9.45	-4.03	1.83	10.27	203.08
1300.00	1.30	132.04	1299.73	-7.36	-9.85	-3.64	0.71	10.50	200.29
1325.00	1.54	125.01	1324.72	-7.92	-10.23	-3.16	1.20	10.70	197.15
1350.00	1.97	123.94	1349.71	-8.58	-10.66	-2.52	1.70	10.96	193.32
1375.00	2.01	120.03	1374.70	-9.31	-11.12	-1.79	0.58	11.26	189.13
1400.00	2.17	118.33	1399.68	-10.05	-11.57	-0.99	0.66	11.61	184.90
1425.00	2.35	111.84	1424.66	-10.80	-11.98	-0.10	1.26	11.98	180.48
1450.00	2.33	106.28	1449.64	-11.51	-12.31	0.86	0.91	12.34	175.98
1475.00	2.18	98.60	1474.62	-12.11	-12.53	1.82	1.35	12.66	171.72
1500.00	1.80	84.31	1499.61	-12.51	-12.56	2.68	2.50	12.84	167.94
1525.00	1.58	64.03	1524.60	-12.63	-12.37	3.38	2.52	12.82	164.70
1550.00	1.62	60.02	1549.59	-12.60	-12.04	4.00	0.48	12.69	161.61
1575.00	1.60	68.41	1574.58	-12.59	-11.74	4.63	0.95	12.62	158.45
1600.00	1.73	68.47	1599.57	-12.64	-11.47	5.31	0.52	12.64	155.16
1625.00	1.73	69.98	1624.55	-12.70	-11.20	6.02	0.18	12.71	151.76
1650.00	1.72	74.02	1649.54	-12.79	-10.97	6.73	0.49	12.87	148.46

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	"/100ft	ft	deg
1675.00	1.78	75.75	1674.53	-12.92	-10.77	7.47	0.33	13.11	145.26
1700.00	1.73	80.50	1699.52	-13.10	-10.61	8.22	0.62	13.42	142.24
1725.00	1.79	87.27	1724.51	-13.35	-10.53	8.98	0.87	13.84	139.54
1750.00	1.80	87.04	1749.50	-13.65	-10.49	9.76	0.03	14.33	137.06
1775.00	1.91	88.32	1774.48	-13.96	-10.46	10.57	0.50	14.87	134.69
1800.00	1.89	90.08	1799.47	-14.30	-10.45	11.40	0.25	15.47	132.49
1825.00	1.83	95.53	1824.46	-14.68	-10.49	12.21	0.75	16.10	130.65
1850.00	1.58	88.33	1849.44	-15.02	-10.51	12.95	1.32	16.68	129.07
1875.00	0.87	64.08	1874.44	-15.16	-10.42	13.47	3.43	17.03	127.73
1900.00	0.48	6.04	1899.44	-15.07	-10.23	13.65	2.97	17.06	126.86
1925.00	0.68	337.54	1924.44	-14.83	-9.99	13.60	1.37	16.88	126.29
1950.00	0.77	332.95	1949.43	-14.51	-9.70	13.47	0.44	16.60	125.77
1975.00	0.73	334.06	1974.43	-14.18	-9.41	13.33	0.19	16.31	125.23
2000.00	0.78	333.15	1999.43	-13.86	-9.12	13.18	0.24	16.03	124.68
2025.00	0.64	338.51	2024.43	-13.54	-8.83	13.05	0.63	15.76	124.10
2050.00	0.53	341.97	2049.43	-13.29	-8.59	12.96	0.47	15.55	123.54
2075.00	0.47	347.09	2074.43	-13.08	-8.38	12.91	0.28	15.39	123.01
2100.00	0.34	344.06	2099.42	-12.90	-8.21	12.86	0.54	15.26	122.56
2125.00	0.38	358.87	2124.42	-12.75	-8.06	12.84	0.40	15.16	122.11
2150.00	0.32	356.30	2149.42	-12.61	-7.91	12.83	0.25	15.07	121.64
2175.00	0.23	357.71	2174.42	-12.50	-7.79	12.83	0.34	15.01	121.26
2200.00	0.10	13.45	2199.42	-12.44	-7.71	12.83	0.55	14.97	121.02
2225.00	0.36	5.45	2224.42	-12.35	-7.61	12.84	1.03	14.93	120.66
2250.00	0.41	6.00	2249.42	-12.21	-7.45	12.86	0.18	14.86	120.08
2275.00	0.30	25.85	2274.42	-12.09	-7.30	12.90	0.65	14.82	119.51
2300.00	0.42	30.31	2299.42	-12.00	-7.16	12.97	0.52	14.82	118.91
2325.00	0.37	29.14	2324.42	-11.90	-7.01	13.06	0.21	14.82	118.24
2350.00	0.36	40.45	2349.42	-11.82	-6.88	13.15	0.29	14.84	117.63
2375.00	0.40	47.40	2374.42	-11.76	-6.76	13.26	0.24	14.89	117.02
2400.00	0.31	89.59	2399.42	-11.76	-6.70	13.39	1.07	14.98	116.59
2425.00	0.30	79.43	2424.42	-11.81	-6.69	13.53	0.22	15.09	116.32
2450.00	0.32	54.96	2449.42	-11.81	-6.64	13.65	0.53	15.18	115.94

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	°/100ft	ft	deg
2475.00	0.38	55.76	2474.42	-11.79	-6.55	13.78	0.25	15.26	115.44
2500.00	0.38	68.73	2499.42	-11.78	-6.47	13.92	0.35	15.36	114.94
2525.00	0.46	75.52	2524.42	-11.80	-6.42	14.10	0.36	15.49	114.48
2550.00	0.43	62.57	2549.42	-11.82	-6.35	14.28	0.42	15.63	113.98
2575.00	0.42	75.09	2574.42	-11.83	-6.28	14.45	0.37	15.76	113.51
2600.00	0.45	80.66	2599.42	-11.87	-6.25	14.63	0.21	15.91	113.11
2625.00	0.32	89.49	2624.41	-11.93	-6.23	14.80	0.56	16.06	112.82
2650.00	0.43	105.89	2649.41	-12.02	-6.25	14.96	0.60	16.22	112.68
2675.00	0.43	108.49	2674.41	-12.15	-6.31	15.14	0.08	16.40	112.62
2700.00	0.42	100.08	2699.41	-12.27	-6.36	15.32	0.26	16.59	112.53
2725.00	0.46	104.41	2724.41	-12.38	-6.40	15.51	0.20	16.78	112.41
2750.00	0.53	112.01	2749.41	-12.53	-6.46	15.71	0.39	16.99	112.36
2775.00	0.58	121.14	2774.41	-12.72	-6.57	15.93	0.41	17.23	112.43
2800.00	0.57	114.58	2799.41	-12.92	-6.69	16.15	0.27	17.48	112.50
2825.00	0.62	110.69	2824.41	-13.11	-6.79	16.39	0.27	17.74	112.50
2850.00	0.61	115.40	2849.41	-13.31	-6.89	16.63	0.21	18.00	112.51
2875.00	0.54	118.65	2874.40	-13.51	-7.01	16.85	0.31	18.25	112.57
2900.00	0.65	115.68	2899.40	-13.71	-7.12	17.09	0.49	18.51	112.63
2925.00	0.76	127.68	2924.40	-13.97	-7.29	17.35	0.72	18.81	112.79
2950.00	0.61	124.23	2949.40	-14.23	-7.46	17.59	0.60	19.11	113.00
2975.00	0.60	114.03	2974.40	-14.45	-7.59	17.82	0.44	19.37	113.08
3000.00	0.63	116.97	2999.40	-14.66	-7.71	18.06	0.16	19.64	113.11
3025.00	0.71	125.86	3024.39	-14.90	-7.86	18.31	0.54	19.93	113.24
3050.00	0.63	130.97	3049.39	-15.16	-8.04	18.54	0.42	20.21	113.45
3075.00	0.68	123.42	3074.39	-15.41	-8.21	18.76	0.40	20.48	113.64
3100.00	0.64	124.57	3099.39	-15.66	-8.37	19.00	0.15	20.77	113.78
3125.00	0.70	128.51	3124.39	-15.92	-8.55	19.24	0.29	21.05	113.96
3150.00	0.71	131.30	3149.39	-16.20	-8.75	19.47	0.14	21.35	114.19
3175.00	0.70	136.23	3174.38	-16.48	-8.96	19.70	0.24	21.64	114.46
3200.00	0.78	135.24	3199.38	-16.79	-9.19	19.92	0.32	21.94	114.76
3225.00	0.65	141.61	3224.38	-17.09	-9.42	20.13	0.62	22.23	115.08
3250.00	0.67	142.93	3249.38	-17.37	-9.65	20.31	0.13	22.48	115.42

