



COG Operating LLC

Eddy County, NM (NAD27 NME)

Road Runner Federal Com

11H

30-015-43900

OH / Job #60727

NM OIL CONSERVATION
ARTESIA DISTRICT

JUL 10 2017

Design: Surveys (Ensign 155)

RECEIVED

Standard Survey Report

23 February, 2017

Provide signature page for survey





Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR

Project Eddy County, NM (NAD27 NME)

Map System: US State Plane 1927 (Exact solution)
Geo Datum: NAD 1927 (NADCON CONUS)
Map Zone: New Mexico East 3001

System Datum: Mean Sea Level

Site Road Runner Federal Com

Site Position: **From:** Map
Position Uncertainty: 0.00 usft
Northing: 397,906.10 usft
Easting: 529,306.00 usft
Slot Radius: 13-3/16 "
Latitude: 32° 5' 38.12810 N
Longitude: 104° 14' 19.31875 W
Grid Convergence: 0.05 °

Well 11H

Well Position **+N/-S** 0.00 usft **Northing:** 397,906.10 usft **Latitude:** 32° 5' 38.12784 N
+E/-W 0.00 usft **Easting:** 529,335.90 usft **Longitude:** 104° 14' 18.97117 W
Position Uncertainty 0.00 usft **Wellhead Elevation:** 0.00 usft **Ground Level:** 3,250.20 usft

Wellbore OH / Job #60727

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	2/17/2017	7.48	59.83	48,039

Design Surveys (Ensign 155)

Audit Notes:

Version: 1.0 **Phase:** ACTUAL **Tie On Depth:** 0.00

Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	0.06

Survey Program **Date** 2/23/2017

From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.00	6,894.00	Scientific Gyro Surveys (OH / Job #60727)	NS-GYRO-MS	North sensing gyrocompassing m/s
6,963.00	17,930.00	Phoenix MWD Surveys (OH / Job #60727)	MWD+HDGM	OWSG Rev.2 MWD + HDGM

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)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.67	314.59	100.00	0.41	-0.42	0.41	0.67	0.67	0.00
125.00	0.77	307.05	125.00	0.61	-0.65	0.61	0.55	0.40	-30.16
150.00	0.83	300.67	149.99	0.81	-0.94	0.81	0.43	0.24	-25.52
175.00	0.86	300.73	174.99	1.00	-1.26	0.99	0.12	0.12	0.24
200.00	0.90	299.62	199.99	1.19	-1.59	1.19	0.17	0.16	-4.44
225.00	0.91	296.92	224.98	1.38	-1.94	1.37	0.18	0.04	-10.80
250.00	0.93	297.55	249.98	1.56	-2.30	1.56	0.09	0.08	2.52
275.00	1.00	300.02	274.98	1.76	-2.67	1.76	0.33	0.28	9.88
300.00	1.03	295.35	299.97	1.97	-3.06	1.96	0.35	0.12	-18.68



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	1.18	286.05	324.97	2.14	-3.51	2.13	0.93	0.60	-37.20
350.00	1.22	271.66	349.96	2.21	-4.02	2.21	1.21	0.16	-57.56
375.00	1.20	270.52	374.96	2.22	-4.55	2.22	0.13	-0.08	-4.56
400.00	1.18	275.29	399.95	2.25	-5.07	2.25	0.40	-0.08	19.08
425.00	1.21	276.15	424.95	2.30	-5.59	2.30	0.14	0.12	3.44
450.00	1.17	264.71	449.94	2.31	-6.10	2.30	0.96	-0.16	-45.76
475.00	1.07	260.09	474.94	2.24	-6.59	2.24	0.54	-0.40	-18.48
500.00	0.90	252.65	499.93	2.14	-7.01	2.14	0.85	-0.68	-29.76
525.00	0.80	227.26	524.93	1.97	-7.32	1.96	1.54	-0.40	-101.56
550.00	0.72	202.21	549.93	1.70	-7.51	1.70	1.36	-0.32	-100.20
575.00	0.82	179.25	574.93	1.38	-7.57	1.37	1.29	0.40	-91.84
600.00	0.99	172.85	599.92	0.99	-7.54	0.98	0.79	0.68	-25.60
625.00	1.14	160.89	624.92	0.54	-7.43	0.53	1.07	0.60	-47.84
650.00	1.32	160.65	649.91	0.03	-7.25	0.02	0.72	0.72	-0.96
675.00	1.38	158.19	674.91	-0.52	-7.04	-0.53	0.33	0.24	-9.84
700.00	1.44	154.56	699.90	-1.08	-6.80	-1.09	0.43	0.24	-14.52
725.00	1.47	142.43	724.89	-1.62	-6.47	-1.63	1.24	0.12	-48.52
750.00	1.78	117.26	749.88	-2.05	-5.93	-2.06	3.08	1.24	-100.68
775.00	2.37	103.10	774.86	-2.35	-5.08	-2.35	3.11	2.36	-56.64
800.00	2.81	97.91	799.84	-2.55	-3.97	-2.55	1.99	1.76	-20.76
825.00	3.14	94.55	824.81	-2.69	-2.68	-2.69	1.49	1.32	-13.44
850.00	3.42	94.01	849.76	-2.80	-1.25	-2.80	1.13	1.12	-2.16
875.00	3.44	93.24	874.72	-2.89	0.24	-2.89	0.20	0.08	-3.08
900.00	3.28	92.20	899.68	-2.96	1.71	-2.96	0.68	-0.64	-4.16
925.00	3.04	90.37	924.64	-2.99	3.08	-2.99	1.04	-0.96	-7.32
950.00	2.47	83.13	949.61	-2.93	4.28	-2.93	2.67	-2.28	-28.96
975.00	1.99	80.86	974.59	-2.80	5.24	-2.79	1.95	-1.92	-9.08
1,000.00	1.45	72.14	999.58	-2.63	5.97	-2.63	2.39	-2.16	-34.88
1,025.00	1.10	48.99	1,024.57	-2.38	6.46	-2.37	2.46	-1.40	-92.60
1,050.00	0.79	15.54	1,049.57	-2.05	6.68	-2.05	2.48	-1.24	-133.80
1,075.00	0.88	352.79	1,074.57	-1.70	6.71	-1.69	1.36	0.36	-91.00
1,100.00	0.99	343.80	1,099.56	-1.30	6.62	-1.29	0.73	0.44	-35.96
1,125.00	0.95	337.74	1,124.56	-0.90	6.48	-0.89	0.44	-0.16	-24.24
1,150.00	0.98	342.78	1,149.56	-0.50	6.34	-0.50	0.36	0.12	20.16
1,175.00	1.02	345.33	1,174.55	-0.08	6.22	-0.08	0.24	0.16	10.20
1,200.00	0.95	342.18	1,199.55	0.33	6.10	0.33	0.35	-0.28	-12.60
1,225.00	0.98	349.84	1,224.55	0.74	6.00	0.74	0.53	0.12	30.64
1,250.00	0.90	358.69	1,249.54	1.14	5.96	1.15	0.66	-0.32	35.40
1,275.00	0.97	17.53	1,274.54	1.54	6.02	1.55	1.25	0.28	75.36
1,300.00	0.99	40.87	1,299.54	1.91	6.22	1.91	1.59	0.08	93.36
1,325.00	1.16	60.77	1,324.53	2.19	6.58	2.20	1.63	0.68	79.60
1,350.00	1.33	66.50	1,349.53	2.43	7.07	2.44	0.84	0.68	22.92
1,375.00	1.58	69.61	1,374.52	2.67	7.66	2.67	1.05	1.00	12.44



