



## COG Operating LLC

Eddy County, NM (NAD83 NME)

Craig Federal Com

2H

30-015-44209

NM OIL CONSERVATION  
ARTESIA DISTRICT

NOV 27 2017

RECEIVED

OH

Design: Surveys (Ensign 155)

## Standard Survey Report

05 September, 2017

Please provide signature  
page for directional survey





# Phoenix Technology Services LP

## Survey Report



**Company:** COG Operating LLC  
**Project:** Eddy County, NM (NAD83 NME)  
**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
**TVD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**MD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** Compass 5000 GCR

**Project** Eddy County, NM (NAD83 NME)

**Map System:** US State Plane 1983  
**Geo Datum:** North American Datum 1983  
**Map Zone:** New Mexico Eastern Zone

**System Datum:** Mean Sea Level

**Site** Craig Federal Com

**Site Position:** **From:** Map  
**Position Uncertainty:** 0.00 usft  
**Northing:** 391,815.00 usft  
**Easting:** 566,289.40 usft  
**Slot Radius:** 13-3/16 "  
**Latitude:** 32° 4' 37.75262 N  
**Longitude:** 104° 15' 9.98177 W  
**Grid Convergence:** 0.04 °

**Well** 2H

**Well Position** **+N/-S** 0.00 usft **Northing:** 391,815.00 usft **Latitude:** 32° 4' 37.75262 N  
**+E/-W** 0.00 usft **Easting:** 566,289.40 usft **Longitude:** 104° 15' 9.98177 W  
**Position Uncertainty** 0.00 usft **Wellhead Elevation:** 0.00 usft **Ground Level:** 3,369.80 usft

**Wellbore** OH

| Magnetics | Model Name | Sample Date | Declination (°) | Dip Angle (°) | Field Strength (nT) |
|-----------|------------|-------------|-----------------|---------------|---------------------|
|           | HDGM       | 8/31/2017   | 7.43            | 59.78         | 47,964              |

**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         | 358.48        |

**Survey Program** Date 9/5/2017

| From (usft) | To (usft) | Survey (Wellbore)                   | Tool Name   | Description                                  |
|-------------|-----------|-------------------------------------|-------------|----------------------------------------------|
| 165.00      | 6,840.00  | Phoenix MWD Surveys (Pre-Gyro) (OH) | MWD+IFR1+MS | OWSG Rev. 2 MWD + IFR1 + Multi-Station Corre |
| 6,910.00    | 18,446.00 | Phoenix MWD Surveys (OH)            | MWD+IFR1+MS | OWSG Rev. 2 MWD + IFR1 + Multi-Station Corre |

**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                  |
| 165.00                | 1.08            | 291.09      | 164.99                | 0.56         | -1.45        | 0.60                    | 0.65                    | 0.65                   | 0.00                  |
| 226.00                | 1.20            | 294.75      | 225.98                | 1.03         | -2.57        | 1.10                    | 0.23                    | 0.20                   | 6.00                  |
| 317.00                | 1.07            | 299.63      | 316.96                | 1.85         | -4.17        | 1.96                    | 0.18                    | -0.14                  | 5.36                  |
| 376.00                | 0.97            | 294.46      | 375.95                | 2.33         | -5.10        | 2.47                    | 0.23                    | -0.17                  | -8.76                 |
| 501.00                | 0.66            | 281.84      | 500.94                | 2.92         | -6.77        | 3.10                    | 0.29                    | -0.25                  | -10.10                |
| 594.00                | 0.59            | 273.99      | 593.93                | 3.06         | -7.77        | 3.27                    | 0.12                    | -0.08                  | -8.44                 |
| 685.00                | 0.52            | 264.46      | 684.93                | 3.05         | -8.65        | 3.28                    | 0.13                    | -0.08                  | -10.47                |
| 775.00                | 0.51            | 275.80      | 774.92                | 3.05         | -9.46        | 3.30                    | 0.11                    | -0.01                  | 12.60                 |
| 865.00                | 0.14            | 223.05      | 864.92                | 3.01         | -9.93        | 3.28                    | 0.49                    | -0.41                  | -58.61                |