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	°/100ft	ft	deg
3275.00	0.62	147.62	3274.38	-17.64	-9.88	20.47	0.31	22.73	115.77
3300.00	0.65	143.94	3299.38	-17.92	-10.11	20.62	0.20	22.97	116.11
3325.00	0.69	136.75	3324.37	-18.20	-10.33	20.81	0.39	23.23	116.41
3350.00	0.71	145.08	3349.37	-18.49	-10.57	21.00	0.41	23.51	116.72
3375.00	0.62	143.73	3374.37	-18.78	-10.80	21.17	0.35	23.77	117.04
3400.00	0.62	131.54	3399.37	-19.04	-11.00	21.35	0.53	24.02	117.27
3425.00	0.62	139.62	3424.37	-19.29	-11.20	21.54	0.35	24.28	117.47
3450.00	0.67	129.67	3449.37	-19.56	-11.39	21.74	0.48	24.54	117.66
3475.00	0.60	116.21	3474.36	-19.79	-11.54	21.97	0.64	24.82	117.72
3500.00	0.59	136.67	3499.36	-20.02	-11.70	22.18	0.85	25.07	117.81
3525.00	0.63	153.24	3524.36	-20.28	-11.91	22.33	0.72	25.31	118.08
3550.00	0.48	134.58	3549.36	-20.51	-12.11	22.46	0.95	25.52	118.33
3575.00	0.10	350.37	3574.36	-20.59	-12.16	22.53	2.24	25.61	118.36
3600.00	0.29	307.79	3599.36	-20.51	-12.10	22.48	0.91	25.53	118.29
3625.00	0.44	293.36	3624.36	-20.38	-12.02	22.34	0.70	25.37	118.29
3650.00	0.57	294.60	3649.36	-20.21	-11.93	22.14	0.54	25.15	118.33
3675.00	0.64	292.61	3674.36	-20.02	-11.83	21.90	0.28	24.89	118.38
3700.00	0.50	299.03	3699.36	-19.82	-11.72	21.67	0.64	24.64	118.41
3725.00	0.43	303.55	3724.36	-19.66	-11.62	21.50	0.30	24.44	118.38
3750.00	0.43	306.50	3749.35	-19.49	-11.51	21.35	0.09	24.25	118.33
3775.00	0.51	285.76	3774.35	-19.34	-11.43	21.17	0.74	24.05	118.36
3800.00	0.55	287.79	3799.35	-19.19	-11.36	20.95	0.20	23.83	118.47
3825.00	0.51	293.03	3824.35	-19.02	-11.28	20.73	0.25	23.60	118.55
3850.00	0.59	290.30	3849.35	-18.85	-11.19	20.51	0.31	23.36	118.62
3875.00	0.57	304.91	3874.35	-18.65	-11.07	20.28	0.59	23.11	118.63
3900.00	0.54	297.77	3899.35	-18.44	-10.95	20.08	0.31	22.87	118.60
3925.00	0.71	293.28	3924.35	-18.23	-10.83	19.83	0.70	22.60	118.64
3950.00	0.59	292.68	3949.34	-18.02	-10.72	19.57	0.45	22.31	118.72
3975.00	0.54	288.91	3974.34	-17.85	-10.63	19.34	0.28	22.07	118.80
4000.00	0.48	281.46	3999.34	-17.70	-10.57	19.13	0.34	21.85	118.94
4025.00	0.64	277.97	4024.34	-17.56	-10.53	18.89	0.63	21.62	119.15
4050.00	0.58	279.12	4049.34	-17.42	-10.49	18.62	0.24	21.38	119.40

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	°/100ft	ft	deg
4075.00	0.58	293.32	4074.34	-17.25	-10.42	18.38	0.57	21.13	119.56
4100.00	0.41	298.82	4099.34	-17.08	-10.33	18.19	0.69	20.92	119.60
4125.00	0.37	283.94	4124.34	-16.96	-10.27	18.03	0.45	20.75	119.66
4150.00	0.43	278.07	4149.34	-16.86	-10.24	17.86	0.31	20.59	119.82
4175.00	0.42	282.06	4174.34	-16.75	-10.20	17.68	0.12	20.41	119.99
4200.00	0.28	283.46	4199.34	-16.66	-10.17	17.53	0.59	20.26	120.12
4225.00	0.37	271.33	4224.33	-16.58	-10.15	17.39	0.48	20.14	120.28
4250.00	0.31	275.88	4249.33	-16.51	-10.15	17.24	0.27	20.00	120.48
4275.00	0.39	291.71	4274.33	-16.41	-10.11	17.09	0.50	19.86	120.60
4300.00	0.35	288.90	4299.33	-16.30	-10.05	16.94	0.20	19.70	120.68
4325.00	0.16	301.49	4324.33	-16.22	-10.01	16.84	0.76	19.59	120.72
4350.00	0.14	224.06	4349.33	-16.20	-10.01	16.79	0.76	19.54	120.81
4375.00	0.24	202.33	4374.33	-16.24	-10.08	16.75	0.49	19.55	121.04
4400.00	0.33	177.09	4399.33	-16.34	-10.20	16.73	0.61	19.59	121.37
4425.00	0.56	169.23	4424.33	-16.53	-10.39	16.76	0.97	19.72	121.80
4450.00	0.62	167.23	4449.33	-16.78	-10.64	16.81	0.24	19.90	122.34
4475.00	0.67	177.44	4474.33	-17.05	-10.92	16.85	0.51	20.08	122.96
4500.00	0.56	172.37	4499.33	-17.30	-11.19	16.87	0.51	20.24	123.56
4525.00	0.56	167.57	4524.33	-17.53	-11.43	16.91	0.19	20.41	124.05
4550.00	0.61	158.55	4549.33	-17.79	-11.67	16.99	0.43	20.61	124.50
4575.00	0.63	182.03	4574.32	-18.04	-11.94	17.03	1.01	20.80	125.02
4600.00	0.63	218.08	4599.32	-18.23	-12.18	16.94	1.55	20.87	125.71
4625.00	0.54	211.35	4624.32	-18.35	-12.39	16.80	0.44	20.87	126.41
4650.00	0.49	203.87	4649.32	-18.49	-12.59	16.69	0.33	20.90	127.02
4675.00	0.62	225.78	4674.32	-18.60	-12.78	16.55	1.00	20.91	127.67
4700.00	0.70	276.74	4699.32	-18.57	-12.86	16.30	2.31	20.76	128.26
4725.00	0.83	288.73	4724.32	-18.36	-12.78	15.98	0.80	20.46	128.66
4750.00	0.88	294.31	4749.31	-18.09	-12.64	15.63	0.41	20.10	128.97
4775.00	0.77	294.43	4774.31	-17.81	-12.49	15.30	0.44	19.75	129.23
4800.00	0.91	293.92	4799.31	-17.54	-12.34	14.97	0.53	19.40	129.51
4825.00	0.84	297.71	4824.30	-17.24	-12.18	14.62	0.35	19.03	129.79
4850.00	0.99	299.30	4849.30	-16.92	-11.99	14.27	0.60	18.64	130.02

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	°/100ft	ft	deg
4875.00	0.85	297.48	4874.30	-16.60	-11.80	13.92	0.55	18.25	130.28
4900.00	0.92	295.57	4899.29	-16.29	-11.62	13.57	0.29	17.87	130.57
4925.00	0.94	290.45	4924.29	-15.99	-11.47	13.20	0.34	17.49	130.97
4950.00	0.94	288.88	4949.29	-15.70	-11.33	12.82	0.10	17.11	131.47
4975.00	0.79	292.48	4974.29	-15.43	-11.20	12.47	0.64	16.76	131.93
5000.00	1.01	281.65	4999.28	-15.18	-11.09	12.09	1.13	16.40	132.52
5025.00	0.92	288.54	5024.28	-14.90	-10.98	11.69	0.60	16.03	133.21
5050.00	0.92	281.18	5049.28	-14.65	-10.88	11.30	0.47	15.68	133.91
5075.00	0.95	281.73	5074.27	-14.41	-10.80	10.90	0.12	15.34	134.72
5100.00	0.87	281.55	5099.27	-14.17	-10.72	10.51	0.32	15.01	135.54
5125.00	1.09	276.12	5124.27	-13.93	-10.65	10.09	0.96	14.67	136.55
5150.00	0.99	268.67	5149.26	-13.72	-10.63	9.64	0.68	14.35	137.80
5175.00	0.97	267.65	5174.26	-13.55	-10.65	9.21	0.09	14.08	139.13
5200.00	1.05	270.71	5199.25	-13.37	-10.65	8.77	0.36	13.80	140.52
5225.00	0.96	265.90	5224.25	-13.20	-10.66	8.34	0.48	13.53	141.98
5250.00	1.07	265.45	5249.25	-13.04	-10.70	7.89	0.46	13.29	143.57
5275.00	0.86	259.95	5274.24	-12.91	-10.75	7.47	0.92	13.09	145.18
5300.00	0.88	251.63	5299.24	-12.83	-10.84	7.11	0.51	12.96	146.75
5325.00	0.88	249.03	5324.24	-12.80	-10.97	6.75	0.16	12.88	148.41
5350.00	1.01	251.18	5349.23	-12.76	-11.11	6.36	0.56	12.80	150.22
5375.00	1.00	246.72	5374.23	-12.73	-11.27	5.95	0.32	12.74	152.17
5400.00	0.92	242.58	5399.23	-12.73	-11.45	5.57	0.41	12.73	154.05
5425.00	0.81	237.12	5424.22	-12.76	-11.64	5.24	0.57	12.76	155.75
5450.00	0.77	223.82	5449.22	-12.84	-11.85	4.98	0.75	12.86	157.22
5475.00	0.65	205.60	5474.22	-13.00	-12.10	4.80	1.02	13.02	158.37
5500.00	0.62	206.33	5499.22	-13.17	-12.35	4.68	0.16	13.21	159.26
5525.00	0.67	214.19	5524.22	-13.33	-12.59	4.54	0.41	13.39	160.19
5550.00	0.66	216.62	5549.21	-13.47	-12.83	4.37	0.12	13.55	161.20
5575.00	0.51	216.58	5574.21	-13.59	-13.03	4.22	0.59	13.70	162.08
5600.00	0.55	209.11	5599.21	-13.71	-13.23	4.09	0.32	13.85	162.81
5625.00	0.47	204.01	5624.21	-13.85	-13.43	3.99	0.35	14.01	163.45
5650.00	0.57	77.62	5649.21	-13.95	-13.50	4.07	3.74	14.10	163.22

