

# Noble Energy

Weld County, CO (NAD 83)

Sec. 12-T9N-R58W

Castor LD12 - 78HN

Design: MWD Field Surveys

## Sperry Drilling Services

### Final Survey Report

23 May, 2013

Well Coordinates: 1,524,007.98 N, 3,465,567.82 E (40° 45' 34.84" N, 103° 49' 09.65" W)

Ground Level: 4,630.00 ft

Local Coordinate Origin:

Centered on Well Castor LD12 - 78HN

Viewing Datum:

RKB 24 ft. @ 4654.00ft (H&P 322)

TVDs to System:

N

North Reference:

Grid

Unit System:

API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 43I

**HALLIBURTON**

## Design Report for Castor LD12 - 78HN - MWD Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
250.00	0.20	304.70	250.00	0.25	-0.36	0.25	0.08
First Sperry MWD Survey @ 250.00 ft. MD							
530.00	0.60	264.10	529.99	0.38	-2.22	0.40	0.17
750.00	0.10	233.00	749.99	0.14	-3.52	0.19	0.23
1,006.00	0.30	152.80	1,005.99	-0.59	-3.39	-0.54	0.12
1,225.00	0.10	258.40	1,224.99	-1.14	-3.32	-1.09	0.16
1,279.00	0.66	218.02	1,278.98	-1.39	-3.55	-1.35	1.09
1,372.00	0.52	228.41	1,371.98	-2.09	-4.20	-2.04	0.19
1,560.00	0.88	184.04	1,559.97	-4.10	-4.94	-4.04	0.33
1,655.00	0.96	148.69	1,654.95	-5.51	-4.58	-5.45	0.59
1,750.00	1.49	151.54	1,749.93	-7.27	-3.57	-7.23	0.56
1,845.00	1.97	131.94	1,844.89	-9.45	-1.77	-9.43	0.80
1,940.00	1.31	73.74	1,939.86	-10.24	0.49	-10.24	1.79
2,034.00	1.62	85.64	2,033.83	-9.84	2.84	-9.87	0.46
2,129.00	2.06	79.04	2,128.78	-9.41	5.86	-9.48	0.51
2,224.00	1.27	343.50	2,223.75	-8.08	7.24	-8.17	2.65
2,319.00	1.09	14.60	2,318.73	-6.19	7.16	-6.28	0.69
2,414.00	1.13	23.63	2,413.71	-4.46	7.77	-4.56	0.19
2,509.00	1.33	28.66	2,508.69	-2.63	8.67	-2.74	0.24
2,604.00	0.90	328.31	2,603.68	-1.03	8.81	-1.14	1.24
2,699.00	0.65	350.73	2,698.67	0.14	8.33	0.03	0.41
2,794.00	0.22	336.94	2,793.66	0.84	8.17	0.73	0.46
2,889.00	0.37	341.59	2,888.66	1.29	8.00	1.19	0.16
2,984.00	0.75	345.20	2,983.66	2.19	7.75	2.09	0.40
3,079.00	1.00	335.41	3,078.65	3.54	7.24	3.45	0.31
3,174.00	1.23	287.51	3,173.63	4.60	5.93	4.53	0.98
3,364.00	1.68	253.86	3,363.57	4.44	1.31	4.42	0.50
3,459.00	2.22	216.66	3,458.52	2.58	-1.13	2.59	1.42
3,554.00	1.70	217.58	3,553.46	-0.01	-3.09	0.03	0.55
3,649.00	1.50	229.98	3,648.43	-1.93	-4.90	-1.87	0.42
3,744.00	1.17	212.99	3,743.40	-3.54	-6.38	-3.46	0.54
3,839.00	2.00	167.91	3,838.37	-5.98	-6.56	-5.89	1.51
3,934.00	2.28	165.91	3,933.30	-9.43	-5.75	-9.36	0.30
4,029.00	2.19	167.71	4,028.23	-13.04	-4.91	-12.97	0.12
4,219.00	2.68	175.61	4,218.06	-21.01	-3.79	-20.96	0.31
4,313.00	1.16	187.40	4,312.00	-24.15	-3.75	-24.10	1.66
4,408.00	0.35	343.72	4,407.00	-24.82	-3.95	-24.77	1.57
4,503.00	1.03	35.81	4,501.99	-23.85	-3.54	-23.81	0.91
4,598.00	1.27	53.41	4,596.97	-22.53	-2.19	-22.50	0.45
4,691.00	1.02	51.54	4,689.95	-21.40	-0.72	-21.39	0.27
4,782.00	2.17	5.28	4,780.92	-19.19	0.08	-19.18	1.80
4,829.00	6.87	357.24	4,827.76	-15.49	0.02	-15.49	10.07
4,876.00	10.24	356.11	4,874.23	-8.51	-0.39	-8.51	7.18
4,923.00	12.96	356.03	4,920.27	0.92	-1.04	0.93	5.79
4,971.00	15.23	357.46	4,966.82	12.59	-1.70	12.61	4.78
5,018.00	17.93	359.89	5,011.86	25.99	-1.98	26.01	5.93
5,066.00	21.96	2.56	5,056.97	42.35	-1.60	42.37	8.61
5,113.00	26.83	3.60	5,099.76	61.73	-0.54	61.73	10.40
5,161.00	31.02	0.44	5,141.77	84.92	0.24	84.91	9.29