# Phoenix Technology Services LP

## Survey Report



**Company:** COG Operating LLC  
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**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
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**MD Reference:** GL + KB @ 3393.80usft (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) |
|-----------------------|-----------------|-------------|-----------------------|--------------|--------------|-------------------------|-------------------------|------------------------|-----------------------|
| 956.00                | 0.43            | 120.00      | 955.92                | 2.76         | -9.71        | 3.02                    | 0.53                    | 0.32                   | -113.24               |
| 1,047.00              | 0.46            | 136.01      | 1,046.92              | 2.33         | -9.16        | 2.57                    | 0.14                    | 0.03                   | 17.59                 |
| 1,138.00              | 0.42            | 174.60      | 1,137.92              | 1.73         | -8.88        | 1.97                    | 0.32                    | -0.04                  | 42.41                 |
| 1,228.00              | 0.46            | 184.10      | 1,227.91              | 1.05         | -8.87        | 1.28                    | 0.09                    | 0.04                   | 10.56                 |
| 1,318.00              | 0.98            | 133.32      | 1,317.91              | 0.16         | -8.34        | 0.38                    | 0.86                    | 0.58                   | -56.42                |
| 1,409.00              | 2.40            | 113.87      | 1,408.87              | -1.15        | -6.03        | -0.99                   | 1.66                    | 1.56                   | -21.37                |
| 1,504.00              | 2.13            | 102.84      | 1,503.79              | -2.34        | -2.49        | -2.28                   | 0.54                    | -0.28                  | -11.61                |
| 1,598.00              | 2.50            | 81.96       | 1,597.72              | -2.45        | 1.24         | -2.48                   | 0.97                    | 0.39                   | -22.21                |
| 1,692.00              | 2.50            | 75.05       | 1,691.63              | -1.63        | 5.26         | -1.77                   | 0.32                    | 0.00                   | -7.35                 |
| 1,786.00              | 0.89            | 26.00       | 1,785.59              | -0.45        | 7.56         | -0.65                   | 2.16                    | -1.71                  | -52.18                |
| 1,880.00              | 1.20            | 296.69      | 1,879.58              | 0.65         | 7.00         | 0.47                    | 1.58                    | 0.33                   | -95.01                |
| 1,975.00              | 1.46            | 292.20      | 1,974.55              | 1.56         | 4.99         | 1.42                    | 0.29                    | 0.27                   | -4.73                 |
| 2,069.00              | 0.92            | 303.61      | 2,068.53              | 2.43         | 3.25         | 2.34                    | 0.62                    | -0.57                  | 12.14                 |
| 2,163.00              | 0.68            | 311.01      | 2,162.52              | 3.21         | 2.20         | 3.15                    | 0.28                    | -0.26                  | 7.87                  |
| 2,258.00              | 0.55            | 321.79      | 2,257.52              | 3.94         | 1.49         | 3.90                    | 0.18                    | -0.14                  | 11.35                 |
| 2,382.00              | 0.41            | 308.55      | 2,381.51              | 4.68         | 0.78         | 4.66                    | 0.14                    | -0.11                  | -10.68                |
| 2,445.00              | 0.48            | 323.64      | 2,444.51              | 5.04         | 0.45         | 5.02                    | 0.22                    | 0.11                   | 23.95                 |
| 2,539.00              | 0.45            | 327.03      | 2,538.51              | 5.66         | 0.01         | 5.66                    | 0.04                    | -0.03                  | 3.61                  |
| 2,633.00              | 0.38            | 324.24      | 2,632.50              | 6.23         | -0.37        | 6.23                    | 0.08                    | -0.07                  | -2.97                 |
| 2,727.00              | 0.23            | 306.04      | 2,726.50              | 6.59         | -0.71        | 6.61                    | 0.19                    | -0.16                  | -19.36                |
| 2,821.00              | 0.20            | 297.19      | 2,820.50              | 6.78         | -1.00        | 6.80                    | 0.05                    | -0.03                  | -9.41                 |
| 2,915.00              | 0.16            | 196.08      | 2,914.50              | 6.72         | -1.19        | 6.75                    | 0.30                    | -0.04                  | -107.56               |
| 3,010.00              | 0.19            | 191.45      | 3,009.50              | 6.44         | -1.26        | 6.47                    | 0.03                    | 0.03                   | -4.87                 |
| 3,104.00              | 0.13            | 205.73      | 3,103.50              | 6.19         | -1.33        | 6.23                    | 0.08                    | -0.06                  | 15.19                 |
| 3,198.00              | 0.32            | 232.74      | 3,197.50              | 5.94         | -1.59        | 5.98                    | 0.23                    | 0.20                   | 28.73                 |
| 3,292.00              | 0.40            | 198.47      | 3,291.50              | 5.47         | -1.90        | 5.52                    | 0.24                    | 0.09                   | -36.46                |
| 3,386.00              | 0.54            | 195.14      | 3,385.50              | 4.73         | -2.12        | 4.78                    | 0.15                    | 0.15                   | -3.54                 |
| 3,481.00              | 0.51            | 214.52      | 3,480.49              | 3.95         | -2.48        | 4.01                    | 0.19                    | -0.03                  | 20.40                 |
| 3,575.00              | 0.90            | 197.60      | 3,574.48              | 2.90         | -2.94        | 2.98                    | 0.47                    | 0.41                   | -18.00                |
| 3,668.00              | 1.03            | 193.24      | 3,667.47              | 1.39         | -3.35        | 1.48                    | 0.16                    | 0.14                   | -4.69                 |
| 3,762.00              | 1.14            | 199.02      | 3,761.45              | -0.32        | -3.85        | -0.21                   | 0.16                    | 0.12                   | 6.15                  |
| 3,856.00              | 1.11            | 205.44      | 3,855.44              | -2.02        | -4.54        | -1.90                   | 0.14                    | -0.03                  | 6.83                  |
| 3,950.00              | 1.17            | 210.08      | 3,949.42              | -3.67        | -5.42        | -3.53                   | 0.12                    | 0.06                   | 4.94                  |
| 4,044.00              | 1.05            | 201.78      | 4,043.40              | -5.30        | -6.22        | -5.14                   | 0.21                    | -0.13                  | -8.83                 |
| 4,138.00              | 0.75            | 197.26      | 4,137.39              | -6.69        | -6.72        | -6.51                   | 0.33                    | -0.32                  | -4.81                 |
| 4,232.00              | 0.97            | 183.55      | 4,231.38              | -8.07        | -6.95        | -7.89                   | 0.32                    | 0.23                   | -14.59                |
| 4,326.00              | 1.29            | 176.99      | 4,325.36              | -9.92        | -6.94        | -9.74                   | 0.37                    | 0.34                   | -6.98                 |
| 4,420.00              | 1.75            | 163.32      | 4,419.33              | -12.36       | -6.48        | -12.18                  | 0.62                    | 0.49                   | -14.54                |
| 4,514.00              | 0.82            | 202.59      | 4,513.30              | -14.35       | -6.32        | -14.18                  | 1.31                    | -0.99                  | 41.78                 |
| 4,608.00              | 0.70            | 235.47      | 4,607.30              | -15.30       | -7.05        | -15.11                  | 0.47                    | -0.13                  | 34.98                 |
| 4,703.00              | 0.70            | 325.07      | 4,702.29              | -15.15       | -7.86        | -14.94                  | 1.04                    | 0.00                   | 94.32                 |
| 4,796.00              | 1.01            | 314.80      | 4,795.28              | -14.11       | -8.77        | -13.87                  | 0.37                    | 0.33                   | -11.04                |
| 4,890.00              | 0.62            | 306.86      | 4,889.27              | -13.22       | -9.77        | -12.96                  | 0.43                    | -0.41                  | -8.45                 |