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	1.74	68.29	1,399.51	2.93	8.34	2.94	0.66	0.64	-5.28
1,425.00	1.74	69.42	1,424.50	3.20	9.04	3.21	0.14	0.00	4.52
1,450.00	2.03	70.91	1,449.48	3.48	9.82	3.49	1.18	1.16	5.96
1,475.00	2.15	73.81	1,474.47	3.76	10.69	3.77	0.64	0.48	11.60
1,500.00	2.14	73.10	1,499.45	4.02	11.58	4.03	0.11	-0.04	-2.84
1,525.00	2.05	75.26	1,524.43	4.27	12.46	4.28	0.48	-0.36	8.64
1,550.00	2.20	76.83	1,549.41	4.49	13.36	4.51	0.64	0.60	6.28
1,575.00	2.10	81.92	1,574.40	4.67	14.28	4.68	0.86	-0.40	20.36
1,600.00	2.23	80.59	1,599.38	4.81	15.22	4.83	0.56	0.52	-5.32
1,625.00	2.10	85.50	1,624.36	4.93	16.15	4.94	0.91	-0.52	19.64
1,650.00	2.07	97.29	1,649.34	4.91	17.06	4.92	1.72	-0.12	47.16
1,675.00	1.93	106.80	1,674.33	4.73	17.91	4.74	1.44	-0.56	38.04
1,700.00	1.97	126.84	1,699.31	4.35	18.65	4.37	2.72	0.16	80.16
1,725.00	2.32	154.20	1,724.30	3.63	19.22	3.65	4.28	1.40	109.44
1,750.00	2.51	168.46	1,749.28	2.64	19.55	2.66	2.51	0.76	57.04
1,775.00	2.78	179.15	1,774.25	1.50	19.67	1.52	2.24	1.08	42.76
1,800.00	2.97	185.67	1,799.22	0.25	19.61	0.27	1.51	0.76	26.08
1,825.00	2.87	188.13	1,824.19	-1.01	19.46	-1.00	0.64	-0.40	9.84
1,850.00	2.37	197.82	1,849.16	-2.13	19.21	-2.11	2.67	-2.00	38.76
1,875.00	1.88	210.49	1,874.14	-2.97	18.85	-2.95	2.70	-1.96	50.68
1,900.00	1.66	222.10	1,899.13	-3.59	18.40	-3.58	1.68	-0.88	46.44
1,925.00	1.62	224.97	1,924.12	-4.11	17.90	-4.09	0.37	-0.16	11.48
1,950.00	1.58	227.89	1,949.11	-4.59	17.40	-4.58	0.36	-0.16	11.68
1,975.00	1.63	225.57	1,974.10	-5.07	16.89	-5.06	0.33	0.20	-9.28
2,000.00	1.56	225.90	1,999.09	-5.56	16.39	-5.54	0.28	-0.28	1.32
2,025.00	1.51	226.22	2,024.08	-6.02	15.91	-6.01	0.20	-0.20	1.28
2,050.00	1.48	226.10	2,049.07	-6.48	15.44	-6.46	0.12	-0.12	-0.48
2,075.00	1.57	226.56	2,074.06	-6.94	14.96	-6.92	0.36	0.36	1.84
2,100.00	1.57	229.19	2,099.06	-7.39	14.45	-7.38	0.29	0.00	10.52
2,125.00	1.53	228.34	2,124.05	-7.84	13.94	-7.83	0.18	-0.16	-3.40
2,150.00	1.67	226.69	2,149.04	-8.31	13.43	-8.30	0.59	0.56	-6.60
2,175.00	1.67	227.13	2,174.03	-8.81	12.89	-8.80	0.05	0.00	1.76
2,200.00	1.67	227.52	2,199.02	-9.30	12.36	-9.29	0.05	0.00	1.56
2,225.00	1.70	225.26	2,224.00	-9.81	11.83	-9.80	0.29	0.12	-9.04
2,250.00	1.52	226.34	2,248.99	-10.30	11.32	-10.29	0.73	-0.72	4.32
2,275.00	1.36	227.83	2,273.99	-10.73	10.86	-10.72	0.66	-0.64	5.96
2,300.00	1.20	229.84	2,298.98	-11.10	10.44	-11.09	0.66	-0.64	8.04
2,325.00	1.11	229.64	2,323.98	-11.42	10.06	-11.41	0.36	-0.36	-0.80
2,350.00	1.03	227.77	2,348.97	-11.73	9.71	-11.72	0.35	-0.32	-7.48
2,375.00	0.92	226.90	2,373.97	-12.02	9.39	-12.01	0.44	-0.44	-3.48
2,400.00	0.86	228.16	2,398.96	-12.28	9.11	-12.27	0.25	-0.24	5.04
2,425.00	0.87	234.49	2,423.96	-12.52	8.81	-12.51	0.38	0.04	25.32
2,450.00	0.90	233.46	2,448.96	-12.74	8.50	-12.73	0.14	0.12	-4.12