## Design Report for Castor LD12 - 78HN - MWD Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
5,208.00	33.78	359.93	5,181.45	110.10	0.32	110.09	5.90
5,256.00	38.25	359.66	5,220.27	138.32	0.21	138.30	9.32
5,303.00	42.78	359.90	5,255.99	168.84	0.10	168.83	9.64
5,351.00	47.04	359.17	5,289.97	202.72	-0.19	202.71	8.94
5,398.00	51.90	358.43	5,320.51	238.42	-0.94	238.42	10.41
5,446.00	55.83	357.33	5,348.81	277.15	-2.39	277.16	8.39
5,493.00	58.26	356.71	5,374.37	316.54	-4.44	316.57	5.29
5,540.00	61.23	357.71	5,398.05	357.08	-6.41	357.13	6.58
5,587.00	64.73	357.32	5,419.40	398.90	-8.23	398.98	7.48
5,635.00	69.08	357.10	5,438.22	442.99	-10.38	443.09	9.07
5,682.00	72.21	357.16	5,453.80	487.28	-12.60	487.40	6.66
5,730.00	74.88	357.47	5,467.39	533.26	-14.75	533.40	5.60
5,777.00	78.19	358.16	5,478.34	578.92	-16.49	579.09	7.19
5,805.00	79.79	357.80	5,483.68	606.39	-17.46	606.57	5.85
5,850.00	83.64	358.66	5,490.17	650.89	-18.83	651.08	8.76
Estimated 7" Casing Point: 938' FSL, 649' FWL (Not a Survey Station)							
5,906.00	88.43	359.71	5,494.04	706.73	-19.63	706.93	8.76
5,999.00	89.85	359.68	5,495.44	799.72	-20.12	799.91	1.53
6,092.00	91.36	359.60	5,494.45	892.71	-20.71	892.90	1.63
6,187.00	90.09	1.36	5,493.25	987.69	-19.91	987.87	2.28
6,282.00	88.31	1.84	5,494.58	1,082.64	-17.26	1,082.78	1.94
6,376.00	88.86	1.71	5,496.90	1,176.57	-14.35	1,176.66	0.60
6,471.00	90.40	2.20	5,497.51	1,271.51	-11.11	1,271.55	1.70
6,566.00	89.85	359.46	5,497.31	1,366.49	-9.73	1,366.50	2.94
6,661.00	87.84	359.57	5,499.22	1,461.46	-10.54	1,461.48	2.12
6,756.00	89.14	359.91	5,501.72	1,556.43	-10.97	1,556.44	1.41
6,851.00	86.82	359.75	5,505.07	1,651.36	-11.25	1,651.37	2.45
6,946.00	88.09	359.63	5,509.29	1,746.26	-11.76	1,746.27	1.34
7,041.00	88.89	0.15	5,511.79	1,841.23	-11.94	1,841.23	1.00
7,135.00	87.50	0.82	5,514.75	1,935.18	-11.15	1,935.16	1.64
7,230.00	88.83	0.85	5,517.80	2,030.11	-9.77	2,030.07	1.40
7,325.00	89.75	359.51	5,518.97	2,125.10	-9.47	2,125.05	1.71
7,420.00	90.03	358.81	5,519.16	2,220.09	-10.86	2,220.05	0.79
7,515.00	89.14	358.65	5,519.84	2,315.07	-12.97	2,315.04	0.95
7,610.00	90.86	358.83	5,519.84	2,410.04	-15.05	2,410.03	1.82
7,705.00	90.28	355.14	5,518.90	2,504.89	-20.05	2,504.94	3.93
7,800.00	90.65	3.01	5,518.13	2,599.80	-21.58	2,599.86	8.29
7,895.00	86.95	2.31	5,520.12	2,694.66	-17.18	2,694.65	3.96
7,990.00	88.06	1.29	5,524.25	2,789.52	-14.19	2,789.47	1.59
8,085.00	88.80	359.67	5,526.85	2,884.47	-13.40	2,884.41	1.87
8,180.00	91.97	359.21	5,526.22	2,979.45	-14.33	2,979.39	3.37
8,274.00	91.02	358.47	5,523.76	3,073.40	-16.23	3,073.35	1.28
8,369.00	90.71	356.96	5,522.33	3,168.31	-20.02	3,168.31	1.62
8,464.00	91.33	358.23	5,520.64	3,263.21	-24.00	3,263.25	1.49
8,559.00	89.26	358.13	5,520.15	3,358.16	-27.02	3,358.23	2.18
8,654.00	89.88	358.35	5,520.86	3,453.11	-29.94	3,453.21	0.69
8,749.00	89.60	359.18	5,521.29	3,548.08	-31.99	3,548.20	0.92
8,844.00	89.91	358.90	5,521.70	3,643.07	-33.58	3,643.20	0.44
8,938.00	89.54	358.78	5,522.15	3,737.05	-35.48	3,737.20	0.41
9,033.00	89.38	0.00	5,523.05	3,832.04	-36.49	3,832.19	1.30
9,128.00	87.63	359.63	5,525.52	3,927.00	-36.80	3,927.15	1.88