# Phoenix Technology Services LP

## Survey Report



**Company:** COG Operating LLC  
**Project:** Eddy County, NM (NAD83 NME)  
**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
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**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) |
|---------------------------------|-----------------|-------------|-----------------------|--------------|--------------|-------------------------|-------------------------|------------------------|-----------------------|
| 4,984.00                        | 0.79            | 294.08      | 4,983.26              | -12.65       | -10.76       | -12.36                  | 0.25                    | 0.18                   | -13.60                |
| 5,078.00                        | 0.53            | 260.19      | 5,077.26              | -12.46       | -11.78       | -12.14                  | 0.49                    | -0.28                  | -36.05                |
| 5,173.00                        | 0.76            | 232.97      | 5,172.25              | -12.91       | -12.72       | -12.57                  | 0.40                    | 0.24                   | -28.65                |
| 5,268.00                        | 0.92            | 210.92      | 5,267.24              | -13.95       | -13.62       | -13.58                  | 0.38                    | 0.17                   | -23.21                |
| 5,362.00                        | 1.19            | 204.83      | 5,361.23              | -15.48       | -14.41       | -15.09                  | 0.31                    | 0.29                   | -6.48                 |
| 5,456.00                        | 1.60            | 208.66      | 5,455.20              | -17.52       | -15.45       | -17.10                  | 0.45                    | 0.44                   | 4.07                  |
| 5,550.00                        | 0.40            | 278.99      | 5,549.18              | -18.62       | -16.41       | -18.18                  | 1.61                    | -1.28                  | 74.82                 |
| 5,644.00                        | 0.52            | 251.55      | 5,643.18              | -18.70       | -17.13       | -18.24                  | 0.26                    | 0.13                   | -29.19                |
| 5,738.00                        | 0.06            | 126.86      | 5,737.18              | -18.87       | -17.50       | -18.40                  | 0.59                    | -0.49                  | -132.65               |
| 5,832.00                        | 0.04            | 65.64       | 5,831.18              | -18.88       | -17.43       | -18.41                  | 0.06                    | -0.02                  | -65.13                |
| 5,926.00                        | 0.45            | 197.41      | 5,925.18              | -19.22       | -17.51       | -18.75                  | 0.51                    | 0.44                   | 140.18                |
| 6,020.00                        | 2.86            | 250.63      | 6,019.14              | -20.35       | -19.83       | -19.82                  | 2.78                    | 2.56                   | 56.62                 |
| 6,114.00                        | 1.25            | 229.90      | 6,113.07              | -21.79       | -22.83       | -21.18                  | 1.86                    | -1.71                  | -22.05                |
| 6,208.00                        | 1.12            | 170.86      | 6,207.06              | -23.36       | -23.47       | -22.73                  | 1.25                    | -0.14                  | -62.81                |
| 6,303.00                        | 1.71            | 181.41      | 6,302.03              | -25.69       | -23.36       | -25.06                  | 0.68                    | 0.62                   | 11.11                 |
| 6,397.00                        | 2.53            | 201.16      | 6,395.96              | -29.03       | -24.14       | -28.38                  | 1.16                    | 0.87                   | 21.01                 |
| 6,491.00                        | 1.97            | 228.66      | 6,489.89              | -32.03       | -26.10       | -31.33                  | 1.28                    | -0.60                  | 29.26                 |
| 6,585.00                        | 0.73            | 272.56      | 6,583.87              | -33.07       | -27.91       | -32.32                  | 1.63                    | -1.32                  | 46.70                 |
| 6,678.00                        | 1.25            | 340.22      | 6,676.86              | -32.09       | -28.85       | -31.31                  | 1.27                    | 0.56                   | 72.75                 |
| 6,772.00                        | 0.84            | 257.23      | 6,770.84              | -31.28       | -29.87       | -30.47                  | 1.51                    | -0.44                  | -88.29                |
| 6,840.00                        | 0.81            | 239.61      | 6,838.84              | -31.63       | -30.77       | -30.80                  | 0.37                    | -0.04                  | -25.90                |
| <b>Tie In</b>                   |                 |             |                       |              |              |                         |                         |                        |                       |
| 6,910.00                        | 0.87            | 222.11      | 6,908.83              | -32.28       | -31.56       | -31.43                  | 0.37                    | 0.08                   | -25.01                |
| <b>First Phoenix MWD Survey</b> |                 |             |                       |              |              |                         |                         |                        |                       |
| 6,967.00                        | 0.62            | 301.22      | 6,965.83              | -32.44       | -32.11       | -31.58                  | 1.70                    | -0.44                  | 138.79                |
| 6,998.00                        | 4.66            | 331.26      | 6,996.79              | -31.25       | -32.86       | -30.36                  | 13.34                   | 13.03                  | 96.90                 |
| 7,029.00                        | 8.46            | 329.66      | 7,027.58              | -28.17       | -34.62       | -27.25                  | 12.27                   | 12.26                  | -5.16                 |
| 7,061.00                        | 11.62           | 329.36      | 7,059.08              | -23.37       | -37.45       | -22.37                  | 9.88                    | 9.88                   | -0.94                 |
| 7,092.00                        | 15.19           | 331.84      | 7,089.24              | -17.10       | -40.96       | -16.01                  | 11.66                   | 11.52                  | 8.00                  |
| 7,124.00                        | 18.54           | 333.97      | 7,119.85              | -8.83        | -45.17       | -7.63                   | 10.64                   | 10.47                  | 6.66                  |
| 7,155.00                        | 20.98           | 338.66      | 7,149.03              | 0.77         | -49.35       | 2.08                    | 9.38                    | 7.87                   | 15.13                 |
| 7,187.00                        | 23.28           | 342.87      | 7,178.67              | 12.15        | -53.30       | 13.56                   | 8.73                    | 7.19                   | 13.16                 |
| 7,218.00                        | 26.62           | 345.13      | 7,206.78              | 24.72        | -56.89       | 26.22                   | 11.20                   | 10.77                  | 7.29                  |
| 7,249.00                        | 29.30           | 344.99      | 7,234.15              | 38.76        | -60.64       | 40.36                   | 8.65                    | 8.65                   | -0.45                 |
| 7,281.00                        | 32.24           | 343.43      | 7,261.65              | 54.51        | -65.10       | 56.22                   | 9.52                    | 9.19                   | -4.88                 |
| 7,312.00                        | 34.97           | 343.65      | 7,287.46              | 70.96        | -69.96       | 72.80                   | 8.82                    | 8.81                   | 0.71                  |
| 7,343.00                        | 38.24           | 343.52      | 7,312.35              | 88.69        | -75.19       | 90.66                   | 10.55                   | 10.55                  | -0.42                 |
| 7,375.00                        | 41.86           | 342.88      | 7,336.84              | 108.40       | -81.14       | 110.52                  | 11.39                   | 11.31                  | -2.00                 |
| 7,406.00                        | 45.18           | 341.69      | 7,359.31              | 128.73       | -87.64       | 131.01                  | 11.03                   | 10.71                  | -3.84                 |
| 7,438.00                        | 48.33           | 340.01      | 7,381.24              | 150.74       | -95.29       | 153.22                  | 10.56                   | 9.84                   | -5.25                 |
| 7,469.00                        | 52.03           | 339.14      | 7,401.08              | 173.05       | -103.61      | 175.74                  | 12.13                   | 11.94                  | -2.81                 |
| 7,500.00                        | 55.23           | 336.35      | 7,419.47              | 196.14       | -113.07      | 199.07                  | 12.61                   | 10.32                  | -9.00                 |
| 7,532.00                        | 59.36           | 336.03      | 7,436.75              | 220.77       | -123.94      | 223.98                  | 12.93                   | 12.91                  | -1.00                 |
| 7,563.00                        | 63.51           | 336.08      | 7,451.57              | 245.65       | -134.99      | 249.14                  | 13.39                   | 13.39                  | 0.16                  |