MD ft	INC deg	AZIM deg	TVD ft	VS ft	+N/-S ft	+E/-W ft	DLS °/100ft	CLOSURE DIST ft	CLOSURE DIR deg
5675.00	1.04	68.14	5674.21	-13.99	-13.39	4.40	1.96	14.09	161.79
5700.00	1.37	66.98	5699.20	-14.01	-13.18	4.89	1.29	14.06	159.66
5725.00	1.49	65.52	5724.19	-14.03	-12.93	5.46	0.52	14.04	157.12
5750.00	1.51	68.62	5749.19	-14.05	-12.68	6.06	0.34	14.05	154.44
5775.00	1.46	71.88	5774.18	-14.11	-12.46	6.67	0.41	14.13	151.83
5800.00	1.26	76.67	5799.17	-14.21	-12.30	7.24	0.91	14.27	149.50
5825.00	0.88	79.73	5824.17	-14.31	-12.20	7.70	1.54	14.42	147.75
5850.00	0.28	104.88	5849.16	-14.40	-12.18	7.94	2.56	14.54	146.89
5875.00	0.15	169.21	5874.16	-14.47	-12.23	8.01	1.00	14.62	146.78
5900.00	0.44	229.38	5899.16	-14.53	-12.32	7.94	1.54	14.66	147.19
5925.00	0.68	232.60	5924.16	-14.58	-12.47	7.75	1.00	14.68	148.14
5950.00	1.03	227.99	5949.16	-14.68	-12.71	7.47	1.41	14.74	149.58
5975.00	1.26	224.62	5974.15	-14.84	-13.06	7.10	0.96	14.87	151.46
6000.00	1.47	224.62	5999.15	-15.05	-13.48	6.69	0.83	15.05	153.63
6025.00	1.54	224.98	6024.14	-15.27	-13.95	6.22	0.29	15.28	155.96
6050.00	1.56	219.89	6049.13	-15.53	-14.45	5.77	0.56	15.56	158.25
6075.00	1.70	214.07	6074.12	-15.86	-15.02	5.34	0.85	15.94	160.43
6100.00	1.63	213.79	6099.11	-16.24	-15.62	4.93	0.26	16.38	162.47
6125.00	1.56	210.28	6124.10	-16.61	-16.21	4.56	0.48	16.84	164.28
6150.00	1.61	206.36	6149.09	-17.03	-16.82	4.24	0.47	17.35	165.86
6175.00	1.66	199.43	6174.08	-17.50	-17.48	3.96	0.82	17.92	167.23
6200.00	2.02	195.33	6199.07	-18.10	-18.24	3.72	1.54	18.62	168.47
6225.00	2.39	190.71	6224.05	-18.85	-19.18	3.51	1.63	19.50	169.63
6250.00	2.70	185.37	6249.02	-19.78	-20.28	3.36	1.56	20.56	170.60
6275.00	2.94	182.06	6273.99	-20.86	-21.51	3.28	1.17	21.76	171.33
6300.00	3.24	178.71	6298.96	-22.08	-22.86	3.27	1.40	23.09	171.85
6325.00	3.33	179.23	6323.92	-23.39	-24.29	3.30	0.36	24.51	172.27
6350.00	3.32	180.05	6348.87	-24.70	-25.74	3.31	0.19	25.95	172.68
6375.00	3.11	181.40	6373.83	-25.97	-27.14	3.29	0.90	27.34	173.09
6400.00	2.66	189.56	6398.80	-27.05	-28.39	3.18	2.44	28.57	173.62
6425.00	1.99	201.81	6423.78	-27.82	-29.37	2.92	3.31	29.51	174.32
6450.00	1.63	211.32	6448.77	-28.32	-30.07	2.57	1.87	30.18	175.11

MD	INC	AZIM	TVD	VS	+N/-S	+E/-W	DLS	CLOSURE DIST	CLOSURE DIR
ft	deg	deg	ft	ft	ft	ft	"/100ft	ft	deg
6475.00	1.35	226.37	6473.76	-28.61	-30.58	2.17	1.93	30.66	175.93
6500.00	1.85	231.46	6498.75	-28.79	-31.04	1.64	2.08	31.08	176.97
6525.00	1.95	237.14	6523.74	-28.94	-31.52	0.97	0.86	31.53	178.23
6550.00	2.07	234.36	6548.72	-29.08	-32.01	0.25	0.60	32.01	179.56
6575.00	2.01	233.56	6573.71	-29.25	-32.54	-0.47	0.26	32.54	180.83
6600.00	1.65	243.98	6598.69	-29.34	-32.95	-1.15	1.94	32.97	181.99
6625.00	1.59	251.42	6623.68	-29.31	-33.22	-1.80	0.88	33.27	183.10
6650.00	1.46	256.17	6648.67	-29.20	-33.41	-2.44	0.74	33.50	184.17
6675.00	1.40	259.16	6673.67	-29.07	-33.54	-3.05	0.37	33.68	185.19
6700.00	1.17	280.69	6698.66	-28.84	-33.55	-3.60	2.13	33.75	186.12
6725.00	0.99	303.25	6723.66	-28.51	-33.39	-4.03	1.83	33.63	186.88
6750.00	0.93	299.56	6748.65	-28.16	-33.17	-4.38	0.34	33.46	187.53
6775.00	0.73	291.96	6773.65	-27.88	-33.01	-4.71	0.90	33.34	188.12
6800.00	0.72	296.33	6798.65	-27.64	-32.88	-5.00	0.23	33.26	188.64
6825.00	0.71	293.37	6823.65	-27.40	-32.75	-5.28	0.15	33.17	189.16
6850.00	0.85	286.33	6848.64	-27.16	-32.64	-5.60	0.65	33.11	189.74
6875.00	1.04	282.85	6873.64	-26.90	-32.53	-6.00	0.79	33.08	190.45
6900.00	1.12	272.99	6898.64	-26.64	-32.47	-6.46	0.82	33.11	191.26
6925.00	1.04	277.43	6923.63	-26.40	-32.43	-6.93	0.48	33.16	192.07
6950.00	0.56	295.92	6948.63	-26.19	-32.35	-7.27	2.14	33.15	192.66
6975.00	0.20	7.27	6973.63	-26.06	-32.25	-7.37	2.13	33.08	192.88
7000.00	0.61	84.63	6998.63	-26.06	-32.20	-7.24	2.38	33.00	192.67
7020.00	0.79	102.01	7018.63	-26.18	-32.21	-6.99	1.41	32.96	192.25



NM OIL CONSERVATION
ARTESIA DISTRICT
DEC 07 2017
RECEIVED

COG Operating LLC

Eddy County, NM (NAD83 NME)
Craig Federal Com
12H

OH /

Design: Surveys (Ensign 155)