## Design Report for Castor LD12 - 78HN - MWD Field Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
9,223.00	90.43	358.08	5,527.13	4,021.96	-38.70	4,022.12	3.37
9,318.00	90.77	357.58	5,526.14	4,116.88	-42.29	4,117.09	0.64
9,413.00	91.67	356.25	5,524.12	4,211.72	-47.40	4,211.98	1.69
9,443.00	92.00	356.33	5,523.15	4,241.64	-49.34	4,241.93	1.13
Final Sperry MWD Survey @ 9443.00 ft. MD							
9,505.00	92.00	356.33	5,520.99	4,303.48	-53.31	4,303.81	0.00
Estimated BHL: 672' FNL, 661' FWL :: Straight Line Projection to TD @ 9505.00 ft. MD							

### Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
250.00	250.00	0.25	-0.36	First Sperry MWD Survey @ 250.00 ft. MD
5,850.00	5,490.17	650.89	-18.83	Estimated 7" Casing Point: 938' FSL, 649' FWL (Not a Survey Station)
5,850.00	5,490.17	650.89	-18.83	Estimated 7" Casing Point: 938' FSL, 649' FWL (Not a Survey Station)
9,443.00	5,523.15	4,241.64	-49.34	Final Sperry MWD Survey @ 9443.00 ft. MD
9,505.00	5,520.99	4,303.48	-53.31	Estimated BHL: 672' FNL, 661' FWL :: Straight Line Projection to TD @ 9505.00 ft. MD

### Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Castor LD12-78HN PARO (BHL)	359.26	Slot	0.00	0.00	0.00

### Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
250.00	5,850.00	Sperry MWD Field Surveys	MWD
5,850.00	9,505.00	Sperry MWD Field Surveys	MWD

### Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
5,850.00	5,490.17	7" Casing PT	7	8-3/4