# Phoenix Technology Services LP

## Survey Report



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|-----------------------|-----------------|-------------|-----------------------|--------------|--------------|-------------------------|-------------------------|------------------------|-----------------------|
| 7,594.00              | 67.25           | 336.52      | 7,464.49              | 271.45       | -146.31      | 275.24                  | 12.13                   | 12.06                  | 1.42                  |
| 7,626.00              | 70.13           | 335.78      | 7,476.11              | 298.71       | -158.36      | 302.81                  | 9.25                    | 9.00                   | -2.31                 |
| 7,657.00              | 73.03           | 334.07      | 7,485.91              | 325.34       | -170.83      | 329.76                  | 10.72                   | 9.35                   | -5.52                 |
| 7,689.00              | 76.10           | 332.56      | 7,494.42              | 352.90       | -184.68      | 357.68                  | 10.62                   | 9.59                   | -4.72                 |
| 7,720.00              | 79.00           | 332.77      | 7,501.11              | 379.79       | -198.58      | 384.92                  | 9.38                    | 9.35                   | 0.68                  |
| 7,752.00              | 82.41           | 332.93      | 7,506.27              | 407.88       | -212.99      | 413.39                  | 10.67                   | 10.66                  | 0.50                  |
| 7,785.00              | 86.44           | 332.45      | 7,509.48              | 437.06       | -228.06      | 442.96                  | 12.30                   | 12.21                  | -1.45                 |
| 7,879.00              | 89.27           | 335.93      | 7,513.00              | 521.60       | -268.94      | 528.56                  | 4.77                    | 3.01                   | 3.70                  |
| 7,973.00              | 89.41           | 337.81      | 7,514.08              | 608.04       | -305.86      | 615.94                  | 2.01                    | 0.15                   | 2.00                  |
| 8,067.00              | 88.46           | 340.61      | 7,515.83              | 695.89       | -339.22      | 704.65                  | 3.14                    | -1.01                  | 2.98                  |
| 8,160.00              | 89.30           | 345.28      | 7,517.65              | 784.76       | -366.48      | 794.21                  | 5.10                    | 0.90                   | 5.02                  |
| 8,254.00              | 91.88           | 349.16      | 7,516.68              | 876.40       | -387.27      | 886.37                  | 4.96                    | 2.74                   | 4.13                  |
| 8,349.00              | 93.36           | 353.34      | 7,512.34              | 970.17       | -401.70      | 980.50                  | 4.66                    | 1.56                   | 4.40                  |
| 8,442.00              | 89.16           | 357.77      | 7,510.29              | 1,062.83     | -408.90      | 1,073.31                | 6.56                    | -4.52                  | 4.76                  |
| 8,537.00              | 89.52           | 1.62        | 7,511.38              | 1,157.80     | -409.41      | 1,168.26                | 4.07                    | 0.38                   | 4.05                  |
| 8,631.00              | 88.85           | 1.73        | 7,512.72              | 1,251.75     | -406.66      | 1,262.11                | 0.72                    | -0.71                  | 0.12                  |
| 8,725.00              | 88.80           | 2.19        | 7,514.65              | 1,345.68     | -403.45      | 1,355.91                | 0.49                    | -0.05                  | 0.49                  |
| 8,819.00              | 89.80           | 0.65        | 7,515.80              | 1,439.64     | -401.12      | 1,449.78                | 1.95                    | 1.06                   | -1.64                 |
| 8,913.00              | 90.64           | 0.77        | 7,515.44              | 1,533.63     | -399.95      | 1,543.71                | 0.90                    | 0.89                   | 0.13                  |
| 9,008.00              | 89.08           | 1.23        | 7,515.67              | 1,628.61     | -398.29      | 1,638.61                | 1.71                    | -1.64                  | 0.48                  |
| 9,102.00              | 89.75           | 1.13        | 7,516.63              | 1,722.58     | -396.36      | 1,732.50                | 0.72                    | 0.71                   | -0.11                 |
| 9,196.00              | 89.94           | 1.36        | 7,516.88              | 1,816.56     | -394.32      | 1,826.39                | 0.32                    | 0.20                   | 0.24                  |
| 9,290.00              | 90.42           | 1.22        | 7,516.59              | 1,910.54     | -392.20      | 1,920.28                | 0.53                    | 0.51                   | -0.15                 |
| 9,385.00              | 89.47           | 0.67        | 7,516.68              | 2,005.52     | -390.63      | 2,015.19                | 1.16                    | -1.00                  | -0.58                 |
| 9,479.00              | 89.36           | 0.67        | 7,517.64              | 2,099.51     | -389.53      | 2,109.11                | 0.12                    | -0.12                  | 0.00                  |
| 9,573.00              | 89.72           | 1.17        | 7,518.39              | 2,193.50     | -388.03      | 2,203.02                | 0.66                    | 0.38                   | 0.53                  |
| 9,667.00              | 89.94           | 2.25        | 7,518.67              | 2,287.45     | -385.22      | 2,296.87                | 1.17                    | 0.23                   | 1.15                  |
| 9,761.00              | 88.96           | 1.16        | 7,519.57              | 2,381.40     | -382.42      | 2,390.72                | 1.56                    | -1.04                  | -1.16                 |
| 9,855.00              | 89.08           | 359.36      | 7,521.18              | 2,475.38     | -382.00      | 2,484.65                | 1.92                    | 0.13                   | -1.91                 |
| 9,949.00              | 88.77           | 0.10        | 7,522.95              | 2,569.37     | -382.44      | 2,578.61                | 0.85                    | -0.33                  | 0.79                  |
| 10,044.00             | 88.46           | 0.31        | 7,525.24              | 2,664.34     | -382.10      | 2,673.54                | 0.39                    | -0.33                  | 0.22                  |
| 10,138.00             | 89.55           | 359.62      | 7,526.87              | 2,758.32     | -382.16      | 2,767.50                | 1.37                    | 1.16                   | -0.73                 |
| 10,232.00             | 88.43           | 359.37      | 7,528.53              | 2,852.30     | -382.99      | 2,861.46                | 1.22                    | -1.19                  | -0.27                 |
| 10,326.00             | 85.93           | 359.89      | 7,533.16              | 2,946.18     | -383.59      | 2,955.32                | 2.72                    | -2.66                  | 0.55                  |
| 10,420.00             | 87.25           | 359.72      | 7,538.75              | 3,040.01     | -383.91      | 3,049.13                | 1.42                    | 1.40                   | -0.18                 |
| 10,515.00             | 88.32           | 359.66      | 7,542.42              | 3,134.93     | -384.43      | 3,144.04                | 1.13                    | 1.13                   | -0.06                 |
| 10,610.00             | 89.69           | 359.73      | 7,544.07              | 3,229.92     | -384.93      | 3,239.00                | 1.44                    | 1.44                   | 0.07                  |
| 10,704.00             | 92.27           | 359.42      | 7,542.46              | 3,323.89     | -385.63      | 3,332.96                | 2.76                    | 2.74                   | -0.33                 |
| 10,798.00             | 92.50           | 359.17      | 7,538.55              | 3,417.80     | -386.78      | 3,426.87                | 0.36                    | 0.24                   | -0.27                 |
| 10,892.00             | 91.88           | 0.23        | 7,534.96              | 3,511.73     | -387.28      | 3,520.78                | 1.31                    | -0.66                  | 1.13                  |
| 10,986.00             | 91.26           | 0.14        | 7,532.38              | 3,605.70     | -386.97      | 3,614.70                | 0.67                    | -0.66                  | -0.10                 |
| 11,080.00             | 91.37           | 0.06        | 7,530.22              | 3,699.67     | -386.81      | 3,708.64                | 0.14                    | 0.12                   | -0.09                 |
| 11,174.00             | 90.56           | 359.65      | 7,528.64              | 3,793.66     | -387.05      | 3,802.60                | 0.97                    | -0.86                  | -0.44                 |