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	0.88	231.53	2,473.96	-12.98	8.19	-12.97	0.14	-0.08	-7.72
2,500.00	0.81	231.89	2,498.95	-13.21	7.90	-13.20	0.28	-0.28	1.44
2,525.00	0.85	226.64	2,523.95	-13.44	7.63	-13.44	0.34	0.16	-21.00
2,550.00	0.88	227.38	2,548.95	-13.70	7.35	-13.69	0.13	0.12	2.96
2,575.00	0.90	229.27	2,573.94	-13.96	7.06	-13.95	0.14	0.08	7.56
2,600.00	0.94	225.77	2,598.94	-14.23	6.77	-14.22	0.28	0.16	-14.00
2,625.00	0.87	223.47	2,623.94	-14.51	6.49	-14.51	0.32	-0.28	-9.20
2,650.00	0.82	222.63	2,648.94	-14.78	6.24	-14.77	0.21	-0.20	-3.36
2,675.00	0.72	225.90	2,673.93	-15.02	6.00	-15.02	0.44	-0.40	13.08
2,700.00	0.82	230.31	2,698.93	-15.25	5.75	-15.24	0.46	0.40	17.64
2,725.00	0.78	227.32	2,723.93	-15.48	5.49	-15.47	0.23	-0.16	-11.96
2,750.00	0.71	227.27	2,748.93	-15.70	5.25	-15.69	0.28	-0.28	-0.20
2,775.00	0.73	228.88	2,773.92	-15.91	5.02	-15.90	0.11	0.08	6.44
2,800.00	0.79	226.89	2,798.92	-16.13	4.77	-16.12	0.26	0.24	-7.96
2,825.00	0.72	230.88	2,823.92	-16.34	4.53	-16.34	0.35	-0.28	15.96
2,850.00	0.72	225.91	2,848.92	-16.55	4.29	-16.55	0.25	0.00	-19.88
2,875.00	0.87	223.11	2,873.92	-16.80	4.05	-16.80	0.62	0.60	-11.20
2,900.00	0.77	224.16	2,898.91	-17.06	3.80	-17.06	0.40	-0.40	4.20
2,925.00	0.77	222.85	2,923.91	-17.30	3.57	-17.30	0.07	0.00	-5.24
2,950.00	0.76	224.36	2,948.91	-17.55	3.34	-17.54	0.09	-0.04	6.04
2,975.00	0.74	221.88	2,973.91	-17.78	3.12	-17.78	0.15	-0.08	-9.92
3,000.00	0.74	223.60	2,998.90	-18.02	2.90	-18.02	0.09	0.00	6.88
3,025.00	0.68	219.36	3,023.90	-18.25	2.69	-18.25	0.32	-0.24	-16.96
3,050.00	0.54	220.04	3,048.90	-18.46	2.52	-18.46	0.56	-0.56	2.72
3,075.00	0.59	218.98	3,073.90	-18.65	2.37	-18.65	0.20	0.20	-4.24
3,100.00	0.35	332.15	3,098.90	-18.68	2.25	-18.68	3.18	-0.96	452.68
3,125.00	0.23	232.35	3,123.90	-18.64	2.17	-18.64	1.80	-0.48	-399.20
3,150.00	0.28	213.22	3,148.90	-18.73	2.10	-18.72	0.39	0.20	-76.52
3,175.00	0.13	192.36	3,173.90	-18.80	2.06	-18.80	0.66	-0.60	-83.44
3,200.00	0.08	80.74	3,198.90	-18.83	2.07	-18.83	0.70	-0.20	-446.48
3,225.00	0.14	74.01	3,223.90	-18.82	2.12	-18.82	0.25	0.24	-26.92
3,250.00	0.14	70.29	3,248.90	-18.80	2.18	-18.80	0.04	0.00	-14.88
3,275.00	0.18	63.04	3,273.90	-18.77	2.24	-18.77	0.18	0.16	-29.00
3,300.00	0.13	49.91	3,298.90	-18.74	2.30	-18.73	0.24	-0.20	-52.52
3,325.00	0.22	41.37	3,323.90	-18.68	2.35	-18.68	0.37	0.36	-34.16
3,350.00	0.18	71.48	3,348.90	-18.63	2.42	-18.63	0.44	-0.16	120.44
3,375.00	0.11	61.98	3,373.90	-18.61	2.48	-18.61	0.30	-0.28	-38.00
3,400.00	0.13	51.61	3,398.90	-18.58	2.52	-18.58	0.12	0.08	-41.48
3,425.00	0.20	45.10	3,423.90	-18.53	2.57	-18.53	0.29	0.28	-26.04
3,450.00	0.12	29.11	3,448.90	-18.48	2.62	-18.48	0.36	-0.32	-63.96
3,475.00	0.15	54.53	3,473.90	-18.44	2.66	-18.43	0.26	0.12	101.68
3,500.00	0.22	42.65	3,498.90	-18.38	2.72	-18.38	0.32	0.28	-47.52
3,525.00	0.10	80.28	3,523.90	-18.34	2.77	-18.34	0.61	-0.48	150.52
3,550.00	0.13	104.59	3,548.90	-18.35	2.82	-18.34	0.23	0.12	97.24