## Design Report for Castor LD12 - 78HN - MWD Field Surveys

Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
Castor Federal	0.00	0.00	2.00	0.00	0.00	1,524,007.99	3,465,567.82	40.759678	-103.819347
- actual wellpath hits target center									
- Polygon									
Point 1				-64.21	311.14	1,524,319.13	3,465,503.61		
Point 2				3,988.85	397.79	1,524,405.78	3,469,556.65		
Point 3				4,031.94	4,385.51	1,528,393.48	3,469,599.74		
Point 4				-116.64	4,376.15	1,528,384.12	3,465,451.18		
Point 5				-64.21	311.14	1,524,319.13	3,465,503.61		
Castor LD12-78HN	0.00	0.00	0.00	0.00	0.00	1,524,007.99	3,465,567.82	40.759678	-103.819347
- actual wellpath hits target center									
- Point									
Castor LD12-78HN		0.00	5,493.37	653.73	-8.44	1,524,661.71	3,465,559.37	40.761472	-103.819333
- actual wellpath misses target center by 10.85ft at 5852.91ft MD (5490.48 TVD, 653.78 N, -18.90 E)									
- Point									
Castor LD12-78HN	0.00	0.00	0.00	0.00	0.00	1,524,007.99	3,465,567.82	40.759678	-103.819347
- actual wellpath hits target center									
- Polygon									
Point 1				-656.21	-299.86	1,523,708.13	3,464,911.61		
Point 2				4,588.85	-202.21	1,523,805.78	3,470,156.65		
Point 3				4,631.94	4,985.51	1,528,993.48	3,470,199.74		
Point 4				-723.64	4,974.65	1,528,982.62	3,464,844.18		
Point 5				-656.21	-299.86	1,523,708.13	3,464,911.61		
Castor LD12-78HN	0.00	0.00	5,496.47	4,316.08	-55.71	1,528,324.04	3,465,512.11	40.771525	-103.819253
- actual wellpath misses target center by 27.68ft at 9505.00ft MD (5520.99 TVD, 4303.48 N, -53.31 E)									
- Point									

**North Reference Sheet for Sec. 12-T9N-R58W - Castor LD12 - 78HN**

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to Grid North Reference.

Vertical Depths are relative to RKB 24 ft. @ 4654.00ft (H&P 322). Northing and Easting are relative to Castor LD12 - 78HN

Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)

Central Meridian is -105.500000°, Longitude Origin:0.000000°, Latitude Origin:40.783333°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99999625

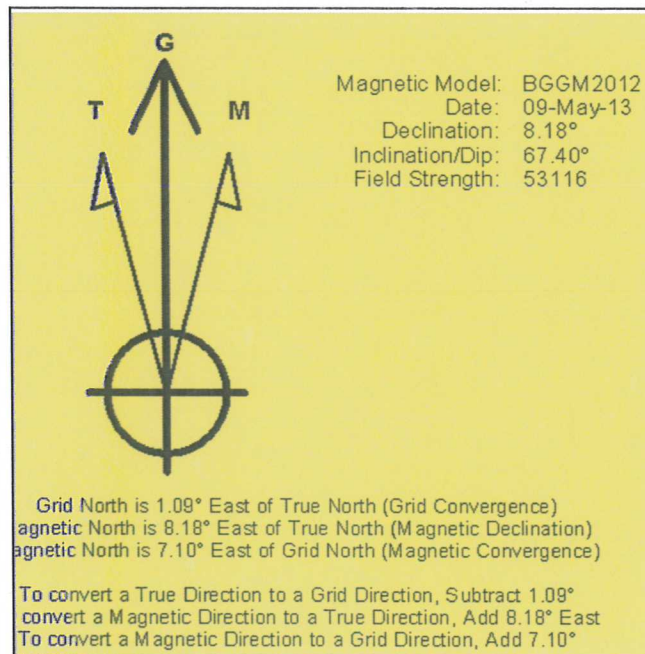
Grid Coordinates of Well: 1,524,007.98 ft N, 3,465,567.82 ft E

Geographical Coordinates of Well: 40° 45' 34.84" N, 103° 49' 09.65" W

Grid Convergence at Surface is: 1.09°

Based upon Minimum Curvature type calculations, at a Measured Depth of 9,505.00ft  
the Bottom Hole Displacement is 4,303.81ft in the Direction of 359.29° (Grid).

