

51-01640



Noble Energy SHL13DHS Gyro+MWD 0ft to 12645ft MD Survey Report

(Def Survey)

Report Date: December 16, 2013 - 10:04 AM
Client: Noble Energy
Field: WV Marshall County (NAD 27)
Structure / Slot: Noble Energy SHL13 Pad / SHL13DHS SHL13DHS
Well: SHL13DHS
Borehole: Original Borehole
UWI / API#: Unknown / Unknown
Survey Name: Noble Energy SHL13DHS Gyro+MWD 0ft to 12645ft MD
Survey Date: December 10, 2013
Tort / AHD / DDI / ERD Ratio: 261.173 / 9856.064 ft / 6.524 / 1.011
Coordinate Reference System: NAD27 West Virginia State Plane, Northern Zone, US Feet
Location Lat / Long: N 49° 0' 14.7105", W 80° 32' 9.65345"
Location Grid NE YX: N 540510 326 NUS, E 1709322 276 NUS
CRS Grid Convergence Angle: -0.6606"
Grid Scale Factor: 0.99999248
Version / Patch: 2.7.998.0
Survey / DLS Computation: Minimum Curvature / Lubinski
Vertical Section Azimuth: 150.102 ° (Grid North)
TVD Reference Datum: 0.000 ft, 0.000 ft
TVD Reference Elevation: 1500.420 ft above MSL
Seabed / Ground Elevation: 1261.910 ft above MSL
Magnetic Declination: -8.434 °
Total Gravity Field Strength: 969.349mgals (9.80665 Based)
Gravity Model: GARM
Total Magnetic Field Strength: 53156.292 nT
Magnetic Dip Angle: 67.570 °
Declination Date: December 10, 2013
Magnetic Declination Model: IGM04.2013
North Reference: Grid North
Grid Convergence Used: -0.6606"
Total Corr Mag North-Grid North: -7.7232"
Local Coord Referenced To: Well Head

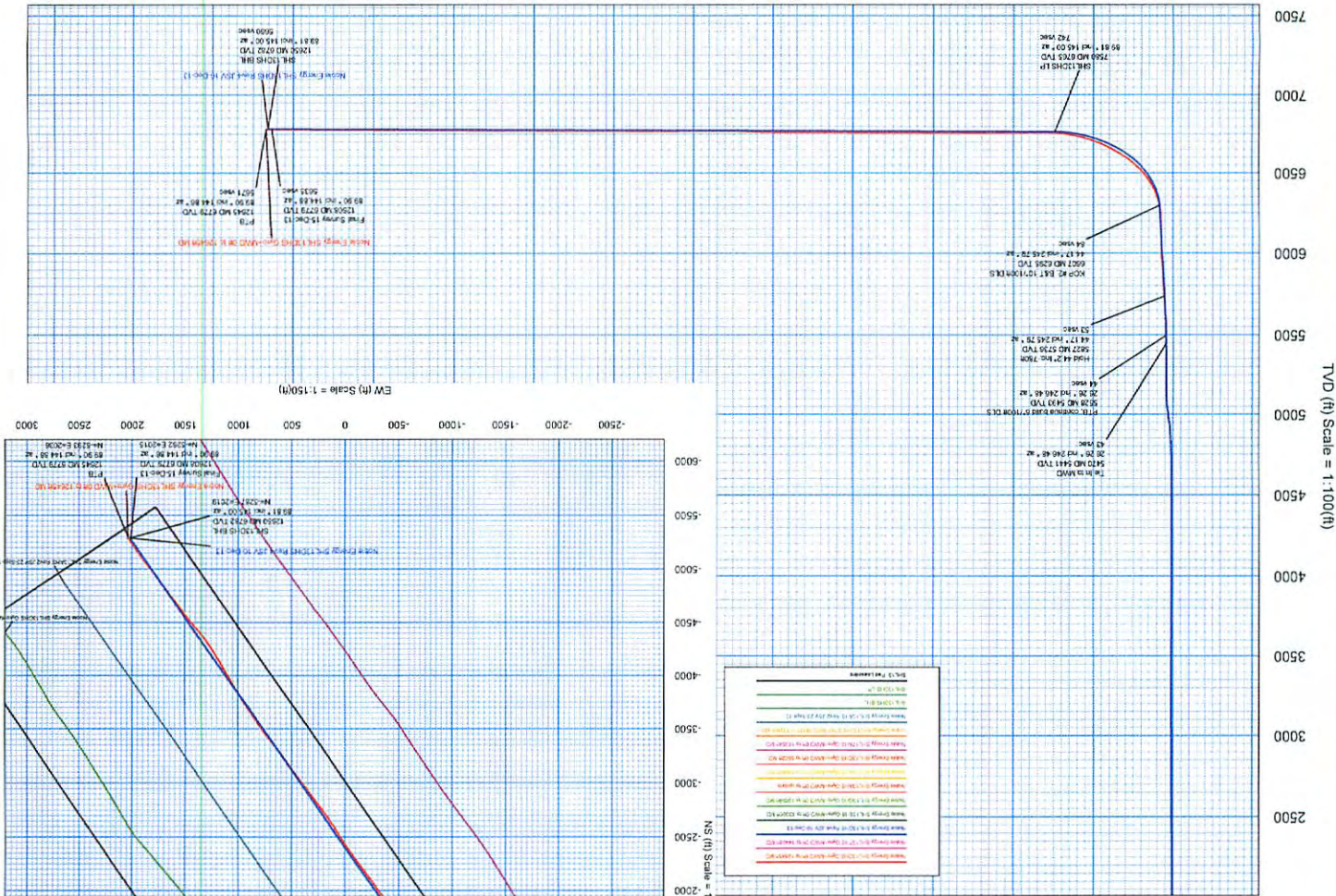
Table with columns: Comments, MD (ft), Incl (°), Azim Grid (°), TVD (ft), TVDSS (ft), VSECC (ft), NS (ft), EW (ft), DLS (ft/100ft), BR (ft/100ft), TR (ft/100ft), Northing (ftUS), Easting (ftUS), Latitude (N/S °), Longitude (E/W °), Directional Difficulty Index. The table contains multiple rows of data for the SHL well, showing depth, inclination, azimuth, and various survey parameters.

51.01640

| Comments | MD (ft) | Incl (°) | Adm Grid (°) | TVD (ft) | TVDSS (ft) | VSEC (ft) | NS (ft) | EW (ft) | DL S (°1000) | BR (°1000) | TR (°1000) | Northing (m/s) | Easting (m/s) | Latitude (N/S °°) | Longitude (E/W °°) | Directional Difficulty Index |
|----------|---------|----------|--------------|----------|------------|-----------|----------|---------|--------------|------------|------------|----------------|-----------------|-------------------|--------------------|------------------------------|
