

# Noble Energy

Weld County, CO (NAD 83)

Sec. 21-T5N-R63W (70 Ranch 21 PAD)

70 Ranch BB21-67HN - A1

Design: MWD Surveys

## Sperry Drilling Services

### Final Survey Report

31 October, 2011

Well Coordinates: 1,384,779.33 N, 3,292,410.74 E (40° 23' 05.53" N, 104° 27' 01.08" W)

Ground Level: 4,613.00 ft

Local Coordinate Origin: Centered on Well 70 Ranch BB21-67HN - Slot A1

Viewing Datum: KB @ 4637.00ft (H&P 315)

TVDs to System: N

North Reference: Grid

Unit System: API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 431

**HALLIBURTON**

**Survey Report for 70 Ranch BB21-67HN - Sperry MWD Surveys**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
705.00	0.52	352.14	704.99	3.17	-0.44	0.47	0.07	0.07	0.00	352.14
<b>First Sperry MWD Survey @ 705.00 ft</b>										
888.00	0.46	317.90	887.98	4.54	-1.04	0.27	0.16	-0.03	-18.71	-118.36
1,131.00	0.61	324.03	1,130.97	6.31	-2.46	-0.59	0.07	0.06	2.52	23.97
1,256.00	2.74	1.52	1,255.91	9.83	-2.77	0.11	1.83	1.70	29.99	46.83
1,351.00	4.98	354.38	1,350.69	16.21	-3.11	1.57	2.41	2.36	-7.52	-15.69
1,446.00	6.53	357.06	1,445.21	25.71	-3.79	3.58	1.66	1.63	2.82	11.17
1,540.00	8.56	356.03	1,538.39	38.02	-4.55	6.32	2.16	2.16	-1.10	-4.32
1,635.00	10.78	358.57	1,632.04	53.96	-5.26	10.11	2.38	2.34	2.67	12.13
1,729.00	12.87	358.45	1,724.04	73.22	-5.77	15.04	2.22	2.22	-0.13	-0.73
1,824.00	14.31	358.40	1,816.38	95.53	-6.38	20.72	1.52	1.52	-0.05	-0.49
1,918.00	16.44	357.11	1,907.01	120.43	-7.38	26.76	2.29	2.27	-1.37	-9.75
2,013.00	18.78	359.26	1,997.55	149.15	-8.25	33.99	2.56	2.46	2.26	16.56
2,107.00	22.45	1.71	2,085.52	182.23	-7.91	43.62	4.01	3.90	2.61	14.38
2,202.00	20.79	0.61	2,173.83	217.22	-7.19	54.14	1.80	-1.75	-1.16	-166.79
2,300.00	20.26	2.01	2,265.61	251.57	-6.41	64.54	0.74	-0.54	1.43	137.85
2,396.00	21.03	359.66	2,355.45	285.41	-5.93	74.51	1.18	0.80	-2.45	-48.20
2,491.00	23.64	0.25	2,443.31	321.51	-5.95	84.64	2.76	2.75	0.62	5.18
2,587.00	20.86	359.72	2,532.16	357.86	-5.95	94.85	2.90	-2.90	-0.55	-176.12
2,682.00	22.16	358.00	2,620.54	392.68	-6.65	103.96	1.52	1.37	-1.81	-26.68
2,778.00	23.51	355.81	2,709.01	429.87	-8.68	112.46	1.66	1.41	-2.28	-33.21
2,873.00	23.87	353.96	2,796.01	467.88	-12.09	119.87	0.87	0.38	-1.95	-65.01
2,969.00	21.56	353.48	2,884.56	504.73	-16.14	126.34	2.41	-2.41	-0.50	-175.63
3,065.00	20.75	353.05	2,974.09	539.14	-20.20	132.11	0.86	-0.84	-0.45	-169.35
3,158.00	19.28	355.56	3,061.47	570.80	-23.38	137.95	1.83	-1.58	2.70	150.87