Magnetic Convergence at surface is: -7.10° ( 9 May 2013, , BGGM2012)

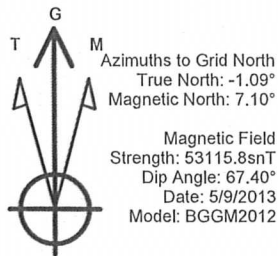


Project: Weld County, CO (NAD 83)  
Site: Sec. 12-T9N-R58W  
Well: Castor LD12 - 78HN

# Noble Energy

**HALLIBURTON**

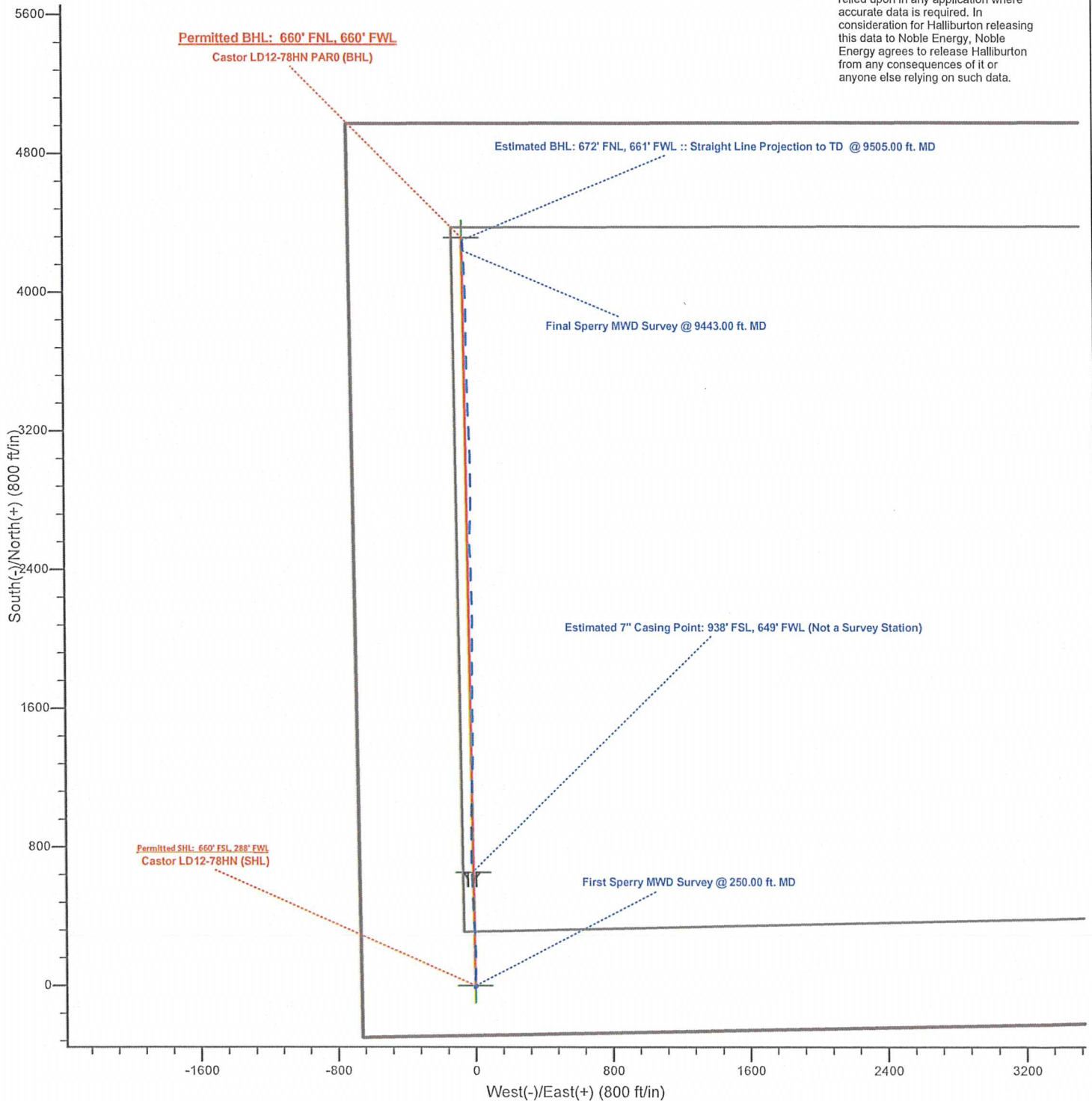
Sperry Drilling



## LEGEND

- Castor LD12 - 78HN, PAR0 Proposal
- - MWD Field Surveys

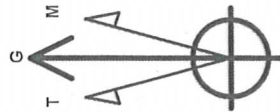
Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Castor LD12-78HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.