# Phoenix Technology Services LP

## Survey Report



**Company:** COG Operating LLC  
**Project:** Eddy County, NM (NAD83 NME)  
**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
**TVD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**MD Reference:** GL + KB @ 3393.80usft (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) |
|-----------------------|-----------------|-------------|-----------------------|--------------|--------------|-------------------------|-------------------------|------------------------|-----------------------|
| 11,268.00             | 89.52           | 358.31      | 7,528.58              | 3,887.64     | -388.72      | 3,896.59                | 1.80                    | -1.11                  | -1.43                 |
| 11,362.00             | 88.82           | 0.27        | 7,529.94              | 3,981.62     | -389.88      | 3,990.56                | 2.21                    | -0.74                  | 2.09                  |
| 11,456.00             | 92.61           | 1.96        | 7,528.76              | 4,075.57     | -388.06      | 4,084.44                | 4.41                    | 4.03                   | 1.80                  |
| 11,551.00             | 93.14           | 2.09        | 7,524.00              | 4,170.39     | -384.70      | 4,179.13                | 0.57                    | 0.56                   | 0.14                  |
| 11,645.00             | 93.56           | 2.04        | 7,518.51              | 4,264.17     | -381.32      | 4,272.79                | 0.45                    | 0.45                   | -0.05                 |
| 11,739.00             | 90.03           | 2.53        | 7,515.56              | 4,358.03     | -377.58      | 4,366.52                | 3.79                    | -3.76                  | 0.52                  |
| 11,830.00             | 90.81           | 2.22        | 7,514.90              | 4,448.95     | -373.81      | 4,457.31                | 0.92                    | 0.86                   | -0.34                 |
| 11,920.00             | 91.15           | 3.03        | 7,513.36              | 4,538.84     | -369.68      | 4,547.06                | 0.98                    | 0.38                   | 0.90                  |
| 12,009.00             | 88.49           | 2.86        | 7,513.64              | 4,627.72     | -365.11      | 4,635.78                | 2.99                    | -2.99                  | -0.19                 |
| 12,100.00             | 88.71           | 3.30        | 7,515.86              | 4,718.56     | -360.22      | 4,726.46                | 0.54                    | 0.24                   | 0.48                  |
| 12,191.00             | 88.54           | 3.26        | 7,518.04              | 4,809.38     | -355.02      | 4,817.11                | 0.19                    | -0.19                  | -0.04                 |
| 12,283.00             | 91.04           | 2.18        | 7,518.38              | 4,901.27     | -350.65      | 4,908.85                | 2.96                    | 2.72                   | -1.17                 |
| 12,374.00             | 93.70           | 0.30        | 7,514.62              | 4,992.16     | -348.68      | 4,999.66                | 3.58                    | 2.92                   | -2.07                 |
| 12,464.00             | 94.71           | 358.49      | 7,508.02              | 5,081.91     | -349.63      | 5,089.40                | 2.30                    | 1.12                   | -2.01                 |
| 12,554.00             | 93.84           | 358.47      | 7,501.31              | 5,171.62     | -352.01      | 5,179.15                | 0.97                    | -0.97                  | -0.02                 |
| 12,645.00             | 92.47           | 358.03      | 7,496.30              | 5,262.44     | -354.79      | 5,270.01                | 1.58                    | -1.51                  | -0.48                 |
| 12,739.00             | 90.90           | 358.24      | 7,493.54              | 5,356.35     | -357.84      | 5,363.96                | 1.69                    | -1.67                  | 0.22                  |
| 12,833.00             | 89.61           | 358.75      | 7,493.12              | 5,450.31     | -360.31      | 5,457.96                | 1.48                    | -1.37                  | 0.54                  |
| 12,928.00             | 90.39           | 359.12      | 7,493.12              | 5,545.29     | -362.08      | 5,552.95                | 0.91                    | 0.82                   | 0.39                  |
| 13,022.00             | 91.46           | 359.59      | 7,491.60              | 5,639.27     | -363.14      | 5,646.93                | 1.24                    | 1.14                   | 0.50                  |