3,252.00	18.15	358.35	3,150.50	600.91	-25.01	144.86	1.53	-1.20	2.97	142.93
3,349.00	18.38	358.36	3,242.61	631.30	-25.88	152.56	0.24	0.24	0.01	0.79
3,446.00	19.25	0.06	3,334.43	662.57	-26.30	160.94	1.06	0.90	1.75	33.03
3,543.00	20.21	0.25	3,425.73	695.32	-26.21	170.23	0.99	0.99	0.20	3.91
3,639.00	23.71	355.13	3,514.76	731.15	-27.78	178.79	4.15	3.65	-5.33	-31.08
3,734.00	24.73	354.33	3,601.40	769.95	-31.36	186.26	1.13	1.07	-0.84	-18.20
3,829.00	26.08	353.64	3,687.21	810.48	-35.64	193.54	1.45	1.42	-0.73	-12.68
3,925.00	24.36	354.76	3,774.06	851.17	-39.78	201.00	1.86	-1.79	1.17	165.00
4,020.00	20.49	357.58	3,861.86	887.31	-42.28	208.76	4.23	-4.07	2.97	165.76
4,116.00	18.72	359.96	3,952.29	919.51	-43.00	217.11	2.02	-1.84	2.48	156.83
4,211.00	17.40	1.41	4,042.61	948.95	-42.66	225.71	1.47	-1.39	1.53	161.88
4,307.00	14.98	2.91	4,134.80	975.70	-41.67	234.17	2.56	-2.52	1.56	170.91
4,402.00	15.78	359.45	4,226.40	1,000.88	-41.17	241.73	1.28	0.84	-3.64	-50.60
4,498.00	16.53	358.78	4,318.60	1,027.58	-41.59	248.83	0.81	0.78	-0.70	-14.28
4,594.00	13.70	0.66	4,411.27	1,052.61	-41.75	255.71	2.99	-2.95	1.96	171.08
4,689.00	12.92	2.22	4,503.72	1,074.47	-41.21	262.37	0.90	-0.82	1.64	156.03
4,784.00	11.45	1.52	4,596.58	1,094.51	-40.55	268.64	1.56	-1.55	-0.74	-174.60
4,880.00	9.78	355.15	4,690.94	1,112.16	-40.98	273.18	2.12	-1.74	-6.64	-148.01
4,976.00	8.22	0.57	4,785.75	1,127.15	-41.61	276.80	1.85	-1.62	5.65	154.13
5,072.00	6.49	357.14	4,880.96	1,139.43	-41.81	280.05	1.86	-1.80	-3.57	-167.45
5,168.00	3.38	351.34	4,976.59	1,147.65	-42.51	281.69	3.28	-3.24	-6.04	-173.77
5,263.00	0.67	22.44	5,071.53	1,150.94	-42.72	282.41	2.98	-2.85	32.74	172.97
5,359.00	0.58	43.51	5,167.52	1,151.81	-42.17	283.19	0.26	-0.09	21.95	121.70
5,454.00	0.38	132.25	5,262.52	1,151.94	-41.60	283.77	0.72	-0.21	93.41	146.39
5,550.00	0.99	173.38	5,358.51	1,150.91	-41.27	283.79	0.78	0.64	42.84	60.68
5,645.00	1.69	186.08	5,453.48	1,148.70	-41.32	283.12	0.80	0.74	13.37	29.42
5,783.00	1.39	228.69	5,591.44	1,145.57	-42.80	280.83	0.84	-0.22	30.88	125.32
5,937.00	4.96	93.12	5,745.27	1,143.97	-37.55	285.42	3.92	2.32	-88.03	-144.83
5,984.00	9.39	89.10	5,791.89	1,143.92	-31.68	291.03	9.48	9.43	-8.55	-8.47
6,032.00	13.71	83.70	5,838.91	1,144.61	-22.11	300.41	9.27	9.00	-11.25	-16.71
6,079.00	17.92	82.86	5,884.12	1,146.12	-9.39	313.04	8.97	8.96	-1.79	-3.52
6,127.00	19.50	84.87	5,929.58	1,147.75	5.92	328.19	3.55	3.29	4.19	23.15