Standard Survey Report

11 August, 2017





Phoenix Technology Services LP
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
325.00	1.56	204.37	324.91	-6.32	-3.42	-6.21	0.20	-0.12	-5.92
350.00	1.49	206.21	349.90	-6.92	-3.70	-6.81	0.34	-0.28	7.36
375.00	1.46	203.25	374.89	-7.50	-3.97	-7.38	0.33	-0.12	-11.84
400.00	1.38	201.92	399.89	-8.07	-4.21	-7.95	0.35	-0.32	-5.32
425.00	1.30	203.24	424.88	-8.61	-4.43	-8.48	0.34	-0.32	5.28
450.00	1.30	205.12	449.87	-9.13	-4.67	-8.99	0.17	0.00	7.52
475.00	1.24	205.69	474.87	-9.63	-4.90	-9.48	0.25	-0.24	2.28
500.00	1.17	208.78	499.86	-10.10	-5.14	-9.94	0.38	-0.28	12.36
525.00	1.04	203.58	524.86	-10.53	-5.36	-10.37	0.66	-0.52	-20.80
550.00	0.90	203.54	549.85	-10.92	-5.53	-10.75	0.56	-0.56	-0.16
575.00	0.89	203.49	574.85	-11.28	-5.68	-11.10	0.04	-0.04	-0.20
600.00	0.81	202.63	599.85	-11.62	-5.83	-11.44	0.32	-0.32	-3.44
625.00	0.71	197.34	624.85	-11.93	-5.94	-11.75	0.49	-0.40	-21.16
650.00	0.46	189.43	649.84	-12.17	-6.00	-11.99	1.05	-1.00	-31.64
675.00	0.38	91.17	674.84	-12.28	-5.94	-12.10	2.55	-0.32	-393.04
700.00	0.73	66.60	699.84	-12.21	-5.71	-12.04	1.66	1.40	-98.28
725.00	1.11	51.91	724.84	-12.00	-5.37	-11.84	1.78	1.52	-58.76
750.00	1.36	52.35	749.83	-11.67	-4.95	-11.52	1.00	1.00	1.76
775.00	1.41	52.45	774.83	-11.30	-4.47	-11.17	0.20	0.20	0.40
800.00	1.48	53.58	799.82	-10.92	-3.96	-10.80	0.30	0.28	4.52
825.00	1.51	52.41	824.81	-10.53	-3.44	-10.42	0.17	0.12	-4.68
850.00	1.48	51.80	849.80	-10.13	-2.93	-10.04	0.14	-0.12	-2.44
875.00	1.62	49.61	874.79	-9.70	-2.41	-9.63	0.61	0.56	-8.76
900.00	1.49	51.37	899.78	-9.27	-1.88	-9.21	0.55	-0.52	7.04
925.00	1.19	50.85	924.78	-8.90	-1.43	-8.86	1.20	-1.20	-2.08
950.00	0.81	46.62	949.77	-8.62	-1.10	-8.58	1.55	-1.52	-16.92
975.00	0.42	359.47	974.77	-8.40	-0.97	-8.37	2.43	-1.56	-188.60
1,000.00	0.56	294.29	999.77	-8.26	-1.08	-8.23	2.16	0.56	-260.72
1,025.00	0.75	275.84	1,024.77	-8.20	-1.36	-8.15	1.13	0.76	-73.80
1,050.00	0.81	275.68	1,049.77	-8.16	-1.69	-8.11	0.24	0.24	-0.64
1,075.00	0.84	269.88	1,074.76	-8.14	-2.05	-8.08	0.35	0.12	-23.20
1,100.00	0.87	266.18	1,099.76	-8.16	-2.43	-8.08	0.25	0.12	-14.80
1,125.00	0.98	257.74	1,124.76	-8.22	-2.82	-8.13	0.70	0.44	-33.76
1,150.00	1.00	260.61	1,149.75	-8.30	-3.25	-8.20	0.21	0.08	11.48
1,175.00	0.95	257.26	1,174.75	-8.38	-3.67	-8.27	0.30	-0.20	-13.40
1,200.00	1.01	237.92	1,199.75	-8.54	-4.06	-8.42	1.34	0.24	-77.36
1,225.00	0.68	205.63	1,224.74	-8.79	-4.31	-8.66	2.27	-1.32	-129.16
1,250.00	0.83	151.47	1,249.74	-9.08	-4.28	-8.95	2.80	0.60	-216.64
1,275.00	1.24	139.60	1,274.74	-9.45	-4.02	-9.33	1.84	1.64	-47.48
1,300.00	1.30	132.04	1,299.73	-9.84	-3.64	-9.73	0.71	0.24	-30.24
1,325.00	1.54	125.01	1,324.72	-10.23	-3.15	-10.13	1.18	0.96	-28.12
1,350.00	1.97	123.94	1,349.71	-10.66	-2.52	-10.58	1.72	1.72	-4.28
1,375.00	2.01	120.03	1,374.70	-11.12	-1.78	-11.06	0.57	0.16	-15.64



Phoenix Technology Services LP
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,400.00	2.17	118.33	1,399.68	-11.56	-0.99	-11.53	0.69	0.64	-6.80
1,425.00	2.35	111.84	1,424.66	-11.98	-0.09	-11.97	1.25	0.72	-25.96
1,450.00	2.33	106.28	1,449.64	-12.31	0.87	-12.33	0.91	-0.08	-22.24
1,475.00	2.18	98.60	1,474.62	-12.53	1.83	-12.57	1.35	-0.60	-30.72
1,500.00	1.80	84.31	1,499.61	-12.56	2.69	-12.63	2.49	-1.52	-57.16
1,525.00	1.58	64.03	1,524.60	-12.37	3.39	-12.46	2.53	-0.88	-81.12
1,550.00	1.62	60.02	1,549.59	-12.04	4.01	-12.15	0.48	0.16	-16.04
1,575.00	1.60	68.41	1,574.58	-11.74	4.64	-11.87	0.95	-0.08	33.56
1,600.00	1.73	68.47	1,599.57	-11.47	5.31	-11.62	0.52	0.52	0.24
1,625.00	1.73	69.98	1,624.55	-11.20	6.02	-11.37	0.18	0.00	6.04
1,650.00	1.72	74.02	1,649.54	-10.97	6.73	-11.16	0.49	-0.04	16.16
1,675.00	1.78	75.75	1,674.53	-10.77	7.47	-10.98	0.32	0.24	6.92
1,700.00	1.73	80.50	1,699.52	-10.61	8.22	-10.85	0.62	-0.20	19.00
1,725.00	1.79	87.27	1,724.51	-10.53	8.98	-10.79	0.87	0.24	27.08
1,750.00	1.80	87.04	1,749.50	-10.49	9.76	-10.77	0.05	0.04	-0.92
1,775.00	1.91	88.32	1,774.48	-10.46	10.57	-10.76	0.47	0.44	5.12
1,800.00	1.89	90.08	1,799.47	-10.45	11.40	-10.78	0.25	-0.08	7.04
1,825.00	1.83	95.53	1,824.46	-10.49	12.21	-10.84	0.75	-0.24	21.80
1,850.00	1.58	88.33	1,849.44	-10.51	12.95	-10.89	1.32	-1.00	-28.80
1,875.00	0.87	64.08	1,874.44	-10.42	13.47	-10.81	3.46	-2.84	-97.00
1,900.00	0.48	6.04	1,899.44	-10.23	13.65	-10.63	2.95	-1.56	-232.16
1,925.00	0.68	337.54	1,924.44	-9.99	13.60	-10.39	1.38	0.80	-114.00
1,950.00	0.77	332.95	1,949.43	-9.71	13.47	-10.10	0.43	0.36	-18.36
1,975.00	0.73	334.06	1,974.43	-9.41	13.32	-9.80	0.17	-0.16	4.44
2,000.00	0.78	333.15	1,999.43	-9.12	13.18	-9.50	0.21	0.20	-3.64
2,025.00	0.64	338.51	2,024.43	-8.84	13.05	-9.22	0.62	-0.56	21.44
2,050.00	0.53	341.97	2,049.43	-8.60	12.96	-8.97	0.46	-0.44	13.84
2,075.00	0.47	347.09	2,074.43	-8.39	12.90	-8.76	0.30	-0.24	20.48
2,100.00	0.34	344.06	2,099.43	-8.22	12.86	-8.59	0.53	-0.52	-12.12
2,125.00	0.38	358.87	2,124.42	-8.06	12.84	-8.43	0.40	0.16	59.24
2,150.00	0.32	356.30	2,149.42	-7.91	12.83	-8.28	0.25	-0.24	-10.28
2,175.00	0.23	357.71	2,174.42	-7.79	12.82	-8.16	0.36	-0.36	5.64
2,200.00	0.10	13.45	2,199.42	-7.72	12.83	-8.09	0.55	-0.52	62.96
2,225.00	0.36	5.45	2,224.42	-7.62	12.84	-7.99	1.05	1.04	-32.00
2,250.00	0.41	6.00	2,249.42	-7.45	12.86	-7.82	0.20	0.20	2.20
2,275.00	0.30	25.85	2,274.42	-7.30	12.90	-7.68	0.65	-0.44	79.40
2,300.00	0.42	30.31	2,299.42	-7.17	12.97	-7.54	0.49	0.48	17.84
2,325.00	0.37	29.14	2,324.42	-7.02	13.06	-7.40	0.20	-0.20	-4.68
2,350.00	0.36	40.45	2,349.42	-6.89	13.15	-7.27	0.29	-0.04	45.24
2,375.00	0.40	47.40	2,374.42	-6.77	13.26	-7.15	0.24	0.16	27.80
2,400.00	0.31	89.59	2,399.42	-6.71	13.39	-7.10	1.08	-0.36	168.76
2,425.00	0.30	79.43	2,424.42	-6.70	13.52	-7.09	0.22	-0.04	-40.64
2,450.00	0.32	54.96	2,449.42	-6.64	13.65	-7.04	0.53	0.08	-97.88