| 13,116.00             | 91.20           | 0.21        | 7,489.42              | 5,733.25     | -363.30      | 5,740.87                | 0.72                    | -0.28                  | 0.66                  |
| 13,210.00             | 92.41           | 0.97        | 7,486.46              | 5,827.19     | -362.33      | 5,834.76                | 1.52                    | 1.29                   | 0.81                  |
| 13,304.00             | 90.61           | 0.80        | 7,483.98              | 5,921.15     | -360.88      | 5,928.64                | 1.92                    | -1.91                  | -0.18                 |
| 13,399.00             | 90.98           | 0.86        | 7,482.66              | 6,016.13     | -359.51      | 6,023.55                | 0.39                    | 0.39                   | 0.06                  |
| 13,493.00             | 89.75           | 0.46        | 7,482.06              | 6,110.12     | -358.42      | 6,117.48                | 1.38                    | -1.31                  | -0.43                 |
| 13,587.00             | 90.98           | 1.12        | 7,481.46              | 6,204.10     | -357.13      | 6,211.40                | 1.48                    | 1.31                   | 0.70                  |
| 13,681.00             | 88.85           | 0.87        | 7,481.60              | 6,298.08     | -355.50      | 6,305.30                | 2.28                    | -2.27                  | -0.27                 |
| 13,776.00             | 89.75           | 1.05        | 7,482.76              | 6,393.06     | -353.90      | 6,400.21                | 0.97                    | 0.95                   | 0.19                  |
| 13,870.00             | 88.48           | 0.75        | 7,484.22              | 6,487.04     | -352.43      | 6,494.11                | 1.39                    | -1.35                  | -0.32                 |
| 13,964.00             | 89.97           | 1.37        | 7,485.49              | 6,581.01     | -350.69      | 6,588.00                | 1.72                    | 1.59                   | 0.66                  |
| 14,058.00             | 89.39           | 1.56        | 7,486.01              | 6,674.98     | -348.29      | 6,681.87                | 0.65                    | -0.62                  | 0.20                  |
| 14,152.00             | 90.39           | 2.04        | 7,486.19              | 6,768.93     | -345.33      | 6,775.71                | 1.18                    | 1.06                   | 0.51                  |
| 14,246.00             | 88.49           | 1.43        | 7,487.11              | 6,862.88     | -342.49      | 6,869.55                | 2.12                    | -2.02                  | -0.65                 |
| 14,341.00             | 89.55           | 1.46        | 7,488.74              | 6,957.83     | -340.09      | 6,964.41                | 1.12                    | 1.12                   | 0.03                  |
| 14,435.00             | 91.04           | 2.12        | 7,488.25              | 7,051.78     | -337.16      | 7,058.25                | 1.73                    | 1.59                   | 0.70                  |
| 14,529.00             | 89.52           | 0.92        | 7,487.79              | 7,145.74     | -334.66      | 7,152.11                | 2.06                    | -1.62                  | -1.28                 |
| 14,624.00             | 90.22           | 1.23        | 7,488.01              | 7,240.73     | -332.88      | 7,247.01                | 0.81                    | 0.74                   | 0.33                  |
| 14,717.00             | 91.74           | 2.08        | 7,486.42              | 7,333.67     | -330.20      | 7,339.85                | 1.87                    | 1.63                   | 0.91                  |
| 14,811.00             | 90.34           | 0.49        | 7,484.71              | 7,427.63     | -328.09      | 7,433.72                | 2.25                    | -1.49                  | -1.69                 |
| 14,905.00             | 90.17           | 358.70      | 7,484.29              | 7,521.62     | -328.75      | 7,527.70                | 1.91                    | -0.18                  | -1.90                 |
| 14,999.00             | 92.61           | 359.01      | 7,482.01              | 7,615.56     | -330.63      | 7,621.66                | 2.62                    | 2.60                   | 0.33                  |
| 15,093.00             | 90.84           | 359.10      | 7,479.18              | 7,709.51     | -332.18      | 7,715.61                | 1.89                    | -1.88                  | 0.10                  |
| 15,187.00             | 88.85           | 358.41      | 7,479.44              | 7,803.48     | -334.22      | 7,809.60                | 2.24                    | -2.12                  | -0.73                 |