## Survey Report for 70 Ranch BB21-67HN - Sperry MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
6,175.00	22.10	88.35	5,974.45	1,148.73	22.92	344.79	6.00	5.42	7.25	27.06
6,223.00	25.97	87.23	6,018.28	1,149.50	42.45	363.75	8.12	8.06	-2.33	-7.24
6,271.00	29.53	87.13	6,060.75	1,150.60	64.77	385.48	7.42	7.42	-0.21	-0.79
6,319.00	33.77	86.28	6,101.61	1,152.06	89.91	410.01	8.88	8.83	-1.77	-6.37
6,367.00	38.40	87.20	6,140.39	1,153.65	118.13	437.54	9.71	9.65	1.92	7.05
6,414.00	41.86	87.22	6,176.32	1,155.13	148.38	466.99	7.36	7.36	0.04	0.22
6,462.00	44.74	87.28	6,211.25	1,156.70	181.26	498.99	6.00	6.00	0.12	0.84
6,510.00	50.05	85.80	6,243.73	1,158.86	216.51	533.42	11.29	11.06	-3.08	-12.10
6,558.00	54.00	86.52	6,273.26	1,161.38	254.25	570.35	8.31	8.23	1.50	8.40
6,605.00	55.37	86.18	6,300.43	1,163.82	292.53	607.77	2.97	2.91	-0.72	-11.55
6,654.00	60.17	84.93	6,326.55	1,167.05	333.84	648.32	10.03	9.80	-2.55	-12.76
6,702.00	64.83	84.78	6,348.71	1,170.87	376.23	690.08	9.71	9.71	-0.31	-1.67
6,750.00	68.45	84.76	6,367.74	1,174.88	420.11	733.32	7.54	7.54	-0.04	-0.29
6,797.00	73.72	84.32	6,382.97	1,179.11	464.35	776.97	11.25	11.21	-0.94	-4.59
6,853.00	76.01	83.76	6,397.59	1,184.73	518.11	830.14	4.20	4.09	-1.00	-13.36
6,911.00	81.45	83.79	6,408.92	1,190.89	574.64	886.12	9.38	9.38	0.05	0.31
6,976.00	84.08	84.30	6,417.11	1,197.58	638.76	949.54	4.12	4.05	0.78	10.92
7,071.00	87.13	84.84	6,424.39	1,206.54	733.05	1,042.55	3.26	3.21	0.57	10.03
7,167.00	89.85	85.79	6,426.92	1,214.38	828.69	1,136.53	3.00	2.83	0.99	19.26
7,293.00	90.99	87.88	6,425.99	1,221.34	954.48	1,259.21	1.89	0.90	1.66	61.38
7,389.00	89.14	87.62	6,425.88	1,225.11	1,050.40	1,352.33	1.95	-1.93	-0.27	-172.00
7,484.00	90.46	87.15	6,426.21	1,229.44	1,145.30	1,444.62	1.47	1.39	-0.49	-19.60
7,579.00	90.49	88.03	6,425.43	1,233.43	1,240.21	1,536.83	0.93	0.03	0.93	88.04
7,675.00	91.85	87.09	6,423.47	1,237.52	1,336.10	1,630.01	1.72	1.42	-0.98	-34.64
7,771.00	90.89	88.89	6,421.17	1,240.89	1,432.01	1,723.00	2.12	-1.00	1.87	118.06
7,866.00	89.51	89.06	6,420.84	1,242.58	1,526.99	1,814.63	1.46	-1.45	0.18	172.98
7,961.00	91.29	89.08	6,420.18	1,244.13	1,621.97	1,906.22	1.87	1.87	0.02	0.64
8,056.00	89.20	88.81	6,419.77	1,245.88	1,716.95	1,997.86	2.22	-2.20	-0.28	-172.64
8,152.00	90.28	89.90	6,420.21	1,246.96	1,812.94	2,090.29	1.60	1.12	1.14	45.27
8,247.00	90.74	88.77	6,419.36	1,248.06	1,907.93	2,181.76	1.28	0.48	-1.19	-67.84