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
2,475.00	0.38	55.76	2,474.42	-6.56	13.77	-6.96	0.24	0.24	3.20
2,500.00	0.38	68.73	2,499.42	-6.48	13.92	-6.88	0.34	0.00	51.88
2,525.00	0.46	75.52	2,524.42	-6.42	14.09	-6.83	0.38	0.32	27.16
2,550.00	0.43	62.57	2,549.42	-6.36	14.27	-6.77	0.42	-0.12	-51.80
2,575.00	0.42	75.09	2,574.42	-6.29	14.44	-6.71	0.37	-0.04	50.08
2,600.00	0.45	80.66	2,599.42	-6.25	14.63	-6.68	0.21	0.12	22.28
2,625.00	0.32	89.49	2,624.41	-6.23	14.80	-6.66	0.57	-0.52	35.32
2,650.00	0.43	105.89	2,649.41	-6.26	14.96	-6.69	0.61	0.44	65.60
2,675.00	0.43	108.49	2,674.41	-6.31	15.14	-6.75	0.08	0.00	10.40
2,700.00	0.42	100.08	2,699.41	-6.36	15.31	-6.80	0.25	-0.04	-33.64
2,725.00	0.46	104.41	2,724.41	-6.40	15.50	-6.85	0.21	0.16	17.32
2,750.00	0.53	112.01	2,749.41	-6.47	15.71	-6.93	0.38	0.28	30.40
2,775.00	0.58	121.14	2,774.41	-6.58	15.92	-7.04	0.41	0.20	36.52
2,800.00	0.57	114.58	2,799.41	-6.69	16.14	-7.16	0.27	-0.04	-26.24
2,825.00	0.62	110.69	2,824.41	-6.79	16.38	-7.27	0.26	0.20	-15.56
2,850.00	0.61	115.40	2,849.41	-6.90	16.63	-7.38	0.21	-0.04	18.84
2,875.00	0.54	118.65	2,874.40	-7.01	16.85	-7.50	0.31	-0.28	13.00
2,900.00	0.65	115.68	2,899.40	-7.13	17.08	-7.63	0.46	0.44	-11.88
2,925.00	0.76	127.68	2,924.40	-7.29	17.34	-7.80	0.73	0.44	48.00
2,950.00	0.61	124.23	2,949.40	-7.47	17.58	-7.98	0.62	-0.60	-13.80
2,975.00	0.60	114.03	2,974.40	-7.60	17.81	-8.12	0.43	-0.04	-40.80
3,000.00	0.63	116.97	2,999.40	-7.71	18.06	-8.24	0.17	0.12	11.76
3,025.00	0.71	125.86	3,024.40	-7.87	18.30	-8.40	0.52	0.32	35.56
3,050.00	0.63	130.97	3,049.39	-8.05	18.53	-8.59	0.40	-0.32	20.44
3,075.00	0.68	123.42	3,074.39	-8.22	18.76	-8.76	0.40	0.20	-30.20
3,100.00	0.64	124.57	3,099.39	-8.38	19.00	-8.93	0.17	-0.16	4.60
3,125.00	0.70	128.51	3,124.39	-8.55	19.23	-9.11	0.30	0.24	15.76
3,150.00	0.71	131.30	3,149.39	-8.75	19.47	-9.32	0.14	0.04	11.16
3,175.00	0.70	136.23	3,174.38	-8.96	19.69	-9.54	0.25	-0.04	19.72
3,200.00	0.78	135.24	3,199.38	-9.20	19.92	-9.77	0.32	0.32	-3.96
3,225.00	0.65	141.61	3,224.38	-9.43	20.13	-10.01	0.61	-0.52	25.48
3,250.00	0.67	142.93	3,249.38	-9.66	20.30	-10.25	0.10	0.08	5.28
3,275.00	0.62	147.62	3,274.38	-9.89	20.46	-10.48	0.29	-0.20	18.76
3,300.00	0.65	143.94	3,299.38	-10.11	20.62	-10.71	0.20	0.12	-14.72
3,325.00	0.69	136.75	3,324.37	-10.34	20.81	-10.94	0.37	0.16	-28.76
3,350.00	0.71	145.08	3,349.37	-10.58	21.00	-11.19	0.41	0.08	33.32
3,375.00	0.62	143.73	3,374.37	-10.81	21.17	-11.43	0.37	-0.36	-5.40
3,400.00	0.62	131.54	3,399.37	-11.01	21.35	-11.63	0.53	0.00	-48.76
3,425.00	0.62	139.62	3,424.37	-11.20	21.54	-11.83	0.35	0.00	32.32
3,450.00	0.67	129.67	3,449.37	-11.40	21.74	-12.03	0.49	0.20	-39.80
3,475.00	0.60	116.21	3,474.36	-11.55	21.97	-12.19	0.66	-0.28	-53.84
3,500.00	0.59	136.67	3,499.36	-11.70	22.17	-12.35	0.85	-0.04	81.84
3,525.00	0.63	153.24	3,524.36	-11.92	22.32	-12.57	0.72	0.16	66.28
3,550.00	0.48	134.58	3,549.36	-12.11	22.46	-12.77	0.93	-0.60	-74.64



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
3,575.00	0.10	350.37	3,574.36	-12.17	22.53	-12.82	2.26	-1.52	-576.84
3,600.00	0.29	307.79	3,599.36	-12.11	22.48	-12.76	0.91	0.76	-170.32
3,625.00	0.44	293.36	3,624.36	-12.03	22.34	-12.68	0.70	0.60	-57.72
3,650.00	0.57	294.60	3,649.36	-11.94	22.14	-12.58	0.52	0.52	4.96
3,675.00	0.64	292.61	3,674.36	-11.83	21.89	-12.47	0.29	0.28	-7.96
3,700.00	0.50	299.03	3,699.36	-11.73	21.67	-12.36	0.61	-0.56	25.68
3,725.00	0.43	303.55	3,724.36	-11.62	21.50	-12.25	0.32	-0.28	18.08
3,750.00	0.43	306.50	3,749.35	-11.52	21.34	-12.13	0.09	0.00	11.80
3,775.00	0.51	285.76	3,774.35	-11.43	21.16	-12.04	0.75	0.32	-82.96
3,800.00	0.55	287.79	3,799.35	-11.36	20.94	-11.97	0.18	0.16	8.12
3,825.00	0.51	293.03	3,824.35	-11.28	20.72	-11.88	0.25	-0.16	20.96
3,850.00	0.59	290.30	3,849.35	-11.19	20.50	-11.79	0.34	0.32	-10.92
3,875.00	0.57	304.91	3,874.35	-11.08	20.28	-11.67	0.60	-0.08	58.44
3,900.00	0.54	297.77	3,899.35	-10.95	20.07	-11.53	0.30	-0.12	-28.56
3,925.00	0.71	293.28	3,924.35	-10.84	19.82	-11.41	0.71	0.68	-17.96
3,950.00	0.59	292.68	3,949.35	-10.73	19.56	-11.29	0.48	-0.48	-2.40
3,975.00	0.54	288.91	3,974.34	-10.64	19.33	-11.20	0.25	-0.20	-15.08
4,000.00	0.48	281.46	3,999.34	-10.58	19.12	-11.13	0.36	-0.24	-29.80
4,025.00	0.64	277.97	4,024.34	-10.54	18.88	-11.09	0.65	0.64	-13.96
4,050.00	0.58	279.12	4,049.34	-10.50	18.61	-11.04	0.24	-0.24	4.60
4,075.00	0.58	293.32	4,074.34	-10.43	18.37	-10.96	0.57	0.00	56.80
4,100.00	0.41	298.82	4,099.34	-10.34	18.18	-10.86	0.71	-0.68	22.00
4,125.00	0.37	283.94	4,124.34	-10.27	18.02	-10.80	0.43	-0.16	-59.52
4,150.00	0.43	278.07	4,149.34	-10.24	17.85	-10.76	0.29	0.24	-23.48
4,175.00	0.42	282.06	4,174.34	-10.21	17.67	-10.72	0.12	-0.04	15.96
4,200.00	0.28	283.46	4,199.34	-10.17	17.52	-10.68	0.56	-0.56	5.60
4,225.00	0.37	271.33	4,224.34	-10.16	17.38	-10.66	0.45	0.36	-48.52
4,250.00	0.31	275.88	4,249.33	-10.15	17.23	-10.65	0.26	-0.24	18.20
4,275.00	0.39	291.71	4,274.33	-10.11	17.08	-10.61	0.50	0.32	63.32
4,300.00	0.35	288.90	4,299.33	-10.06	16.93	-10.55	0.18	-0.16	-11.24
4,325.00	0.16	301.49	4,324.33	-10.01	16.83	-10.50	0.79	-0.76	50.36
4,350.00	0.14	224.06	4,349.33	-10.02	16.78	-10.50	0.75	-0.08	-309.72
4,375.00	0.24	202.33	4,374.33	-10.09	16.74	-10.57	0.49	0.40	-86.92
4,400.00	0.33	177.09	4,399.33	-10.21	16.72	-10.69	0.61	0.36	-100.96
4,425.00	0.56	169.23	4,424.33	-10.40	16.75	-10.88	0.95	0.92	-31.44
4,450.00	0.62	167.23	4,449.33	-10.65	16.80	-11.14	0.25	0.24	-8.00
4,475.00	0.67	177.44	4,474.33	-10.93	16.84	-11.42	0.50	0.20	40.84
4,500.00	0.56	172.37	4,499.33	-11.20	16.86	-11.68	0.49	-0.44	-20.28
4,525.00	0.56	167.57	4,524.33	-11.44	16.90	-11.93	0.19	0.00	-19.20
4,550.00	0.61	158.55	4,549.33	-11.68	16.98	-12.17	0.42	0.20	-36.08
4,575.00	0.63	182.03	4,574.32	-11.94	17.02	-12.43	1.01	0.08	93.92
4,600.00	0.63	218.08	4,599.32	-12.19	16.93	-12.68	1.56	0.00	144.20
4,625.00	0.54	211.35	4,624.32	-12.39	16.79	-12.88	0.45	-0.36	-26.92