# Phoenix Technology Services LP

## Survey Report



**Company:** COG Operating LLC  
**Project:** Eddy County, NM (NAD83 NME)  
**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
**TVD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**MD Reference:** GL + KB @ 3393.80usft (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) |
|-----------------------|-----------------|-------------|-----------------------|--------------|--------------|-------------------------|-------------------------|------------------------|-----------------------|
| 15,281.00             | 86.83           | 358.23      | 7,482.98              | 7,897.37     | -336.98      | 7,903.53                | 2.16                    | -2.15                  | -0.19                 |
| 15,375.00             | 87.73           | 358.78      | 7,487.44              | 7,991.23     | -339.43      | 7,997.42                | 1.12                    | 0.96                   | 0.59                  |
| 15,469.00             | 88.99           | 359.37      | 7,490.13              | 8,085.17     | -340.94      | 8,091.38                | 1.48                    | 1.34                   | 0.63                  |
| 15,563.00             | 89.19           | 0.54        | 7,491.63              | 8,179.16     | -341.02      | 8,185.33                | 1.26                    | 0.21                   | 1.24                  |
| 15,656.00             | 89.64           | 0.76        | 7,492.57              | 8,272.15     | -339.96      | 8,278.26                | 0.54                    | 0.48                   | 0.24                  |
| 15,750.00             | 90.59           | 1.13        | 7,492.39              | 8,366.13     | -338.41      | 8,372.17                | 1.08                    | 1.01                   | 0.39                  |
| 15,844.00             | 91.26           | 1.74        | 7,490.87              | 8,460.09     | -336.06      | 8,466.03                | 0.96                    | 0.71                   | 0.65                  |
| 15,938.00             | 92.52           | 2.61        | 7,487.77              | 8,553.97     | -332.49      | 8,559.78                | 1.63                    | 1.34                   | 0.93                  |
| 16,032.00             | 91.46           | 1.75        | 7,484.50              | 8,647.84     | -328.92      | 8,653.53                | 1.45                    | -1.13                  | -0.91                 |
| 16,126.00             | 90.36           | 1.29        | 7,483.01              | 8,741.80     | -326.43      | 8,747.38                | 1.27                    | -1.17                  | -0.49                 |
| 16,220.00             | 90.92           | 0.95        | 7,481.96              | 8,835.77     | -324.59      | 8,841.28                | 0.70                    | 0.60                   | -0.36                 |
| 16,314.00             | 91.88           | 0.67        | 7,479.66              | 8,929.73     | -323.26      | 8,935.17                | 1.06                    | 1.02                   | -0.30                 |
| 16,408.00             | 93.23           | 0.97        | 7,475.47              | 9,023.63     | -321.92      | 9,028.99                | 1.47                    | 1.44                   | 0.32                  |
| 16,502.00             | 90.89           | 0.34        | 7,472.10              | 9,117.55     | -320.84      | 9,122.86                | 2.58                    | -2.49                  | -0.67                 |
| 16,597.00             | 92.10           | 0.16        | 7,469.62              | 9,212.52     | -320.43      | 9,217.78                | 1.29                    | 1.27                   | -0.19                 |
| 16,691.00             | 91.37           | 359.31      | 7,466.77              | 9,306.47     | -320.86      | 9,311.71                | 1.19                    | -0.78                  | -0.90                 |
| 16,785.00             | 92.35           | 0.12        | 7,463.72              | 9,400.42     | -321.33      | 9,405.64                | 1.35                    | 1.04                   | 0.86                  |
| 16,880.00             | 91.34           | 0.77        | 7,460.66              | 9,495.37     | -320.59      | 9,500.53                | 1.26                    | -1.06                  | 0.68                  |
| 16,974.00             | 92.72           | 0.74        | 7,457.33              | 9,589.30     | -319.36      | 9,594.40                | 1.47                    | 1.47                   | -0.03                 |
| 17,068.00             | 90.56           | 0.93        | 7,454.64              | 9,683.24     | -317.99      | 9,688.27                | 2.31                    | -2.30                  | 0.20                  |