8,342.00	89.85	86.68	6,418.87	1,251.83	2,002.85	2,273.91	2.39	-0.94	-2.20	-113.06
8,438.00	90.74	86.57	6,418.38	1,257.48	2,098.68	2,367.47	0.93	0.93	-0.11	-7.05
8,533.00	89.60	87.73	6,418.10	1,262.20	2,193.56	2,459.85	1.71	-1.20	1.22	134.50
8,629.00	90.50	88.41	6,418.01	1,265.44	2,289.50	2,552.84	1.18	0.94	0.71	37.07
8,724.00	88.99	88.00	6,418.43	1,268.41	2,384.45	2,644.80	1.65	-1.59	-0.43	-164.81
8,820.00	91.02	88.49	6,418.43	1,271.35	2,480.40	2,737.71	2.18	2.11	0.51	13.57
8,916.00	90.03	86.71	6,417.55	1,275.37	2,576.31	2,830.88	2.12	-1.03	-1.85	-119.07
9,011.00	91.51	85.66	6,416.27	1,281.69	2,671.08	2,923.61	1.91	1.56	-1.11	-35.35
9,107.00	89.35	86.17	6,415.55	1,288.53	2,766.83	3,017.42	2.31	-2.25	0.53	166.71
9,203.00	89.10	86.19	6,416.85	1,294.93	2,862.61	3,111.14	0.26	-0.26	0.02	175.43
9,299.00	90.34	87.19	6,417.32	1,300.47	2,958.44	3,204.67	1.66	1.29	1.04	38.89
9,394.00	89.29	87.63	6,417.62	1,304.76	3,053.35	3,296.96	1.20	-1.11	0.46	157.26
9,489.00	90.52	88.17	6,417.78	1,308.24	3,148.28	3,389.04	1.41	1.29	0.57	23.70
9,585.00	89.51	86.84	6,417.76	1,312.42	3,244.18	3,482.26	1.74	-1.05	-1.39	-127.21
9,681.00	92.59	87.29	6,416.00	1,317.34	3,340.03	3,575.62	3.24	3.21	0.47	8.31
9,776.00	91.23	87.75	6,412.83	1,321.44	3,434.89	3,667.81	1.51	-1.43	0.48	161.31
9,871.00	90.18	86.82	6,411.66	1,325.94	3,529.77	3,760.14	1.48	-1.11	-0.98	-138.46
9,966.00	91.85	86.79	6,409.98	1,331.24	3,624.60	3,852.64	1.76	1.76	-0.03	-1.03
10,062.00	90.50	87.13	6,408.01	1,336.33	3,720.45	3,946.05	1.45	-1.41	0.35	165.86
10,157.00	89.78	86.35	6,407.78	1,341.73	3,815.29	4,038.59	1.12	-0.76	-0.82	-132.71
10,252.00	89.72	86.65	6,408.19	1,347.53	3,910.11	4,131.22	0.32	-0.06	0.32	101.31
10,348.00	90.43	85.48	6,408.07	1,354.12	4,005.88	4,224.99	1.43	0.74	-1.22	-58.75
10,443.00	90.93	85.85	6,406.94	1,361.30	4,100.61	4,317.91	0.65	0.53	0.39	36.50
10,539.00	90.12	86.34	6,406.06	1,367.83	4,196.38	4,411.66	0.99	-0.84	0.51	148.83
10,634.00	88.71	85.54	6,407.03	1,374.56	4,291.13	4,504.48	1.71	-1.48	-0.84	-150.43
10,730.00	90.65	86.22	6,407.57	1,381.46	4,386.88	4,598.31	2.14	2.02	0.71	19.32
10,825.00	90.15	87.39	6,406.90	1,386.75	4,481.72	4,690.82	1.34	-0.53	1.23	113.14
10,921.00	91.48	86.76	6,405.54	1,391.65	4,577.59	4,784.20	1.53	1.39	-0.66	-25.34
11,066.00	91.08	88.28	6,402.30	1,397.92	4,722.41	4,924.95	1.08	-0.28	1.05	104.73