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,650.00	0.49	203.87	4,649.32	-12.59	16.68	-13.08	0.33	-0.20	-29.92
4,675.00	0.62	225.78	4,674.32	-12.79	16.54	-13.26	0.99	0.52	87.64
4,700.00	0.70	276.74	4,699.32	-12.86	16.29	-13.33	2.29	0.32	203.84
4,725.00	0.83	288.73	4,724.32	-12.79	15.97	-13.25	0.82	0.52	47.96
4,750.00	0.88	294.31	4,749.31	-12.65	15.62	-13.10	0.39	0.20	22.32
4,775.00	0.77	294.43	4,774.31	-12.50	15.30	-12.94	0.44	-0.44	0.48
4,800.00	0.91	293.92	4,799.31	-12.35	14.96	-12.78	0.56	0.56	-2.04
4,825.00	0.84	297.71	4,824.30	-12.18	14.62	-12.61	0.36	-0.28	15.16
4,850.00	0.99	299.30	4,849.30	-11.99	14.27	-12.41	0.61	0.60	6.36
4,875.00	0.85	297.48	4,874.30	-11.80	13.91	-12.20	0.57	-0.56	-7.28
4,900.00	0.92	295.57	4,899.30	-11.63	13.57	-12.02	0.30	0.28	-7.64
4,925.00	0.94	290.45	4,924.29	-11.47	13.20	-11.85	0.34	0.08	-20.48
4,950.00	0.94	288.88	4,949.29	-11.33	12.81	-11.70	0.10	0.00	-6.28
4,975.00	0.79	292.48	4,974.29	-11.20	12.46	-11.56	0.64	-0.60	14.40
5,000.00	1.01	281.65	4,999.28	-11.09	12.08	-11.44	1.11	0.88	-43.32
5,025.00	0.92	288.54	5,024.28	-10.98	11.68	-11.32	0.59	-0.36	27.56
5,050.00	0.92	281.18	5,049.28	-10.88	11.29	-11.21	0.47	0.00	-29.44
5,075.00	0.95	281.73	5,074.27	-10.80	10.89	-11.11	0.13	0.12	2.20
5,100.00	0.87	281.55	5,099.27	-10.72	10.50	-11.02	0.32	-0.32	-0.72
5,125.00	1.09	276.12	5,124.27	-10.66	10.08	-10.95	0.95	0.88	-21.72
5,150.00	0.99	268.67	5,149.26	-10.63	9.62	-10.91	0.67	-0.40	-29.80
5,175.00	0.97	267.65	5,174.26	-10.65	9.20	-10.91	0.11	-0.08	-4.08
5,200.00	1.05	270.71	5,199.25	-10.65	8.76	-10.91	0.39	0.32	12.24
5,225.00	0.96	265.90	5,224.25	-10.67	8.32	-10.91	0.49	-0.36	-19.24
5,250.00	1.07	265.45	5,249.25	-10.70	7.88	-10.93	0.44	0.44	-1.80
5,275.00	0.86	259.95	5,274.24	-10.75	7.46	-10.97	0.92	-0.84	-22.00
5,300.00	0.88	251.63	5,299.24	-10.84	7.09	-11.05	0.51	0.08	-33.28
5,325.00	0.88	249.03	5,324.24	-10.97	6.73	-11.17	0.16	0.00	-10.40
5,350.00	1.01	251.18	5,349.23	-11.11	6.34	-11.29	0.54	0.52	8.60
5,375.00	1.00	246.72	5,374.23	-11.27	5.93	-11.44	0.32	-0.04	-17.84
5,400.00	0.92	242.58	5,399.23	-11.45	5.56	-11.61	0.42	-0.32	-16.56
5,425.00	0.81	237.12	5,424.22	-11.64	5.23	-11.79	0.55	-0.44	-21.84
5,450.00	0.77	223.82	5,449.22	-11.86	4.97	-12.00	0.75	-0.16	-53.20
5,475.00	0.65	205.60	5,474.22	-12.10	4.79	-12.24	1.02	-0.48	-72.88
5,500.00	0.62	206.33	5,499.22	-12.35	4.67	-12.48	0.12	-0.12	2.92
5,525.00	0.67	214.19	5,524.22	-12.60	4.52	-12.72	0.41	0.20	31.44
5,550.00	0.66	216.62	5,549.21	-12.83	4.36	-12.95	0.12	-0.04	9.72
5,575.00	0.51	216.58	5,574.21	-13.04	4.20	-13.15	0.60	-0.60	-0.16
5,600.00	0.55	209.11	5,599.21	-13.23	4.08	-13.34	0.32	0.16	-29.88
5,625.00	0.47	204.01	5,624.21	-13.43	3.98	-13.54	0.37	-0.32	-20.40
5,650.00	0.57	77.62	5,649.21	-13.50	4.06	-13.61	3.72	0.40	-505.56
5,675.00	1.04	68.14	5,674.21	-13.39	4.39	-13.51	1.95	1.88	-37.92
5,700.00	1.37	66.98	5,699.20	-13.18	4.88	-13.32	1.32	1.32	-4.64



Phoenix Technology Services LP
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
5,725.00	1.49	65.52	5,724.19	-12.93	5.45	-13.09	0.50	0.48	-5.84
5,750.00	1.51	68.62	5,749.19	-12.68	6.05	-12.85	0.33	0.08	12.40
5,775.00	1.46	71.88	5,774.18	-12.46	6.66	-12.65	0.39	-0.20	13.04
5,800.00	1.26	76.67	5,799.17	-12.30	7.23	-12.50	0.92	-0.80	19.16
5,825.00	0.88	79.73	5,824.17	-12.20	7.69	-12.42	1.54	-1.52	12.24
5,850.00	0.28	104.88	5,849.16	-12.18	7.93	-12.41	2.55	-2.40	100.60
5,875.00	0.15	169.21	5,874.16	-12.23	8.00	-12.46	1.02	-0.52	257.32
5,900.00	0.44	229.38	5,899.16	-12.32	7.93	-12.55	1.55	1.16	240.68
5,925.00	0.68	232.60	5,924.16	-12.47	7.74	-12.70	0.97	0.96	12.88
5,950.00	1.03	227.99	5,949.16	-12.72	7.46	-12.93	1.43	1.40	-18.44
5,975.00	1.26	224.62	5,974.16	-13.06	7.10	-13.26	0.96	0.92	-13.48
6,000.00	1.47	224.62	5,999.15	-13.49	6.68	-13.68	0.84	0.84	0.00
6,025.00	1.54	224.98	6,024.14	-13.95	6.22	-14.13	0.28	0.28	1.44
6,050.00	1.56	219.89	6,049.13	-14.45	5.76	-14.61	0.56	0.08	-20.36
6,075.00	1.70	214.07	6,074.12	-15.02	5.33	-15.17	0.87	0.56	-23.28
6,100.00	1.63	213.79	6,099.11	-15.62	4.93	-15.76	0.28	-0.28	-1.12
6,125.00	1.56	210.28	6,124.10	-16.21	4.56	-16.34	0.48	-0.28	-14.04
6,150.00	1.61	206.36	6,149.09	-16.82	4.23	-16.94	0.48	0.20	-15.68
6,175.00	1.66	199.43	6,174.08	-17.48	3.96	-17.58	0.82	0.20	-27.72
6,200.00	2.02	195.33	6,199.07	-18.24	3.72	-18.34	1.53	1.44	-16.40
6,225.00	2.39	190.71	6,224.05	-19.18	3.51	-19.27	1.64	1.48	-18.48
6,250.00	2.70	185.37	6,249.02	-20.28	3.35	-20.37	1.56	1.24	-21.36
6,275.00	2.94	182.06	6,273.99	-21.50	3.27	-21.59	1.16	0.96	-13.24
6,300.00	3.24	178.71	6,298.96	-22.85	3.27	-22.94	1.40	1.20	-13.40
6,325.00	3.33	179.23	6,323.92	-24.28	3.29	-24.37	0.38	0.36	2.08
6,350.00	3.32	180.05	6,348.87	-25.73	3.30	-25.82	0.19	-0.04	3.28
6,375.00	3.11	181.40	6,373.83	-27.14	3.29	-27.22	0.89	-0.84	5.40
6,400.00	2.66	189.56	6,398.80	-28.39	3.17	-28.47	2.43	-1.80	32.64
6,425.00	1.99	201.81	6,423.78	-29.36	2.91	-29.43	3.32	-2.68	49.00
6,450.00	1.63	211.32	6,448.77	-30.07	2.57	-30.13	1.87	-1.44	38.04
6,475.00	1.35	226.37	6,473.76	-30.57	2.17	-30.62	1.92	-1.12	60.20
6,500.00	1.85	231.46	6,498.75	-31.03	1.64	-31.06	2.08	2.00	20.36
6,525.00	1.95	237.14	6,523.74	-31.51	0.97	-31.53	0.85	0.40	22.72
6,550.00	2.07	234.36	6,548.72	-32.00	0.24	-32.00	0.62	0.48	-11.12
6,575.00	2.01	233.56	6,573.71	-32.53	-0.47	-32.50	0.27	-0.24	-3.20
6,600.00	1.65	243.98	6,598.69	-32.95	-1.15	-32.90	1.96	-1.44	41.68
6,625.00	1.59	251.42	6,623.68	-33.21	-1.80	-33.15	0.87	-0.24	29.76
6,650.00	1.46	256.17	6,648.68	-33.40	-2.44	-33.32	0.72	-0.52	19.00
6,675.00	1.40	259.16	6,673.67	-33.54	-3.05	-33.43	0.38	-0.24	11.96
6,700.00	1.17	280.69	6,698.66	-33.55	-3.60	-33.43	2.12	-0.92	86.12
6,725.00	0.99	303.25	6,723.66	-33.38	-4.03	-33.25	1.83	-0.72	90.24
6,750.00	0.93	299.56	6,748.65	-33.16	-4.39	-33.02	0.34	-0.24	-14.76
6,775.00	0.73	291.96	6,773.65	-33.00	-4.71	-32.85	0.91	-0.80	-30.40
6,800.00	0.72	296.33	6,798.65	-32.87	-5.00	-32.71	0.22	-0.04	17.48