| 17,160.00             | 90.95           | 1.12        | 7,453.43              | 9,775.22     | -316.34      | 9,780.17                | 0.47                    | 0.42                   | 0.21                  |
| 17,254.00             | 93.23           | 1.65        | 7,450.00              | 9,869.12     | -314.07      | 9,873.98                | 2.49                    | 2.43                   | 0.56                  |
| 17,348.00             | 91.96           | 1.02        | 7,445.75              | 9,963.00     | -311.88      | 9,967.77                | 1.51                    | -1.35                  | -0.67                 |
| 17,443.00             | 89.47           | 0.34        | 7,444.56              | 10,057.98    | -310.76      | 10,062.68               | 2.72                    | -2.62                  | -0.72                 |
| 17,537.00             | 90.81           | 0.30        | 7,444.33              | 10,151.97    | -310.23      | 10,156.63               | 1.43                    | 1.43                   | -0.04                 |
| 17,632.00             | 92.38           | 0.40        | 7,441.69              | 10,246.93    | -309.65      | 10,251.54               | 1.66                    | 1.65                   | 0.11                  |
| 17,726.00             | 90.92           | 0.87        | 7,438.98              | 10,340.88    | -308.61      | 10,345.43               | 1.63                    | -1.55                  | 0.50                  |
| 17,820.00             | 88.18           | 0.85        | 7,439.72              | 10,434.86    | -307.20      | 10,439.34               | 2.91                    | -2.91                  | -0.02                 |
| 17,914.00             | 90.03           | 1.20        | 7,441.19              | 10,528.83    | -305.52      | 10,533.23               | 2.00                    | 1.97                   | 0.37                  |
| 18,008.00             | 88.35           | 2.05        | 7,442.52              | 10,622.78    | -302.85      | 10,627.08               | 2.00                    | -1.79                  | 0.90                  |
| 18,103.00             | 89.83           | 2.65        | 7,444.02              | 10,717.69    | -298.96      | 10,721.84               | 1.68                    | 1.56                   | 0.63                  |
| 18,197.00             | 89.10           | 3.22        | 7,444.90              | 10,811.56    | -294.14      | 10,815.56               | 0.99                    | -0.78                  | 0.61                  |
| 18,291.00             | 91.12           | 1.09        | 7,444.72              | 10,905.48    | -290.61      | 10,909.35               | 3.12                    | 2.15                   | -2.27                 |
| 18,384.00             | 93.28           | 1.21        | 7,441.15              | 10,998.39    | -288.75      | 11,002.18               | 2.33                    | 2.32                   | 0.13                  |

### Final Phoenix MWD Survey

|           |       |      |          |           |         |           |      |      |      |
|-----------|-------|------|----------|-----------|---------|-----------|------|------|------|
| 18,446.00 | 93.28 | 1.21 | 7,437.60 | 11,060.27 | -287.44 | 11,064.00 | 0.00 | 0.00 | 0.00 |
|-----------|-------|------|----------|-----------|---------|-----------|------|------|------|

### Projection to TD



Phoenix Technology Services LP  
Survey Report



**Company:** COG Operating LLC  
**Project:** Eddy County, NM (NAD83 NME)  
**Site:** Craig Federal Com  
**Well:** 2H  
**Wellbore:** OH  
**Design:** Surveys (Ensign 155)

**Local Co-ordinate Reference:** Well 2H  
**TVD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**MD Reference:** GL + KB @ 3393.80usft (Ensign 155)  
**North Reference:** Grid  
**Survey Calculation Method:** Minimum Curvature  
**Database:** Compass 5000 GCR

**Design Annotations**

| Measured<br>Depth<br>(usft) | Vertical<br>Depth<br>(usft) | Local Coordinates |                 | Comment                  |
|-----------------------------|-----------------------------|-------------------|-----------------|--------------------------|
|                             |                             | +N/-S<br>(usft)   | +E/-W<br>(usft) |                          |
| 6,840.00                    | 6,838.84                    | -31.63            | -30.77          | Tie In                   |
| 6,910.00                    | 6,908.83                    | -32.28            | -31.56          | First Phoenix MWD Survey |
| 18,384.00                   | 7,441.15                    | 10,998.39         | -288.75         | Final Phoenix MWD Survey |
| 18,446.00                   | 7,437.60                    | 11,060.27         | -287.44         | Projection to TD         |