| 7104.00 | 56.66 | 179.55 | 6015.30 | 5314.68 | 322.17 | -733.01 | -1016.80 | 10.18 | 4.14 | -11.00 | 548777.34 | 1706805.71 | N 40 0 7.41 W | 80 32 21.99 | 5.30 | |
| 7140.00 | 59.72 | 174.33 | 6036.26 | 5331.94 | 358.94 | -771.59 | -1014.53 | 10.24 | 2.36 | -11.60 | 548738.77 | 1706801.79 | N 40 0 7.03 W | 80 32 21.85 | 5.33 | |
| 7194.00 | 61.74 | 169.82 | 6060.37 | 5359.95 | 397.18 | -810.45 | -1000.11 | 9.63 | 4.49 | -10.02 | 548599.91 | 1706813.21 | N 40 0 6.65 W | 80 32 21.67 | 5.35 | |
| 7230.00 | 64.74 | 165.68 | 6080.84 | 5380.22 | 439.89 | -849.69 | -1000.57 | 10.58 | 6.87 | -9.20 | 548090.87 | 1706821.75 | N 40 0 6.26 W | 80 32 21.78 | 5.38 | |
| 7284.00 | 68.34 | 162.76 | 6098.56 | 5398.13 | 477.99 | -889.40 | -989.33 | 9.97 | 8.00 | -6.49 | 548020.96 | 1706832.90 | N 40 0 5.87 W | 80 32 21.61 | 5.41 | |
| 7328.00 | 71.54 | 160.42 | 6113.83 | 5413.41 | 519.21 | -928.54 | -978.29 | 7.91 | 6.14 | -5.32 | 548561.82 | 1706846.02 | N 40 0 5.48 W | 80 32 21.44 | 5.43 | |
| 7373.00 | 74.49 | 159.22 | 6127.18 | 5428.74 | 562.18 | -968.88 | -961.48 | 8.06 | 7.87 | -2.67 | 548541.46 | 1706858.05 | N 40 0 5.09 W | 80 32 21.24 | 5.45 | |
| 7418.00 | 77.61 | 156.99 | 6138.01 | 5437.59 | 605.83 | -1008.24 | -944.82 | 8.93 | 6.93 | -7.18 | 548501.13 | 1706877.40 | N 40 0 4.69 W | 80 32 21.02 | 5.48 | |
| 7463.00 | 80.33 | 152.21 | 6148.82 | 5446.20 | 649.81 | -1048.98 | -925.53 | 10.22 | 6.04 | -6.40 | 548461.41 | 1706896.79 | N 40 0 4.30 W | 80 32 20.77 | 5.50 | |
| 7507.00 | 83.25 | 149.57 | 6157.90 | 5452.48 | 692.91 | -1087.00 | -904.34 | 9.90 | 6.64 | -6.30 | 548423.37 | 1706917.97 | N 40 0 3.93 W | 80 32 20.49 | 5.53 | |
| 7552.00 | 86.18 | 147.13 | 6165.05 | 5456.63 | 736.02 | -1125.13 | -880.83 | 8.48 | 8.51 | -6.42 | 548385.24 | 1706941.48 | N 40 0 3.56 W | 80 32 20.18 | 5.55 | |
| 7607.00 | 89.86 | 144.55 | 6170.88 | 5458.28 | 780.58 | -1162.34 | -855.50 | 6.62 | 7.73 | -5.73 | 548348.04 | 1706968.72 | N 40 0 3.19 W | 80 32 19.85 | 5.57 | |
| 7665.00 | 90.39 | 144.37 | 6175.85 | 5458.23 | 825.50 | -1242.08 | -798.62 | 0.76 | 0.70 | -0.18 | 548288.30 | 1706992.68 | N 40 0 2.41 W | 80 32 19.11 | 5.60 | |
| 7784.00 | 90.27 | 143.80 | 6178.14 | 5457.72 | 861.48 | -1314.18 | -748.42 | 0.85 | -0.12 | -0.64 | 548198.22 | 1707078.89 | N 40 0 1.70 W | 80 32 18.43 | 5.63 | |