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	0.07	75.59	3,573.90	-18.35	2.86	-18.35	0.31	-0.24	-116.00
3,600.00	0.10	54.91	3,598.90	-18.33	2.89	-18.33	0.17	0.12	-82.72
3,625.00	0.13	95.64	3,623.90	-18.32	2.94	-18.32	0.34	0.12	162.92
3,650.00	0.14	111.97	3,648.90	-18.34	3.00	-18.33	0.16	0.04	65.32
3,675.00	0.13	110.33	3,673.90	-18.36	3.05	-18.36	0.04	-0.04	-6.56
3,700.00	0.18	86.98	3,698.90	-18.37	3.12	-18.36	0.32	0.20	-93.40
3,725.00	0.15	115.27	3,723.90	-18.38	3.19	-18.38	0.34	-0.12	113.16
3,750.00	0.16	124.04	3,748.90	-18.41	3.24	-18.41	0.10	0.04	35.08
3,775.00	0.13	121.23	3,773.90	-18.45	3.30	-18.44	0.12	-0.12	-11.24
3,800.00	0.18	125.57	3,798.90	-18.48	3.35	-18.48	0.21	0.20	17.36
3,825.00	0.17	119.60	3,823.90	-18.52	3.42	-18.52	0.08	-0.04	-23.88
3,850.00	0.23	144.13	3,848.90	-18.58	3.48	-18.58	0.41	0.24	98.12
3,875.00	0.24	150.77	3,873.90	-18.67	3.54	-18.67	0.12	0.04	26.56
3,900.00	0.17	131.03	3,898.90	-18.74	3.59	-18.74	0.39	-0.28	-78.96
3,925.00	0.22	102.79	3,923.90	-18.78	3.66	-18.77	0.43	0.20	-112.96
3,950.00	0.24	104.84	3,948.90	-18.80	3.76	-18.80	0.09	0.08	8.20
3,975.00	0.18	122.68	3,973.90	-18.83	3.84	-18.83	0.35	-0.24	71.36
4,000.00	0.23	138.74	3,998.90	-18.89	3.91	-18.89	0.30	0.20	64.24
4,025.00	0.21	142.16	4,023.90	-18.97	3.97	-18.96	0.10	-0.08	13.68
4,050.00	0.25	115.57	4,048.89	-19.03	4.05	-19.02	0.45	0.16	-106.36
4,075.00	0.25	114.08	4,073.89	-19.07	4.15	-19.07	0.03	0.00	-5.96
4,100.00	0.23	145.76	4,098.89	-19.14	4.23	-19.13	0.53	-0.08	126.72
4,125.00	0.20	132.21	4,123.89	-19.21	4.29	-19.20	0.24	-0.12	-54.20
4,150.00	0.21	129.07	4,148.89	-19.26	4.35	-19.26	0.06	0.04	-12.56
4,175.00	0.34	131.47	4,173.89	-19.34	4.45	-19.34	0.52	0.52	9.60
4,200.00	0.27	136.02	4,198.89	-19.43	4.54	-19.43	0.30	-0.28	18.20
4,225.00	0.25	123.84	4,223.89	-19.51	4.63	-19.50	0.23	-0.08	-48.72
4,250.00	0.29	125.82	4,248.89	-19.57	4.73	-19.57	0.16	0.16	7.92
4,275.00	0.27	122.44	4,273.89	-19.64	4.83	-19.64	0.10	-0.08	-13.52
4,300.00	0.26	133.29	4,298.89	-19.71	4.92	-19.71	0.20	-0.04	43.40
4,325.00	0.26	138.71	4,323.89	-19.80	5.00	-19.79	0.10	0.00	21.68
4,350.00	0.26	130.69	4,348.89	-19.87	5.08	-19.87	0.15	0.00	-32.08
4,375.00	0.28	131.51	4,373.89	-19.95	5.16	-19.95	0.08	0.08	3.28
4,400.00	0.24	111.42	4,398.89	-20.01	5.26	-20.01	0.40	-0.16	-80.36
4,425.00	0.30	128.19	4,423.89	-20.07	5.36	-20.07	0.39	0.24	67.08
4,450.00	0.31	133.81	4,448.89	-20.16	5.46	-20.15	0.13	0.04	22.48
4,475.00	0.37	129.93	4,473.89	-20.26	5.57	-20.25	0.26	0.24	-15.52
4,500.00	0.33	150.88	4,498.89	-20.37	5.67	-20.37	0.53	-0.16	83.80
4,525.00	0.43	117.69	4,523.89	-20.48	5.79	-20.47	0.95	0.40	-132.76
4,550.00	0.41	139.01	4,548.89	-20.59	5.93	-20.58	0.63	-0.08	85.28
4,575.00	0.31	122.42	4,573.89	-20.69	6.04	-20.69	0.57	-0.40	-66.36
4,600.00	0.38	125.63	4,598.89	-20.78	6.17	-20.77	0.29	0.28	12.84
4,625.00	0.35	132.95	4,623.89	-20.88	6.29	-20.87	0.22	-0.12	29.28