Project: Weld County, CO (NAD 83)  
 Site: Sec. 12-T9N-R58W  
 Well: Castor LD12 - 78HN

# Noble Energy

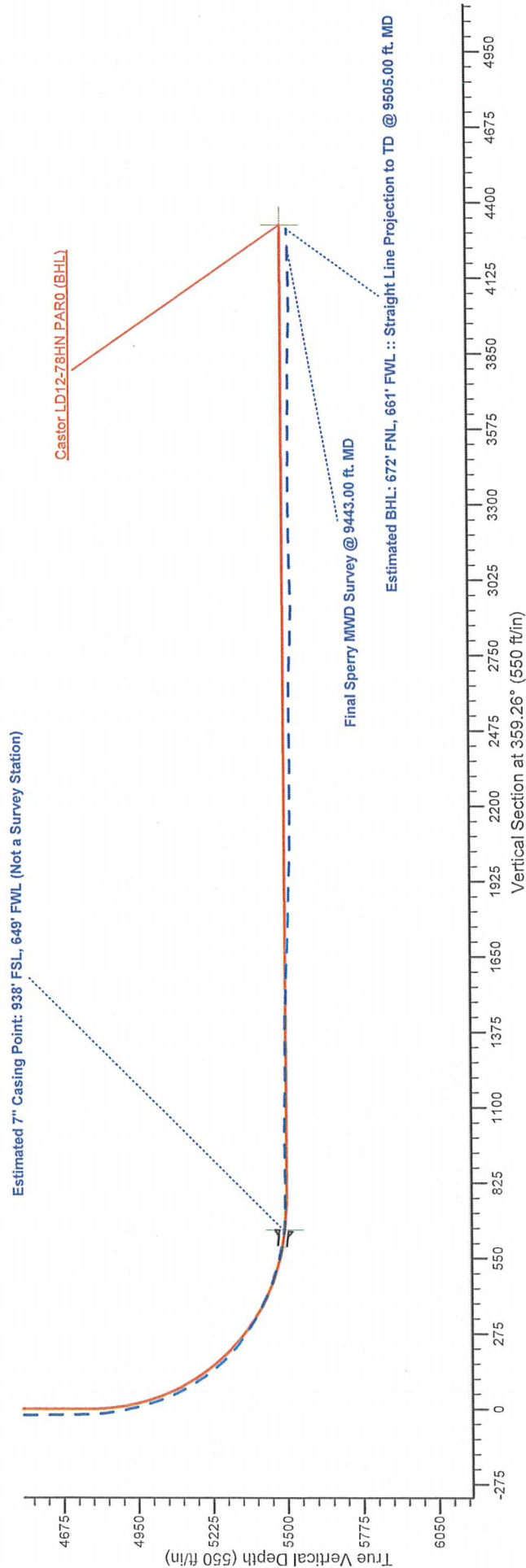


Azimuths to Grid North  
 True North: -1.09°  
 Magnetic North: 7.10°  
 Magnetic Field  
 Strength: 53115.8snT  
 Dip Angle: 67.40°  
 Date: 5/9/2013  
 Model: EGGM2012

## LEGEND

- Castor LD12 - 78HN, PAR0 Proposal V0
- - - MWD Field Surveys

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Castor LD12-78HN well located at Weld County, CO. At the conclusion of the job Halliburton performed a final survey on the well. Noble Energy has requested that Halliburton provide them the distances from BHL to section lines from that final survey to allow Noble Energy to meet its requirements under Colorado law. These distances are generated by a mathematical algorithm based on rough data collected after the well is drilled. Halliburton considers it to be a rough estimate only and it is not to be relied upon in any application where accurate data is required. In consideration for Halliburton releasing this data to Noble Energy, Noble Energy agrees to release Halliburton from any consequences of it or anyone else relying on such data.



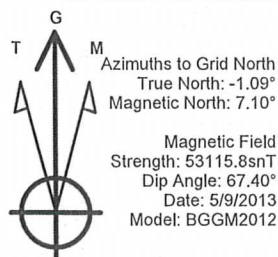


Project: Weld County, CO (NAD 83)  
 Site: Sec. 12-T9N-R58W  
 Well: Castor LD12 - 78HN

# Noble Energy

**HALLIBURTON**

Sperry Drilling



## LEGEND

- Castor LD12 - 78HN, PAR0 Proposal
- - MWD Field Surveys

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