Phoenix Technology Services LP
Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
6,825.00	0.71	293.37	6,823.65	-32.74	-5.29	-32.57	0.15	-0.04	-11.84
6,850.00	0.85	286.33	6,848.64	-32.63	-5.61	-32.45	0.68	0.56	-28.16
6,875.00	1.04	282.85	6,873.64	-32.52	-6.00	-32.34	0.79	0.76	-13.92
6,900.00	1.12	272.99	6,898.64	-32.46	-6.47	-32.26	0.81	0.32	-39.44
6,925.00	1.04	277.43	6,923.63	-32.42	-6.94	-32.20	0.46	-0.32	17.76
6,950.00	0.56	295.92	6,948.63	-32.34	-7.27	-32.11	2.16	-1.92	73.96
6,975.00	0.20	7.27	6,973.63	-32.24	-7.38	-32.01	2.12	-1.44	285.40
7,000.00	0.61	84.63	6,998.63	-32.18	-7.24	-31.96	2.40	1.64	309.44
7,020.00	0.79	102.01	7,018.63	-32.20	-7.00	-31.98	1.38	0.90	86.90
Tie In									
7,127.00	2.45	163.69	7,125.59	-34.55	-5.64	-34.37	2.05	1.55	57.64
First Phoenix MWD Survey									
7,220.00	3.72	350.28	7,218.54	-33.48	-5.59	-33.31	6.62	1.37	-186.46
7,315.00	12.19	346.47	7,312.54	-20.67	-8.46	-20.42	8.93	8.92	-4.01
7,360.00	15.87	348.46	7,356.19	-10.02	-10.80	-9.70	8.25	8.18	4.42
7,409.00	19.52	348.31	7,402.86	4.56	-13.80	4.97	7.45	7.45	-0.31
7,454.00	23.05	344.78	7,444.79	20.43	-17.64	20.94	8.34	7.84	-7.84
7,503.00	26.58	343.58	7,489.26	40.21	-23.26	40.87	7.28	7.20	-2.45
7,548.00	29.89	339.79	7,528.90	60.40	-29.98	61.25	8.36	7.36	-8.42
7,598.00	32.91	335.69	7,571.58	84.48	-39.88	85.61	7.40	6.04	-8.20
7,643.00	36.44	335.36	7,608.58	107.77	-50.49	109.20	7.86	7.84	-0.73
7,692.00	39.15	336.77	7,647.30	135.22	-62.66	136.99	5.80	5.53	2.88
7,723.00	41.39	336.46	7,670.95	153.61	-70.61	155.61	7.25	7.23	-1.00
7,754.00	43.77	336.38	7,693.77	172.83	-79.00	175.07	7.68	7.68	-0.26
7,786.00	46.00	337.02	7,716.44	193.57	-87.93	196.06	7.11	6.97	2.00
7,831.00	49.63	337.02	7,746.66	224.26	-100.95	227.12	8.07	8.07	0.00
7,881.00	53.56	336.83	7,777.71	260.30	-116.30	263.59	7.87	7.86	-0.38
7,926.00	57.90	336.78	7,803.04	294.48	-130.95	298.18	9.64	9.64	-0.11
7,975.00	61.87	337.49	7,827.63	333.53	-147.41	337.70	8.20	8.10	1.45
8,022.00	66.14	338.69	7,848.22	372.71	-163.16	377.33	9.37	9.09	2.55
8,069.00	69.87	338.41	7,865.82	413.27	-179.09	418.33	7.96	7.94	-0.60
8,116.00	73.32	338.22	7,880.66	454.70	-195.57	460.23	7.35	7.34	-0.40
8,163.00	77.80	338.69	7,892.37	497.02	-212.28	503.02	9.58	9.53	1.00
8,211.00	82.68	338.74	7,900.51	541.09	-229.45	547.57	10.17	10.17	0.10
8,258.00	87.01	339.37	7,904.73	584.80	-246.17	591.75	9.31	9.21	1.34
8,352.00	93.33	338.26	7,904.45	672.40	-280.13	680.30	6.83	6.72	-1.18
8,446.00	92.60	338.11	7,899.59	759.55	-315.01	768.44	0.79	-0.78	-0.16
8,540.00	89.52	338.98	7,897.85	847.01	-349.38	856.87	3.40	-3.28	0.93
8,634.00	88.63	343.10	7,899.37	935.88	-379.91	946.59	4.48	-0.95	4.38
8,703.87	88.78	346.28	7,900.95	1,003.24	-398.35	1,014.47	4.56	0.21	4.55
First Take Point									
8,729.00	88.83	347.42	7,901.47	1,027.71	-404.07	1,039.09	4.54	0.20	4.54
8,824.00	89.61	352.09	7,902.77	1,121.16	-420.96	1,132.99	4.98	0.82	4.92



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
8,918.00	89.75	357.54	7,903.29	1,214.73	-429.45	1,226.78	5.80	0.15	5.80
9,012.00	90.59	1.06	7,903.01	1,308.71	-430.60	1,320.75	3.85	0.89	3.74
9,106.00	91.56	0.93	7,901.25	1,402.68	-428.97	1,414.63	1.04	1.03	-0.14
9,200.00	92.83	0.81	7,897.65	1,496.60	-427.54	1,508.47	1.36	1.35	-0.13
9,294.00	92.49	0.29	7,893.29	1,590.49	-426.64	1,602.29	0.66	-0.36	-0.55
9,388.00	89.83	1.10	7,891.38	1,684.46	-425.50	1,696.19	2.96	-2.83	0.86
9,482.00	90.06	1.69	7,891.47	1,778.43	-423.21	1,790.05	0.67	0.24	0.63
9,577.00	88.74	0.65	7,892.47	1,873.40	-421.27	1,884.92	1.77	-1.39	-1.09
9,671.00	90.45	359.94	7,893.13	1,967.39	-420.79	1,978.86	1.97	1.82	-0.76
9,765.00	87.43	359.75	7,894.87	2,061.36	-421.04	2,072.80	3.22	-3.21	-0.20
9,859.00	88.57	359.79	7,898.15	2,155.31	-421.42	2,166.71	1.21	1.21	0.04
9,953.00	90.00	0.21	7,899.33	2,249.30	-421.42	2,260.66	1.59	1.52	0.45
10,048.00	87.51	0.08	7,901.39	2,344.27	-421.18	2,355.58	2.62	-2.62	-0.14
10,142.00	88.38	359.12	7,904.76	2,438.20	-421.83	2,449.50	1.38	0.93	-1.02
10,236.00	91.34	358.64	7,904.99	2,532.17	-423.67	2,543.48	3.19	3.15	-0.51
10,330.00	89.86	359.35	7,904.01	2,626.15	-425.32	2,637.47	1.75	-1.57	0.76
10,425.00	86.86	0.73	7,906.73	2,721.10	-425.26	2,732.37	3.48	-3.16	1.45
10,518.00	87.00	1.05	7,911.71	2,813.95	-423.81	2,825.15	0.38	0.15	0.34
10,613.00	89.11	1.18	7,914.93	2,908.87	-421.97	2,919.97	2.23	2.22	0.14
10,707.00	90.79	1.17	7,915.01	3,002.85	-420.04	3,013.85	1.79	1.79	-0.01
10,801.00	92.52	1.07	7,912.30	3,096.79	-418.20	3,107.70	1.84	1.84	-0.11
10,895.00	91.68	0.83	7,908.85	3,190.71	-416.64	3,201.54	0.93	-0.89	-0.26
10,989.00	89.52	0.91	7,907.87	3,284.69	-415.22	3,295.43	2.30	-2.30	0.09
11,083.00	90.39	0.99	7,907.94	3,378.68	-413.66	3,389.33	0.93	0.93	0.09
11,178.00	88.23	1.83	7,909.09	3,473.64	-411.32	3,484.18	2.44	-2.27	0.88
11,272.00	89.13	2.02	7,911.25	3,567.56	-408.16	3,577.97	0.98	0.96	0.20
11,366.00	90.81	2.47	7,911.30	3,661.48	-404.48	3,671.75	1.85	1.79	0.48
11,460.00	88.04	1.24	7,912.24	3,755.42	-401.44	3,765.55	3.22	-2.95	-1.31
11,554.00	88.77	0.98	7,914.86	3,849.36	-399.62	3,859.40	0.82	0.78	-0.28
11,649.00	90.31	1.67	7,915.62	3,944.33	-397.42	3,954.27	1.78	1.62	0.73
11,743.00	87.79	0.67	7,917.18	4,038.29	-395.50	4,048.13	2.88	-2.68	-1.06
11,837.00	88.77	0.43	7,920.00	4,132.24	-394.60	4,142.02	1.07	1.04	-0.26
11,931.00	90.20	0.83	7,920.85	4,226.23	-393.57	4,235.93	1.58	1.52	0.43
12,022.00	91.65	1.19	7,919.38	4,317.20	-391.96	4,326.82	1.64	1.59	0.40
12,112.00	90.73	359.06	7,917.51	4,407.17	-391.77	4,416.75	2.58	-1.02	-2.37
12,201.00	88.12	357.77	7,918.40	4,496.13	-394.23	4,505.73	3.27	-2.93	-1.45
12,292.00	89.58	357.99	7,920.23	4,587.04	-397.60	4,596.71	1.62	1.60	0.24
12,383.00	91.04	358.78	7,919.74	4,678.00	-400.16	4,687.71	1.82	1.60	0.87
12,474.00	90.84	359.78	7,918.24	4,768.98	-401.30	4,778.68	1.12	-0.22	1.10
12,565.00	91.90	0.63	7,916.07	4,859.95	-400.98	4,869.60	1.49	1.16	0.93
12,655.00	93.70	1.18	7,911.67	4,949.83	-399.56	4,959.40	2.09	2.00	0.61
12,745.00	91.93	2.33	7,907.25	5,039.67	-396.80	5,049.13	2.34	-1.97	1.28
12,836.00	89.33	1.08	7,906.25	5,130.62	-394.10	5,139.95	3.17	-2.86	-1.37
12,930.00	89.27	359.91	7,907.40	5,224.61	-393.29	5,233.88	1.25	-0.06	-1.24