| 7874.00 | 90.34 | 143.32 | 6177.56 | 5457.24 | 1048.57 | -1387.48 | -694.23 | 1.89 | 0.08 | 1.89 | 548122.80 | 1707126.07 | N 40 0 0.98 W | 80 32 17.75 | 5.66 | |
| 7963.00 | 90.48 | 140.33 | 6175.03 | 5456.81 | 1135.19 | -1461.11 | -644.24 | 1.15 | 0.16 | 1.13 | 548049.28 | 1707176.06 | N 40 0 0.26 W | 80 32 17.09 | 5.68 | |
| 8053.00 | 90.38 | 147.31 | 6176.35 | 5455.80 | 1223.12 | -1536.43 | -604.99 | 1.09 | -0.11 | 1.09 | 547973.96 | 1707227.31 | N 39 59 59.52 W | 80 32 16.45 | 5.71 | |
| 8143.00 | 89.28 | 147.04 | 6176.82 | 5456.20 | 1311.18 | -1612.00 | -546.20 | 1.26 | -1.22 | -0.30 | 547898.33 | 1707270.00 | N 39 59 58.78 W | 80 32 15.81 | 5.73 | |
| 8232.00 | 90.21 | 150.48 | 6175.01 | 5456.50 | 1398.72 | -1688.14 | -500.06 | 4.00 | 1.04 | 3.87 | 547822.25 | 1707322.24 | N 39 59 58.03 W | 80 32 15.21 | 5.76 | |
| 8321.00 | 90.38 | 151.92 | 6175.56 | 5456.14 | 1486.87 | -1766.13 | -457.18 | 1.63 | 1.09 | 1.62 | 547744.27 | 1707365.11 | N 39 59 57.27 W | 80 32 14.65 | 5.78 | |
| 8411.00 | 89.31 | 149.28 | 6175.80 | 5456.38 | 1575.87 | -1844.53 | -413.00 | 3.17 | -1.18 | -2.93 | 547665.87 | 1707409.20 | N 39 59 56.50 W | 80 32 14.07 | 5.81 | |
| 8501.00 | 89.53 | 146.96 | 6175.32 | 5456.90 | 1664.21 | -1929.95 | -365.48 | 2.70 | 0.80 | -2.58 | 547589.46 | 1707455.91 | N 39 59 55.75 W | 80 32 13.44 | 5.83 | |
| 8590.00 | 89.79 | 144.78 | 6175.48 | 5457.04 | 1750.84 | -1994.81 | -315.53 | 2.49 | -0.27 | -2.47 | 547515.80 | 1707506.78 | N 39 59 55.02 W | 80 32 12.79 | 5.86 | |
| 8680.00 | 89.93 | 144.46 | 6175.68 | 5457.20 | 1837.98 | -2067.93 | -263.41 | 0.37 | 0.16 | -0.33 | 547442.43 | 1707566.88 | N 39 59 54.31 W | 80 32 12.11 | 5.88 | |
| 8769.00 | 89.79 | 144.10 | 6175.90 | 5457.48 | 1924.02 | -2140.23 | -211.45 | 0.43 | -0.16 | -0.40 | 547370.18 | 1707610.84 | N 39 59 53.60 W | 80 32 11.43 | 5.90 | |
| 8859.00 | 89.76 | 143.52 | 6176.25 | 5457.83 | 2010.83 | -2212.87 | -158.31 | 0.65 | -0.03 | -0.64 | 547297.55 | 1707660.98 | N 39 59 52.90 W | 80 32 10.74 | 5.91 | |
| 8948.00 | 89.76 | 143.44 | 6176.82 | 5458.20 | 2096.54 | -2284.39 | -105.34 | 0.00 | 0.00 | -0.09 | 547226.03 | 1707718.94 | N 39 59 52.19 W | 80 32 10.05 | 5.93 | |
| 9038.00 | 89.82 | 144.54 | 6176.11 | 5458.69 | 2183.43 | -2357.19 | -52.43 | 1.23 | -0.16 | 1.22 | 547153.23 | 1707780.85 | N 39 59 51.47 W | 80 32 9.36 | 5.95 | |