## Survey Report for 70 Ranch BB21-67HN - Sperry MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
Final Sperry MWD Survey @ 11066.00 ft										
11,124.00	91.08	88.28	6,401.21	1,399.66	4,780.37	4,981.07	0.00	0.00	0.00	0.00
Straight Line Projection to TD @ 11124.00 ft - Estimated BHL: 1315' FNL, 538' FEL										

Survey Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
705.00	704.99	3.17	-0.44	First Sperry MWD Survey @ 705.00 ft
11,066.00	6,402.30	1,397.92	4,722.41	Final Sperry MWD Survey @ 11066.00 ft
11,124.00	6,401.21	1,399.66	4,780.37	Straight Line Projection to TD @ 11124.00 ft
11,124.00	6,401.21	1,399.66	4,780.37	Estimated BHL: 1315' FNL, 538' FEL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
User	No Target (Freehand)	73.68	Slot	0.00	0.00	0.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
705.00	11,124.00	Sperry MWD Surveys	MWD

## Targets associated with this wellbore

Target Name	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Shape
70 Ranch BB21-67HN_Sec. Lines	0.00	0.00	0.00	Polygon
70 Ranch BB21-67HN_460' Setbacks	0.00	0.00	0.00	Polygon
70 Ranch BB21-67HN_PlanA - Rev1_BHL Tgt	6,405.85	1,394.21	4,783.57	Point

## North Reference Sheet for Sec. 21-T5N-R63W (70 Ranch 21 PAD) - 70 Ranch BB21-67HN

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

Vertical Depths are relative to KB @ 4637.00ft (H&P 315). Northing and Easting are relative to 70 Ranch BB21-67HN - Slot A1

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 -105.50°, Longitude Origin: 0° 0' 0.000 E°, Latitude Origin: 40° 47' 0.000 N°

False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995958

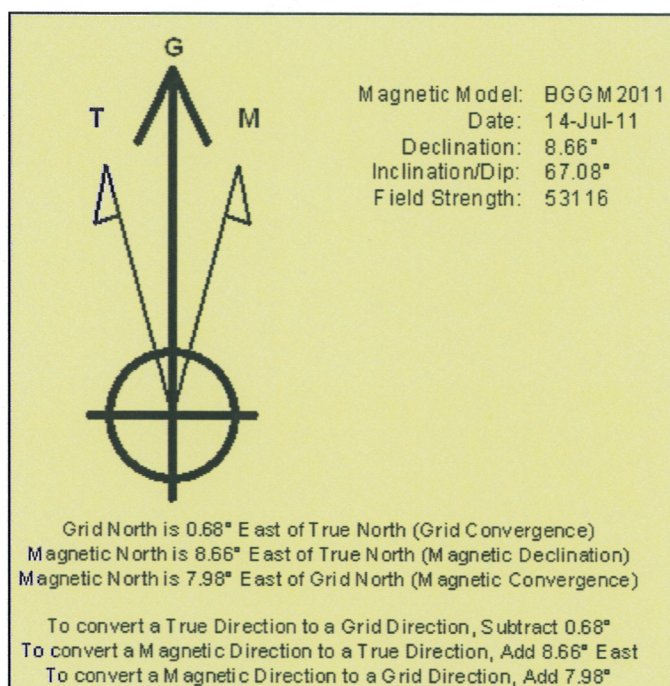
Grid Coordinates of Well: 1,384,779.33 ft N, 3,292,410.74 ft E

Geographical Coordinates of Well: 40° 23' 05.53" N, 104° 27' 01.08" W

Grid Convergence at Surface is: 0.68°

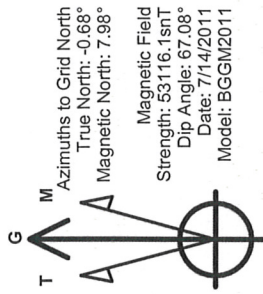
Based upon Minimum Curvature type calculations, at a Measured Depth of 11,124.00ft  
the Bottom Hole Displacement is 4,981.07ft in the Direction of 73.68° (Grid).

Magnetic Convergence at surface is: -7.98° (14 July 2011, , BGGM2011)