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	0.22	130.45	4,648.89	-20.96	6.38	-20.96	0.52	-0.52	-10.00
4,675.00	0.13	91.61	4,673.89	-20.99	6.45	-20.99	0.58	-0.36	-155.36
4,700.00	0.08	83.08	4,698.89	-20.99	6.49	-20.99	0.21	-0.20	-34.12
4,725.00	0.04	69.93	4,723.89	-20.99	6.52	-20.98	0.17	-0.16	-52.60
4,750.00	0.09	34.86	4,748.89	-20.97	6.54	-20.96	0.25	0.20	-140.28
4,775.00	0.10	45.69	4,773.89	-20.94	6.57	-20.93	0.08	0.04	43.32
4,800.00	0.12	64.34	4,798.89	-20.91	6.60	-20.90	0.16	0.08	74.60
4,825.00	0.11	36.44	4,823.89	-20.88	6.64	-20.87	0.23	-0.04	-111.60
4,850.00	0.13	341.07	4,848.89	-20.83	6.65	-20.83	0.45	0.08	-221.48
4,875.00	0.12	289.69	4,873.89	-20.80	6.61	-20.79	0.43	-0.04	-205.52
4,900.00	0.01	216.42	4,898.89	-20.79	6.59	-20.78	0.47	-0.44	-293.08
4,925.00	0.05	88.07	4,923.89	-20.79	6.60	-20.79	0.23	0.16	-513.40
4,950.00	0.09	121.66	4,948.89	-20.80	6.63	-20.80	0.22	0.16	134.36
4,975.00	0.17	86.96	4,973.89	-20.81	6.68	-20.80	0.44	0.32	-138.80
5,000.00	0.13	122.86	4,998.89	-20.82	6.74	-20.82	0.40	-0.16	143.60
5,025.00	0.15	150.27	5,023.89	-20.87	6.78	-20.86	0.28	0.08	109.64
5,050.00	0.16	137.83	5,048.89	-20.92	6.82	-20.91	0.14	0.04	-49.76
5,075.00	0.23	117.23	5,073.89	-20.97	6.89	-20.96	0.39	0.28	-82.40
5,100.00	0.18	120.03	5,098.89	-21.01	6.97	-21.01	0.20	-0.20	11.20
5,125.00	0.22	109.49	5,123.89	-21.05	7.05	-21.04	0.22	0.16	-42.16
5,150.00	0.23	114.83	5,148.89	-21.09	7.14	-21.08	0.09	0.04	21.36
5,175.00	0.29	142.42	5,173.89	-21.16	7.22	-21.15	0.55	0.24	110.36
5,200.00	0.42	154.15	5,198.88	-21.29	7.30	-21.28	0.59	0.52	46.92
5,225.00	0.37	146.74	5,223.88	-21.44	7.38	-21.43	0.29	-0.20	-29.64
5,250.00	0.39	147.79	5,248.88	-21.58	7.47	-21.57	0.08	0.08	4.20
5,275.00	0.45	155.40	5,273.88	-21.74	7.56	-21.73	0.33	0.24	30.44
5,300.00	0.41	165.77	5,298.88	-21.92	7.62	-21.91	0.35	-0.16	41.48
5,325.00	0.49	174.03	5,323.88	-22.11	7.65	-22.10	0.41	0.32	33.04
5,350.00	0.48	164.40	5,348.88	-22.32	7.69	-22.31	0.33	-0.04	-38.52
5,375.00	0.56	170.15	5,373.88	-22.54	7.74	-22.53	0.38	0.32	23.00
5,400.00	0.60	172.59	5,398.88	-22.79	7.78	-22.78	0.19	0.16	9.76
5,425.00	0.51	207.03	5,423.88	-23.02	7.75	-23.01	1.36	-0.36	137.76
5,450.00	0.61	223.00	5,448.88	-23.21	7.61	-23.21	0.74	0.40	63.88
5,475.00	0.60	229.91	5,473.87	-23.39	7.42	-23.39	0.29	-0.04	27.64
5,500.00	0.54	237.89	5,498.87	-23.54	7.22	-23.53	0.40	-0.24	31.92
5,525.00	0.64	238.66	5,523.87	-23.68	7.00	-23.67	0.40	0.40	3.08
5,550.00	0.56	255.61	5,548.87	-23.78	6.76	-23.77	0.77	-0.32	67.80
5,575.00	0.74	268.04	5,573.87	-23.82	6.48	-23.81	0.91	0.72	49.72
5,600.00	0.81	283.32	5,598.87	-23.78	6.15	-23.77	0.87	0.28	61.12
5,625.00	0.83	294.54	5,623.86	-23.66	5.81	-23.66	0.65	0.08	44.88
5,650.00	0.85	291.01	5,648.86	-23.52	5.47	-23.52	0.22	0.08	-14.12
5,675.00	0.88	287.80	5,673.86	-23.40	5.12	-23.39	0.23	0.12	-12.84
5,700.00	0.96	282.88	5,698.86	-23.29	4.73	-23.29	0.45	0.32	-19.68



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	0.90	286.62	5,723.85	-23.19	4.34	-23.19	0.34	-0.24	14.96
5,750.00	0.89	283.44	5,748.85	-23.09	3.96	-23.08	0.20	-0.04	-12.72
5,775.00	0.93	285.95	5,773.85	-22.99	3.57	-22.98	0.23	0.16	10.04
5,800.00	0.88	283.85	5,798.84	-22.89	3.19	-22.88	0.24	-0.20	-8.40
5,825.00	0.85	281.67	5,823.84	-22.80	2.83	-22.80	0.18	-0.12	-8.72
5,850.00	0.83	272.37	5,848.84	-22.76	2.46	-22.76	0.55	-0.08	-37.20
5,875.00	0.69	264.04	5,873.84	-22.77	2.13	-22.76	0.71	-0.56	-33.32
5,900.00	0.51	267.05	5,898.83	-22.79	1.87	-22.79	0.73	-0.72	12.04
5,925.00	0.42	274.10	5,923.83	-22.79	1.67	-22.78	0.43	-0.36	28.20
5,950.00	0.27	279.68	5,948.83	-22.77	1.52	-22.77	0.61	-0.60	22.32
5,975.00	0.08	229.11	5,973.83	-22.77	1.45	-22.77	0.91	-0.76	-202.28
6,000.00	0.22	93.24	5,998.83	-22.79	1.48	-22.78	1.13	0.56	-543.48
6,025.00	0.24	91.99	6,023.83	-22.79	1.58	-22.79	0.08	0.08	-5.00
6,050.00	0.43	75.82	6,048.83	-22.77	1.73	-22.77	0.84	0.76	-64.68
6,075.00	1.00	46.32	6,073.83	-22.60	1.98	-22.59	2.64	2.28	-118.00
6,100.00	1.30	39.49	6,098.82	-22.23	2.31	-22.22	1.32	1.20	-27.32
6,125.00	1.39	43.24	6,123.82	-21.79	2.70	-21.78	0.50	0.36	15.00
6,150.00	1.44	48.56	6,148.81	-21.36	3.14	-21.35	0.56	0.20	21.28
6,175.00	1.58	62.05	6,173.80	-20.99	3.68	-20.98	1.52	0.56	53.96
6,200.00	1.62	66.58	6,198.79	-20.69	4.31	-20.68	0.53	0.16	18.12
6,225.00	1.64	72.95	6,223.78	-20.44	4.98	-20.44	0.73	0.08	25.48
6,250.00	1.59	73.57	6,248.77	-20.24	5.65	-20.23	0.21	-0.20	2.48
6,275.00	1.43	78.83	6,273.76	-20.08	6.29	-20.07	0.85	-0.64	21.04
6,300.00	1.32	86.91	6,298.76	-20.00	6.89	-20.00	0.89	-0.44	32.32
6,325.00	1.36	88.32	6,323.75	-19.98	7.47	-19.97	0.21	0.16	5.64
6,350.00	1.61	95.53	6,348.74	-20.00	8.12	-20.00	1.25	1.00	28.84
6,375.00	2.01	100.47	6,373.73	-20.12	8.90	-20.11	1.72	1.60	19.76
6,400.00	2.17	102.24	6,398.71	-20.30	9.79	-20.29	0.69	0.64	7.08
6,425.00	2.12	97.71	6,423.69	-20.46	10.71	-20.45	0.71	-0.20	-18.12
6,450.00	1.88	81.31	6,448.68	-20.46	11.58	-20.45	2.47	-0.96	-65.60
6,475.00	1.84	63.77	6,473.67	-20.22	12.34	-20.21	2.27	-0.16	-70.16
6,500.00	1.84	56.91	6,498.65	-19.82	13.04	-19.81	0.88	0.00	-27.44
6,525.00	1.83	53.24	6,523.64	-19.37	13.69	-19.35	0.47	-0.04	-14.68
6,550.00	1.77	51.53	6,548.63	-18.89	14.32	-18.87	0.32	-0.24	-6.84
6,575.00	1.81	43.46	6,573.62	-18.36	14.89	-18.35	1.02	0.16	-32.28
6,600.00	1.77	40.78	6,598.60	-17.78	15.41	-17.77	0.37	-0.16	-10.72
6,625.00	1.79	33.94	6,623.59	-17.16	15.88	-17.15	0.85	0.08	-27.36
6,650.00	1.79	27.07	6,648.58	-16.49	16.28	-16.48	0.86	0.00	-27.48
6,675.00	1.78	24.82	6,673.57	-15.79	16.62	-15.78	0.28	-0.04	-9.00
6,700.00	2.10	18.98	6,698.55	-15.01	16.93	-14.99	1.50	1.28	-23.36
6,725.00	1.97	18.57	6,723.54	-14.17	17.22	-14.15	0.52	-0.52	-1.64
6,750.00	1.74	13.15	6,748.52	-13.39	17.44	-13.37	1.16	-0.92	-21.68
6,775.00	1.62	4.54	6,773.51	-12.67	17.55	-12.65	1.12	-0.48	-34.44
6,800.00	1.53	351.34	6,798.50	-11.99	17.53	-11.97	1.49	-0.36	-52.80