| 9127.00 | 89.73 | 148.11 | 6176.81 | 5459.19 | 2269.86 | -2430.38 | -1.80 | 1.77 | 0.12 | 1.78 | 547080.64 | 1707840.46 | N 39 59 50.75 W | 80 32 8.70 | 5.97 | |
| 9216.00 | 90.24 | 149.60 | 6176.64 | 5459.22 | 2358.12 | -2506.57 | -64.08 | 3.92 | -0.57 | -3.88 | 547003.85 | 1707902.01 | N 39 59 50.01 W | 80 32 8.07 | 5.99 | |
| 9307.00 | 89.45 | 146.58 | 6176.88 | 5459.48 | 2446.45 | -2582.98 | 93.84 | 3.47 | -0.68 | -3.38 | 546927.47 | 1707959.92 | N 39 59 49.29 W | 80 32 7.45 | 6.01 | |
| 9396.00 | 89.18 | 145.11 | 6176.94 | 5460.52 | 2533.07 | -2656.60 | 143.61 | 1.68 | -0.30 | -1.65 | 546853.83 | 1708026.88 | N 39 59 48.54 W | 80 32 6.79 | 6.03 | |
| 9486.00 | 87.08 | 142.25 | 6176.88 | 5460.48 | 2619.77 | -2729.07 | 198.88 | 3.94 | -2.33 | -3.18 | 546781.37 | 1710010.14 | N 39 59 47.83 W | 80 32 6.10 | 6.05 | |
| 9575.00 | 88.42 | 142.85 | 6176.35 | 5460.98 | 2705.01 | -2799.87 | 259.05 | 1.85 | 1.51 | 0.87 | 546710.77 | 1710079.22 | N 39 59 47.13 W | 80 32 5.39 | 6.07 | |
| 9664.00 | 89.52 | 142.78 | 6176.88 | 5461.56 | 2790.42 | -2870.55 | 304.74 | 1.24 | 1.24 | -0.10 | 546639.68 | 1710127.01 | N 39 59 46.44 W | 80 32 4.69 | 6.09 | |
| 9754.00 | 89.97 | 142.78 | 6176.93 | 5462.98 | 2876.70 | -2942.21 | 350.19 | 0.50 | 0.60 | 0.02 | 546568.23 | 1710181.46 | N 39 59 45.74 W | 80 32 3.98 | 6.10 | |
| 9843.00 | 90.58 | 142.59 | 6176.95 | 5463.53 | 2962.10 | -3012.99 | 413.15 | 0.72 | 0.62 | -0.21 | 546497.45 | 1710235.41 | N 39 59 45.04 W | 80 32 3.28 | 6.12 | |
| 9933.00 | 90.55 | 143.18 | 6176.98 | 5464.84 | 3048.67 | -3084.78 | 467.45 | 0.88 | -0.03 | 0.88 | 546425.69 | 1710289.71 | N 39 59 44.34 W | 80 32 2.57 | 6.13 | |
| 10023.00 | 90.41 | 144.24 | 6178.31 | 5465.89 | 3135.34 | -3157.30 | 520.72 | 1.19 | -0.18 | 1.18 | 546353.18 | 1710343.97 | N 39 59 43.63 W | 80 32 1.88 | 6.15 | |
| 10112.00 | 90.21 | 143.78 | 6178.83 | 5466.41 | 3221.27 | -3229.31 | 573.02 | 0.56 | -0.22 | -0.52 | 546281.15 | 1710395.27 | N 39 59 42.92 W | 80 32 1.18 | 6.18 | |
| 10202.00 | 89.62 | 141.87 | 6178.96 | 5466.84 | 3307.66 | -3301.01 | 627.40 | 2.22 | -0.68 | -2.12 | 546209.44 | 1710444.85 | N 39 59 42.22 W | 80 32 0.49 | 6.18 | |
| 10291.00 | 89.86 | 141.38 | 6179.52 | 5467.10 | 3392.95 | -3379.79 | 682.85 | 0.66 | 0.04 | -0.55 | 546139.68 | 1710504.89 | N 39 59 41.54 W | 80 32 69.78 | 6.19 | |