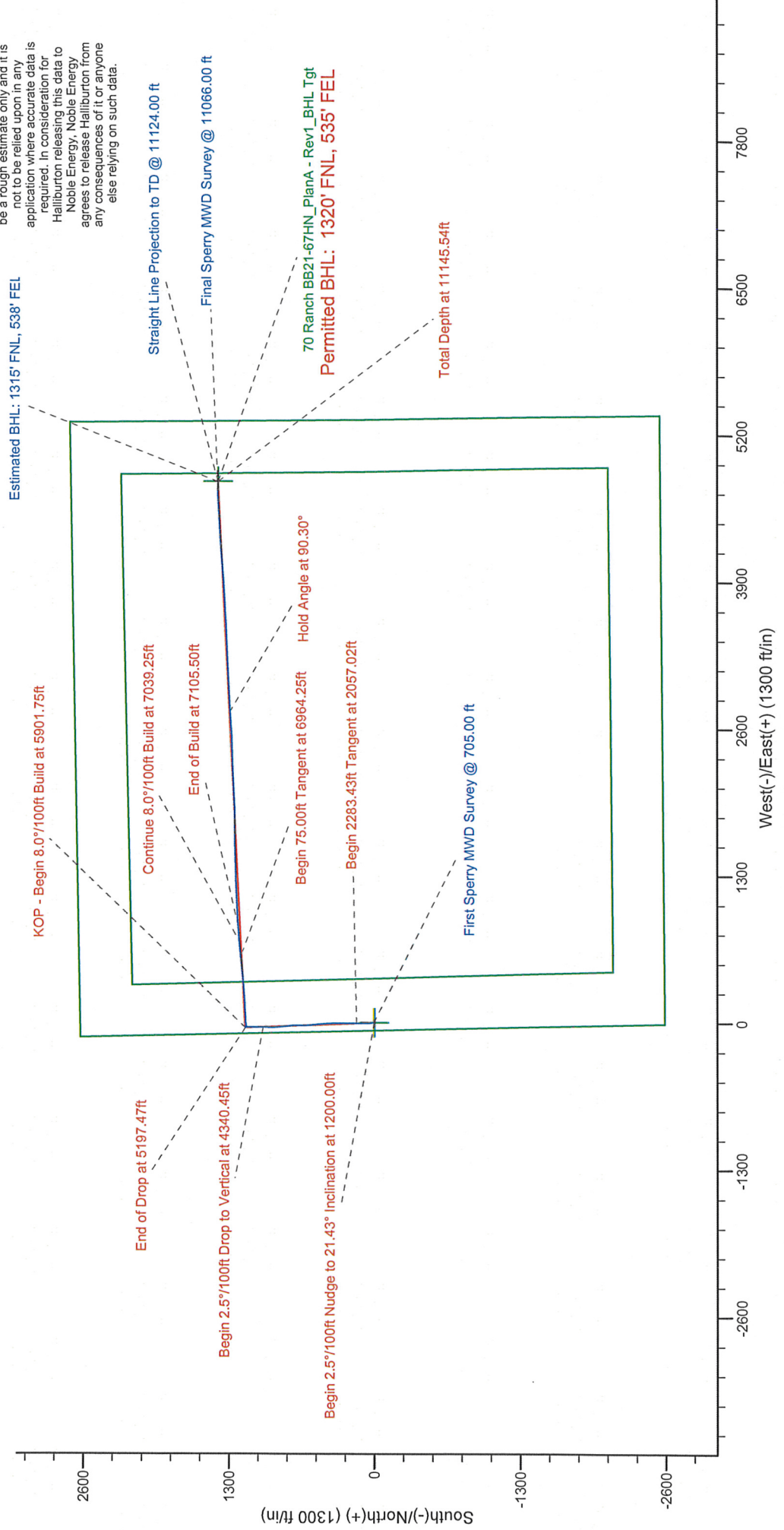
# Noble Energy



## LEGEND

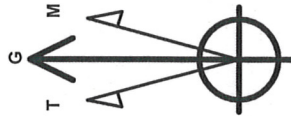
- 70 Ranch BB21-67HN, Plan A, Plan A - Rev 1 Proposal V0
- MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the 70 Ranch BB21-67HN 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. 21-T5N-R63W (70 Ranch 21 PAD)  
Well: 70 Ranch BB21-67HN

# Noble Energy



Azimuths to Grid North  
True North: -0.68°  
Magnetic North: 7.98°  
  
Magnetic Field  
Strength: 53116.4 nT  
Dip Angle: 67.08°  
Date: 7/14/2011  
Model: BGGM2011

## LEGEND

- 70 Ranch BB21-67HN, Plan A, Plan A - Rev 1 Proposal V0
- MWD Survey

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