Phoenix Technology Services LP
Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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	1.66	348.49	6,823.49	-11.30	17.41	-11.28	0.61	0.52	-11.40
6,850.00	1.76	343.25	6,848.48	-10.58	17.23	-10.56	0.74	0.40	-20.96
6,875.00	1.68	340.09	6,873.47	-9.87	16.99	-9.85	0.50	-0.32	-12.64
6,894.00	1.51	332.78	6,892.46	-9.38	16.78	-9.37	1.39	-0.89	-38.47
Tie In									
6,963.00	1.55	329.54	6,961.44	-7.77	15.89	-7.75	0.14	0.06	-4.70
First Phoenix MWD Survey									
7,151.00	1.40	353.95	7,149.38	-3.29	14.36	-3.28	0.34	-0.08	12.98
7,245.00	0.85	346.80	7,243.36	-1.47	14.08	-1.46	0.60	-0.59	-7.61
7,258.00	0.88	347.24	7,256.36	-1.28	14.04	-1.27	0.24	0.23	3.38
7,285.00	0.75	353.04	7,283.36	-0.90	13.97	-0.89	0.57	-0.48	21.48
7,380.00	8.49	5.96	7,377.98	6.70	14.62	6.71	8.17	8.15	13.60
7,426.00	13.89	3.58	7,423.09	15.59	15.32	15.61	11.78	11.74	-5.17
7,475.00	19.82	4.57	7,469.96	29.76	16.35	29.77	12.12	12.10	2.02
7,521.00	24.76	4.65	7,512.51	47.14	17.76	47.16	10.74	10.74	0.17
7,569.00	29.75	4.06	7,555.17	69.05	19.41	69.07	10.41	10.40	-1.23
7,616.00	34.53	3.86	7,594.95	93.99	21.14	94.01	10.17	10.17	-0.43
7,664.00	39.66	4.14	7,633.23	122.86	23.16	122.88	10.69	10.69	0.58
7,690.00	42.63	4.37	7,652.80	139.92	24.43	139.94	11.43	11.41	0.88
FTP									
7,710.00	44.91	4.53	7,667.25	153.71	25.51	153.74	11.43	11.41	0.80
7,758.00	50.01	4.33	7,699.69	188.96	28.23	188.99	10.63	10.63	-0.42
7,805.00	55.43	3.13	7,728.15	226.26	30.65	226.29	11.71	11.53	-2.55
7,852.00	60.91	2.91	7,752.93	266.13	32.75	266.16	11.67	11.66	-0.47
7,899.00	66.41	1.91	7,773.77	308.19	34.51	308.23	11.86	11.70	-2.13
7,947.00	71.75	359.47	7,790.91	353.01	35.04	353.04	12.09	11.13	-5.08
7,994.00	77.38	356.92	7,803.41	398.26	33.60	398.30	13.07	11.98	-5.43
8,041.00	81.84	354.42	7,811.89	444.35	30.10	444.38	10.84	9.49	-5.32
8,087.00	84.94	354.39	7,817.18	489.82	25.65	489.84	6.74	6.74	-0.07
8,167.00	90.03	353.73	7,820.69	569.28	17.38	569.30	6.42	6.36	-0.83
8,261.00	91.85	356.93	7,819.15	662.94	9.72	662.95	3.92	1.94	3.40
8,355.00	90.28	0.02	7,817.40	756.88	7.22	756.89	3.69	-1.67	3.29
8,449.00	90.53	0.24	7,816.74	850.88	7.44	850.88	0.35	0.27	0.23
8,544.00	91.32	0.13	7,815.20	945.86	7.74	945.87	0.84	0.83	-0.12
8,638.00	89.27	359.56	7,814.72	1,039.86	7.49	1,039.86	2.26	-2.18	-0.61
8,732.00	89.97	359.43	7,815.34	1,133.85	6.66	1,133.86	0.76	0.74	-0.14
8,826.00	89.78	359.60	7,815.55	1,227.85	5.87	1,227.85	0.27	-0.20	0.18
8,920.00	90.31	0.00	7,815.47	1,321.84	5.54	1,321.85	0.71	0.56	0.43
9,014.00	90.59	0.19	7,814.74	1,415.84	5.69	1,415.85	0.36	0.30	0.20
9,109.00	90.98	0.17	7,813.43	1,510.83	5.99	1,510.84	0.41	0.41	-0.02
9,203.00	91.71	0.42	7,811.23	1,604.80	6.48	1,604.81	0.82	0.78	0.27
9,296.00	92.35	0.80	7,807.93	1,697.74	7.47	1,697.75	0.80	0.69	0.41
9,390.00	90.70	0.40	7,805.43	1,791.70	8.45	1,791.71	1.81	-1.76	-0.43