| 10381.00 | 89.97 | 143.32 | 6179.81 | 5467.39 | 3478.72 | -3442.04 | 737.62 | 2.18 | 0.34 | 2.16 | 546068.42 | 1710568.88 | N 39 59 40.84 W | 80 31 59.05 | 6.21 | |
| 10470.00 | 89.83 | 145.05 | 6179.97 | 5467.55 | 3564.72 | -3514.21 | 789.70 | 1.95 | -0.16 | 1.94 | 545998.28 | 1710611.94 | N 39 59 40.13 W | 80 31 58.37 | 6.22 | |
| 10560.00 | 89.59 | 145.67 | 6178.42 | 5468.00 | 3652.14 | -3588.25 | 840.85 | 0.74 | -0.27 | 0.69 | 545922.22 | 1710663.10 | N 39 59 39.41 W | 80 31 57.70 | 6.24 | |
| 10650.00 | 89.76 | 146.27 | 6178.93 | 5468.51 | 3739.79 | -3662.84 | 891.22 | 0.69 | 0.19 | 0.87 | 545847.63 | 1710713.46 | N 39 59 38.68 W | 80 31 57.04 | 6.25 | |
| 10739.00 | 89.69 | 147.05 | 6179.26 | 5469.00 | 3826.70 | -3737.19 | 940.13 | 0.68 | -0.08 | 0.68 | 545773.29 | 1710762.37 | N 39 59 37.95 W | 80 31 56.34 | 6.26 | |
| 10829.00 | 89.83 | 146.78 | 6179.66 | 5469.24 | 3914.68 | -3813.43 | 987.95 | 1.92 | -0.27 | 1.90 | 545697.65 | 1710810.19 | N 39 59 37.20 W | 80 31 55.79 | 6.28 | |
| 10919.00 | 89.79 | 149.72 | 6179.88 | 5469.48 | 4003.65 | -3890.77 | 1033.98 | 1.08 | -0.18 | 1.07 | 545619.71 | 1710865.21 | N 39 59 36.44 W | 80 31 55.17 | 6.29 | |
| 11008.00 | 89.76 | 150.81 | 6179.23 | 5469.81 | 4091.67 | -3967.97 | 1078.28 | 1.00 | -0.03 | 1.00 | 545542.51 | 1710900.49 | N 39 59 35.68 W | 80 31 54.59 | 6.30 | |
| 11098.00 | 89.76 | 149.73 | 6179.80 | 5470.18 | 4180.47 | -4046.05 | 1123.02 | 0.98 | -0.38 | -0.64 | 545464.44 | 1710945.25 | N 39 59 34.92 W | 80 31 54.01 | 6.31 | |
| 11187.00 | 89.79 | 150.93 | 6179.95 | 5470.53 | 4269.35 | -4123.11 | 1167.55 | 0.56 | 0.03 | 0.56 | 545387.39 | 1710988.78 | N 39 59 34.16 W | 80 31 53.42 | 6.33 | |
| 11277.00 | 89.79 | 148.27 | 6177.26 | 5470.86 | 4357.01 | -4200.45 | 1213.58 | 2.18 | 0.00 | -2.18 | 545310.05 | 1711033.79 | N 39 59 33.40 W | 80 31 52.82 | 6.34 | |
| 11366.00 | 89.79 | 146.77 | 6177.61 | 5471.19 | 4444.20 | -4278.52 | 1261.38 | 1.69 | 0.00 | -1.69 | 545234.97 | 1711083.58 | N 39 59 32.68 W | 80 31 52.20 | 6.35 | |
| 11456.00 | 89.59 | 143.35 | 6177.10 | 5471.68 | 4531.50 | -4348.29 | 1312.89 | 3.81 | -0.22 | -3.80 | 545161.21 | 1711138.12 | N 39 59 31.94 W | 80 31 51.62 | 6.37 | |