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
13,024.00	90.48	0.06	7,907.60	5,318.60	-393.31	5,327.83	1.30	1.29	0.16
13,118.00	91.88	0.17	7,905.67	5,412.58	-393.12	5,421.77	1.49	1.49	0.12
13,213.00	91.79	0.74	7,902.63	5,507.53	-392.37	5,516.65	0.61	-0.09	0.60
13,307.00	88.88	0.87	7,902.08	5,601.51	-391.05	5,610.55	3.10	-3.10	0.14
13,401.00	89.21	1.14	7,903.64	5,695.48	-389.40	5,704.44	0.45	0.35	0.29
13,495.00	85.52	1.59	7,907.96	5,789.34	-387.16	5,798.19	3.95	-3.93	0.48
13,590.00	85.10	1.35	7,915.73	5,883.99	-384.73	5,892.73	0.51	-0.44	-0.25
13,684.00	87.68	359.46	7,921.65	5,977.79	-384.07	5,986.47	3.40	2.74	-2.01
13,778.00	90.14	359.23	7,923.44	6,071.76	-385.15	6,080.43	2.63	2.62	-0.24
13,872.00	91.59	359.73	7,922.02	6,165.74	-386.00	6,174.39	1.63	1.54	0.53
13,966.00	92.27	359.94	7,918.85	6,259.69	-386.27	6,268.31	0.76	0.72	0.22
14,060.00	91.62	0.61	7,915.66	6,353.63	-385.82	6,362.20	0.99	-0.69	0.71
14,154.00	93.84	1.15	7,911.19	6,447.51	-384.38	6,455.99	2.43	2.36	0.57
14,248.00	92.69	1.24	7,905.83	6,541.33	-382.42	6,549.72	1.23	-1.22	0.10
14,342.00	92.72	1.63	7,901.40	6,635.20	-380.07	6,643.48	0.42	0.03	0.41
14,436.00	91.57	1.24	7,897.88	6,729.10	-377.72	6,737.27	1.29	-1.22	-0.41
14,530.00	90.53	1.16	7,896.16	6,823.06	-375.75	6,831.13	1.11	-1.11	-0.09
14,624.00	89.08	1.34	7,896.48	6,917.04	-373.70	6,925.01	1.55	-1.54	0.19
14,718.00	89.24	2.06	7,897.85	7,010.98	-370.91	7,018.83	0.78	0.17	0.77
14,812.00	91.04	2.54	7,897.62	7,104.90	-367.14	7,112.60	1.98	1.91	0.51
14,905.00	90.34	1.75	7,896.50	7,197.83	-363.66	7,205.39	1.13	-0.75	-0.85
14,999.00	88.66	0.28	7,897.33	7,291.81	-361.99	7,299.28	2.37	-1.79	-1.56
15,093.00	89.80	0.30	7,898.59	7,385.79	-361.52	7,393.21	1.21	1.21	0.02
15,187.00	90.42	0.42	7,898.41	7,479.79	-360.93	7,487.15	0.67	0.66	0.13
15,281.00	88.40	0.35	7,899.38	7,573.78	-360.29	7,581.08	2.15	-2.15	-0.07
15,375.00	89.24	0.22	7,901.31	7,667.76	-359.83	7,675.00	0.90	0.89	-0.14
15,469.00	90.25	1.17	7,901.73	7,761.75	-358.69	7,768.92	1.48	1.07	1.01
15,563.00	91.21	1.68	7,900.53	7,855.71	-356.35	7,862.77	1.16	1.02	0.54
15,657.00	90.36	1.54	7,899.24	7,949.66	-353.71	7,956.61	0.92	-0.90	-0.15
15,751.00	89.27	1.04	7,899.55	8,043.64	-351.59	8,050.48	1.28	-1.16	-0.53
15,846.00	90.56	1.21	7,899.69	8,138.62	-349.73	8,145.37	1.37	1.36	0.18
15,940.00	89.21	359.87	7,899.88	8,232.61	-348.84	8,239.29	2.02	-1.44	-1.43
16,034.00	87.84	359.16	7,902.30	8,326.57	-349.64	8,333.24	1.64	-1.46	-0.76
16,129.00	88.01	359.16	7,905.74	8,421.50	-351.03	8,428.16	0.18	0.18	0.00
16,223.00	88.85	359.17	7,908.31	8,515.45	-352.40	8,522.12	0.89	0.89	0.01
16,317.00	90.22	358.77	7,909.08	8,609.43	-354.09	8,616.11	1.52	1.46	-0.43
16,410.00	89.21	0.28	7,909.54	8,702.42	-354.86	8,709.08	1.95	-1.09	1.62
16,505.00	89.52	0.20	7,910.59	8,797.42	-354.46	8,804.02	0.34	0.33	-0.08
16,599.00	90.22	0.46	7,910.80	8,891.41	-353.92	8,897.96	0.79	0.74	0.28
16,694.00	90.39	1.05	7,910.30	8,986.40	-352.67	8,992.88	0.65	0.18	0.62
16,787.00	90.70	1.65	7,909.41	9,079.37	-350.48	9,085.74	0.73	0.33	0.65
16,882.00	89.02	1.26	7,909.65	9,174.34	-348.06	9,180.60	1.82	-1.77	-0.41
16,977.00	89.33	1.40	7,911.01	9,269.30	-345.86	9,275.45	0.36	0.33	0.15



Phoenix Technology Services LP

Survey Report



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 12H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Site:	Craig Federal Com	MD Reference:	GL + KB @ 3394.10usft (Ensign 155)
Well:	12H	North Reference:	Grid
Wellbore:	OH /	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Ensign 155)	Database:	Compass 5000 GCR

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
17,071.00	89.02	1.88	7,912.37	9,363.25	-343.17	9,369.29	0.61	-0.33	0.51
17,165.00	89.47	2.20	7,913.61	9,457.19	-339.82	9,463.08	0.59	0.48	0.34
17,259.00	88.40	1.55	7,915.35	9,551.12	-336.75	9,556.88	1.33	-1.14	-0.69
17,353.00	87.96	1.45	7,918.34	9,645.04	-334.29	9,650.69	0.48	-0.47	-0.11
17,447.00	88.26	1.47	7,921.44	9,738.96	-331.90	9,744.50	0.32	0.32	0.02
17,542.00	88.21	1.74	7,924.36	9,833.87	-329.24	9,839.30	0.29	-0.05	0.28
17,636.00	89.55	1.03	7,926.20	9,927.83	-326.97	9,933.14	1.61	1.43	-0.76
17,730.00	90.91	0.17	7,925.82	10,021.82	-325.98	10,027.06	1.71	1.45	-0.91
17,824.00	90.98	0.50	7,924.27	10,115.80	-325.43	10,120.99	0.36	0.07	0.35
17,918.00	90.36	0.94	7,923.17	10,209.79	-324.25	10,214.90	0.81	-0.66	0.47
18,012.00	89.12	0.73	7,923.60	10,303.78	-322.88	10,308.81	1.34	-1.32	-0.22
18,104.00	89.05	0.58	7,925.07	10,395.76	-321.83	10,400.72	0.18	-0.08	-0.16
18,198.00	91.46	359.69	7,924.65	10,489.75	-321.61	10,494.67	2.73	2.56	-0.95
18,292.00	91.49	359.52	7,922.23	10,583.71	-322.25	10,588.61	0.18	0.03	-0.18
18,386.00	91.40	359.62	7,919.86	10,677.68	-322.96	10,682.56	0.14	-0.10	0.11
18,480.00	91.09	359.65	7,917.82	10,771.66	-323.56	10,776.51	0.33	-0.33	0.03
18,574.00	90.98	359.69	7,916.12	10,865.64	-324.10	10,870.47	0.12	-0.12	0.04
18,647.10	91.15	359.81	7,914.76	10,938.73	-324.42	10,943.54	0.28	0.23	0.16
Last Take Point									
18,668.00	91.20	359.85	7,914.33	10,959.62	-324.48	10,964.43	0.31	0.24	0.19
18,706.00	91.15	359.81	7,913.56	10,997.62	-324.59	11,002.40	0.17	-0.13	-0.11
Final Phoenix MWD Survey									
18,767.00	91.15	359.81	7,912.33	11,058.60	-324.80	11,063.37	0.00	0.00	0.00
Projection to TD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
7,020.00	7,018.63	-32.20	-7.00	Tie In
7,127.00	7,125.59	-34.55	-5.64	First Phoenix MWD Survey
8,703.87	7,900.95	1,003.24	-398.35	First Take Point
18,647.10	7,914.76	10,938.73	-324.42	Last Take Point
18,706.00	7,913.56	10,997.62	-324.59	Final Phoenix MWD Survey
18,767.00	7,912.33	11,058.60	-324.80	Projection to TD