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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)
9,485.00	90.70	0.06	7,804.27	1,886.69	8.83	1,886.70	0.36	0.00	-0.36
9,579.00	90.53	0.11	7,803.26	1,980.68	8.97	1,980.69	0.19	-0.18	0.05
9,673.00	90.73	359.82	7,802.23	2,074.68	8.91	2,074.69	0.37	0.21	-0.31
9,767.00	91.32	359.88	7,800.55	2,168.66	8.67	2,168.67	0.63	0.63	0.06
9,861.00	91.51	359.36	7,798.23	2,262.63	8.04	2,262.64	0.59	0.20	-0.55
9,955.00	91.71	358.59	7,795.59	2,356.58	6.36	2,356.58	0.85	0.21	-0.82
10,049.00	90.56	0.14	7,793.72	2,450.55	5.32	2,450.55	2.05	-1.22	1.65
10,143.00	90.84	359.44	7,792.57	2,544.54	4.98	2,544.55	0.80	0.30	-0.74
10,237.00	91.12	359.39	7,790.97	2,638.52	4.02	2,638.53	0.30	0.30	-0.05
10,331.00	91.15	358.98	7,789.11	2,732.50	2.68	2,732.50	0.44	0.03	-0.44
10,426.00	92.63	359.04	7,785.97	2,827.43	1.04	2,827.43	1.56	1.56	0.06
10,520.00	90.28	0.08	7,783.59	2,921.39	0.32	2,921.38	2.73	-2.50	1.11
10,614.00	89.94	0.31	7,783.40	3,015.38	0.64	3,015.38	0.44	-0.36	0.24
10,708.00	89.94	0.11	7,783.50	3,109.38	0.98	3,109.38	0.21	0.00	-0.21
10,803.00	90.31	0.40	7,783.30	3,204.38	1.41	3,204.38	0.49	0.39	0.31
10,898.00	90.98	0.73	7,782.23	3,299.37	2.34	3,299.37	0.79	0.71	0.35
10,992.00	91.09	0.66	7,780.53	3,393.35	3.48	3,393.35	0.14	0.12	-0.07
11,087.00	90.78	0.91	7,778.98	3,488.33	4.78	3,488.33	0.42	-0.33	0.26
11,181.00	91.09	0.61	7,777.44	3,582.31	6.03	3,582.31	0.46	0.33	-0.32
11,275.00	90.00	0.18	7,776.55	3,676.30	6.68	3,676.30	1.25	-1.16	-0.46
11,369.00	90.03	0.21	7,776.53	3,770.30	7.00	3,770.30	0.05	0.03	0.03
11,463.00	89.94	359.99	7,776.55	3,864.30	7.16	3,864.30	0.25	-0.10	-0.23
11,558.00	89.94	0.07	7,776.65	3,959.30	7.21	3,959.30	0.08	0.00	0.08
11,652.00	89.89	359.62	7,776.79	4,053.30	6.96	4,053.30	0.48	-0.05	-0.48
11,746.00	89.80	359.81	7,777.04	4,147.30	6.49	4,147.30	0.22	-0.10	0.20
11,840.00	90.31	359.37	7,776.95	4,241.29	5.82	4,241.30	0.72	0.54	-0.47
11,934.00	90.87	359.15	7,775.99	4,335.28	4.60	4,335.28	0.64	0.60	-0.23
12,028.00	90.98	358.86	7,774.47	4,429.25	2.97	4,429.25	0.33	0.12	-0.31
12,121.00	91.71	358.84	7,772.29	4,522.21	1.11	4,522.21	0.79	0.78	-0.02
12,212.00	91.51	359.04	7,769.73	4,613.16	-0.58	4,613.15	0.31	-0.22	0.22
12,301.00	89.58	359.54	7,768.88	4,702.14	-1.68	4,702.14	2.24	-2.17	0.56
12,392.00	90.14	359.84	7,769.10	4,793.14	-2.17	4,793.13	0.70	0.62	0.33
12,484.00	90.70	359.39	7,768.43	4,885.13	-2.79	4,885.13	0.78	0.61	-0.49
12,575.00	91.37	359.73	7,766.79	4,976.11	-3.49	4,976.11	0.83	0.74	0.37
12,666.00	91.82	359.98	7,764.25	5,067.08	-3.72	5,067.07	0.57	0.49	0.27
12,757.00	90.95	0.70	7,762.05	5,158.05	-3.18	5,158.04	1.24	-0.96	0.79
12,847.00	89.27	0.27	7,761.88	5,248.04	-2.42	5,248.04	1.93	-1.87	-0.48
12,941.00	88.96	0.73	7,763.33	5,342.03	-1.60	5,342.02	0.59	-0.33	0.49
13,035.00	88.99	1.14	7,765.01	5,436.00	-0.06	5,436.00	0.44	0.03	0.44
13,129.00	89.83	0.87	7,765.98	5,529.98	1.59	5,529.98	0.94	0.89	-0.29
13,223.00	90.56	1.38	7,765.66	5,623.96	3.43	5,623.96	0.95	0.78	0.54
13,318.00	90.73	1.57	7,764.59	5,718.92	5.88	5,718.93	0.27	0.18	0.20
13,412.00	90.92	1.32	7,763.24	5,812.88	8.25	5,812.89	0.33	0.20	-0.27
13,506.00	90.28	1.90	7,762.26	5,906.84	10.89	5,906.85	0.92	-0.68	0.62