| 11545.00 | 89.42 | 139.23 | 6172.87 | 5472.45 | 4619.21 | -4418.72 | 1368.54 | 4.83 | -0.19 | -4.63 | 545091.78 | 1711190.78 | N 39 59 31.26 W | 80 31 50.80 | 6.39 | |
| 11635.00 | 89.69 | 139.37 | 6173.56 | 5473.14 | 4700.88 | -4486.95 | 1427.22 | 3.34 | 0.30 | 0.16 | 545023.55 | 1711246.44 | N 39 59 30.50 W | 80 31 50.03 | 6.40 | |
| 11724.00 | 89.79 | 142.43 | 6173.07 | 5473.65 | 4785.42 | -4556.01 | 1483.35 | 3.44 | 0.11 | 3.44 | 544954.50 | 1711305.66 | N 39 59 29.72 W | 80 31 49.30 | 6.41 | |
| 11814.00 | 89.52 | 142.19 | 6174.61 | 5474.00 | 4871.88 | -4627.23 | 1538.37 | 0.40 | -0.30 | -0.27 | 544883.25 | 1711360.50 | N 39 59 29.22 W | 80 31 48.58 | 6.42 | |
| 11903.00 | 89.69 | 142.04 | 6175.12 | 5474.70 | 4958.60 | -4697.47 | 1602.02 | 0.26 | 0.19 | -0.17 | 544813.64 | 1711415.23 | N 39 59 28.53 W | 80 31 47.87 | 6.43 | |
| 11993.00 | 89.88 | 141.35 | 6175.48 | 5475.06 | 5042.57 | -4768.09 | 1648.61 | 0.70 | 0.19 | -0.77 | 544742.42 | 1711471.02 | N 39 59 27.84 W | 80 31 47.15 | 6.44 | |
| 12083.00 | 89.86 | 144.39 | 6175.70 | 5475.28 | 5128.87 | -4838.84 | 1703.13 | 3.38 | 0.00 | 3.38 | 544670.68 | 1711525.34 | N 39 59 27.14 W | 80 31 46 | | |

| | | | | | | | |
|------------------|--------------------------|--------------------------|---|----------------|---|--------------------------------|--|
| Borehole: | Original Borehole | Well: | SHL13DHS | Field: | WV Marshall County (NAD 27) | Structure: | Precision 543 |
| Company: | Noble Energy | Surface Location: | NAD27 West Virginia State Plane, Northern Zone, US Feet | Method: | Vertical Section (H) Azim = 159.102° Scale = 1:100(H) Origin = 0N/-S, 0E/-W | Plan: | Noble Energy SHL13DHS Dym+MWD to 1545(N) |
| Model: | MOCM 2013 | Lat: | 39.83913 | Scale: | 1:150(N) | Sheet: | SHL13DHS |
| Dip: | 87.57° | Long: | -80.3293 | Scale: | 1:150(N) | Mag Conv: | -0.661° |
| Dir: | S155.292N1 | North: | 170.82227 | Scale: | 1:150(N) | Tot Cor (M > 7.73°): | -2.773° |
| Mag Dec: | -8.44° | East: | 170.82227 | Scale: | 1:150(N) | Gnd Conv (-0.661°): | -0.661° |

| Well | Depth | Interval | Formation | Stratigraphic Unit | Core | Log | Notes |
|----------|-------|----------|-----------|--------------------|------|-----|-------|
| SHL13DHS | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |
| | 0.00 | 0.00 | SHL13 | SHL13 | | | |



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