Phoenix Technology Services LP
Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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)
13,600.00	89.97	2.06	7,762.05	6,000.78	14.14	6,000.79	0.37	-0.33	0.17
13,694.00	89.30	1.10	7,762.65	6,094.74	16.73	6,094.76	1.25	-0.71	-1.02
13,788.00	89.55	1.16	7,763.59	6,188.72	18.58	6,188.74	0.27	0.27	0.06
13,882.00	87.79	0.38	7,765.77	6,282.68	19.84	6,282.70	2.05	-1.87	-0.83
13,977.00	88.12	0.25	7,769.16	6,377.62	20.37	6,377.64	0.37	0.35	-0.14
14,071.00	88.23	359.99	7,772.16	6,471.57	20.56	6,471.59	0.30	0.12	-0.28
14,165.00	88.32	359.38	7,774.99	6,565.53	20.05	6,565.54	0.66	0.10	-0.65
14,259.00	88.54	0.07	7,777.56	6,659.49	19.59	6,659.51	0.77	0.23	0.73
14,353.00	89.16	0.52	7,779.45	6,753.47	20.08	6,753.49	0.81	0.66	0.48
14,444.00	89.41	0.75	7,780.58	6,844.46	21.09	6,844.47	0.37	0.27	0.25
14,538.00	89.78	0.75	7,781.25	6,938.45	22.32	6,938.47	0.39	0.39	0.00
14,632.00	90.03	0.77	7,781.41	7,032.44	23.56	7,032.46	0.27	0.27	0.02
14,726.00	89.97	1.08	7,781.41	7,126.43	25.08	7,126.45	0.34	-0.06	0.33
14,821.00	90.08	1.26	7,781.36	7,221.41	27.02	7,221.43	0.22	0.12	0.19
14,915.00	90.11	1.90	7,781.21	7,315.37	29.61	7,315.39	0.68	0.03	0.68
15,009.00	88.46	359.95	7,782.38	7,409.34	31.13	7,409.37	2.72	-1.76	-2.07
15,103.00	88.74	359.86	7,784.68	7,503.31	30.98	7,503.34	0.31	0.30	-0.10
15,198.00	89.16	357.17	7,786.42	7,598.26	28.51	7,598.28	2.87	0.44	-2.83
15,292.00	89.36	357.02	7,787.63	7,692.13	23.75	7,692.15	0.27	0.21	-0.16
15,386.00	89.27	357.03	7,788.76	7,785.99	18.87	7,786.01	0.10	-0.10	0.01
15,480.00	89.11	357.21	7,790.09	7,879.87	14.15	7,879.88	0.26	-0.17	0.19
15,574.00	89.41	358.94	7,791.30	7,973.80	10.99	7,973.81	1.87	0.32	1.84
15,668.00	89.52	358.99	7,792.18	8,067.78	9.29	8,067.79	0.13	0.12	0.05
15,762.00	90.03	359.30	7,792.55	8,161.77	7.89	8,161.77	0.63	0.54	0.33
15,856.00	90.22	359.27	7,792.34	8,255.76	6.72	8,255.77	0.20	0.20	-0.03
15,951.00	90.56	359.65	7,791.69	8,350.76	5.82	8,350.76	0.54	0.36	0.40
16,045.00	90.81	359.78	7,790.57	8,444.75	5.36	8,444.75	0.30	0.27	0.14
16,139.00	91.15	0.07	7,788.96	8,538.73	5.23	8,538.74	0.48	0.36	0.31
16,233.00	91.54	0.11	7,786.76	8,632.71	5.38	8,632.71	0.42	0.41	0.04
16,327.00	91.90	0.08	7,783.94	8,726.67	5.54	8,726.67	0.38	0.38	-0.03
16,422.00	90.67	1.05	7,781.80	8,821.63	6.47	8,821.64	1.65	-1.29	1.02
16,516.00	90.92	1.27	7,780.50	8,915.61	8.38	8,915.61	0.35	0.27	0.23
16,611.00	91.17	1.20	7,778.77	9,010.57	10.42	9,010.57	0.27	0.26	-0.07
16,705.00	88.99	1.15	7,778.64	9,104.54	12.35	9,104.55	2.32	-2.32	-0.05
16,799.00	89.36	1.10	7,779.99	9,198.51	14.20	9,198.52	0.40	0.39	-0.05
16,893.00	89.75	1.36	7,780.72	9,292.49	16.21	9,292.50	0.50	0.41	0.28
16,987.00	90.06	1.05	7,780.88	9,386.47	18.19	9,386.48	0.47	0.33	-0.33
17,082.00	90.48	1.13	7,780.43	9,481.45	20.00	9,481.47	0.45	0.44	0.08
17,176.00	90.67	1.33	7,779.49	9,575.42	22.02	9,575.44	0.29	0.20	0.21
17,270.00	91.01	1.46	7,778.11	9,669.39	24.30	9,669.40	0.39	0.36	0.14
17,365.00	91.43	1.70	7,776.08	9,764.33	26.92	9,764.35	0.51	0.44	0.25
17,459.00	90.08	0.55	7,774.85	9,858.30	28.77	9,858.32	1.89	-1.44	-1.22
17,552.00	90.22	0.45	7,774.60	9,951.29	29.58	9,951.32	0.18	0.15	-0.11



Phoenix Technology Services LP

Survey Report



Company: COG Operating LLC
Project: Eddy County, NM (NAD27 NME)
Site: Road Runner Federal Com
Well: 11H
Wellbore: OH / Job #60727
Design: Surveys (Ensign 155)

Local Co-ordinate Reference: Well 11H
TVD Reference: GL + KB @ 3274.20usft (Ensign 155)
MD Reference: GL + KB @ 3274.20usft (Ensign 155)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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)
17,647.00	90.48	0.32	7,774.02	10,046.29	30.22	10,046.31	0.31	0.27	-0.14
17,665.00	90.58	0.41	7,773.86	10,064.29	30.33	10,064.31	0.72	0.53	0.48
LTP									
17,741.00	90.98	0.77	7,772.82	10,140.28	31.11	10,140.30	0.72	0.53	0.48
17,835.00	91.37	0.62	7,770.90	10,234.25	32.25	10,234.28	0.44	0.41	-0.16
17,874.00	91.45	0.98	7,769.94	10,273.23	32.80	10,273.26	0.95	0.21	0.92
Final Phoenix MWD Survey									
17,930.00	91.45	0.98	7,768.52	10,329.21	33.75	10,329.24	0.00	0.00	0.00

Projection to TD - BHL v2 - Road Runner Federal Com 11H - BHL v4 - Road Runner Federal Com 11H - BHL v5 - Road Runner Federal Cor

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		
		+N/-S (usft)	+E/-W (usft)	Comment
6,894.00	6,892.46	-9.38	16.78	Tie In
6,963.00	6,961.44	-7.77	15.89	First Phoenix MWD Survey
7,690.00	7,652.80	139.92	24.43	FTP
17,665.00	7,773.86	10,064.29	30.33	LTP
17,874.00	7,769.94	10,273.23	32.80	Final Phoenix MWD Survey
17,930.00	7,768.52	10,329.21	33.75	Projection to TD

Checked By: _____ Approved By: _____ Date: _____