

Noble Energy

Weld County, CO (NAD 83)
Sec. 5-T5N-R62W (Wells Ranch BB01)
Wells Ranch BB01-615
05-123-41988
Plan A

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

22 February, 2016

Surface UWI : 05-123-41988

Well Coordinates: 1,399,120.26 N, 3,318,703.33 E (40° 25' 24.02" N, 104° 21' 18.94" W)
Ground Level: 4,662.00 usft

Local Coordinate Origin:

Centered on Well Wells Ranch BB01-615

Viewing Datum:

KB = 24' @ 4686.00usft (H&P 343)

TVDs to System:

N

North Reference:

Grid

Unit System:

Dec-Deg - API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

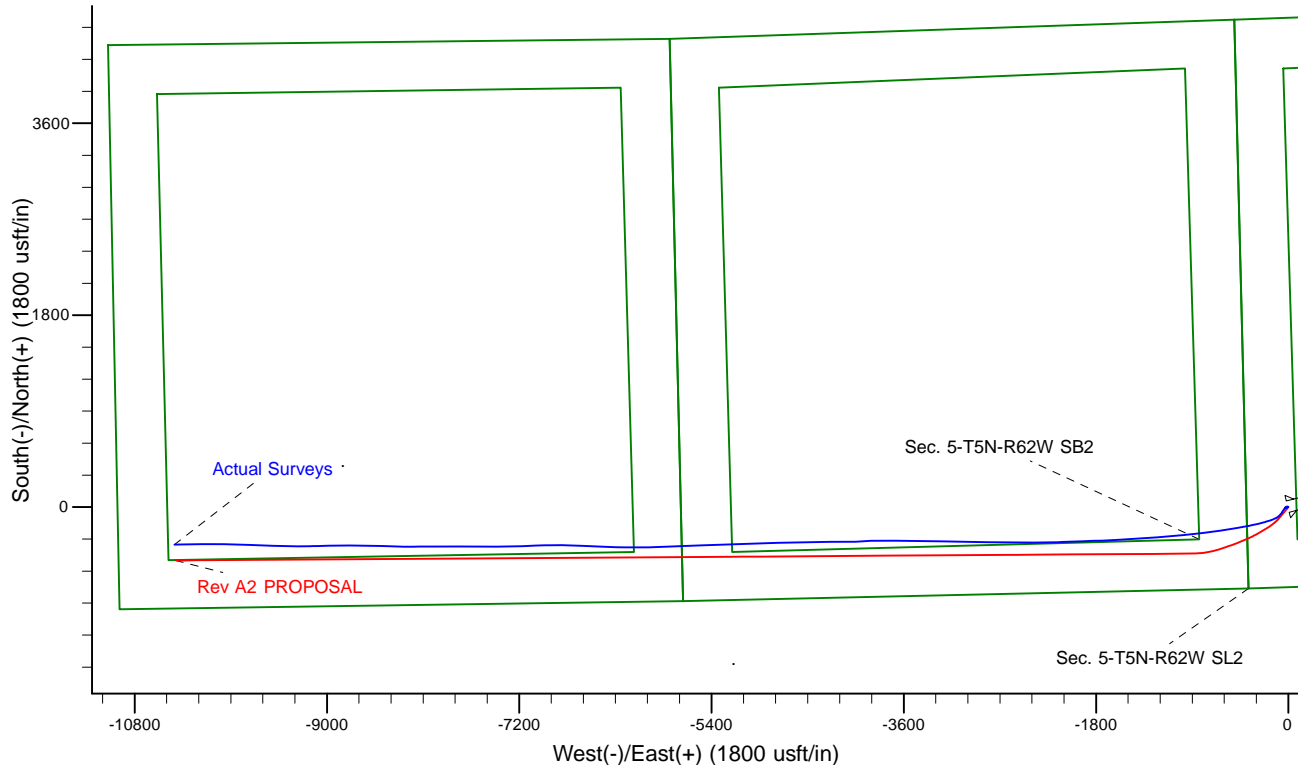
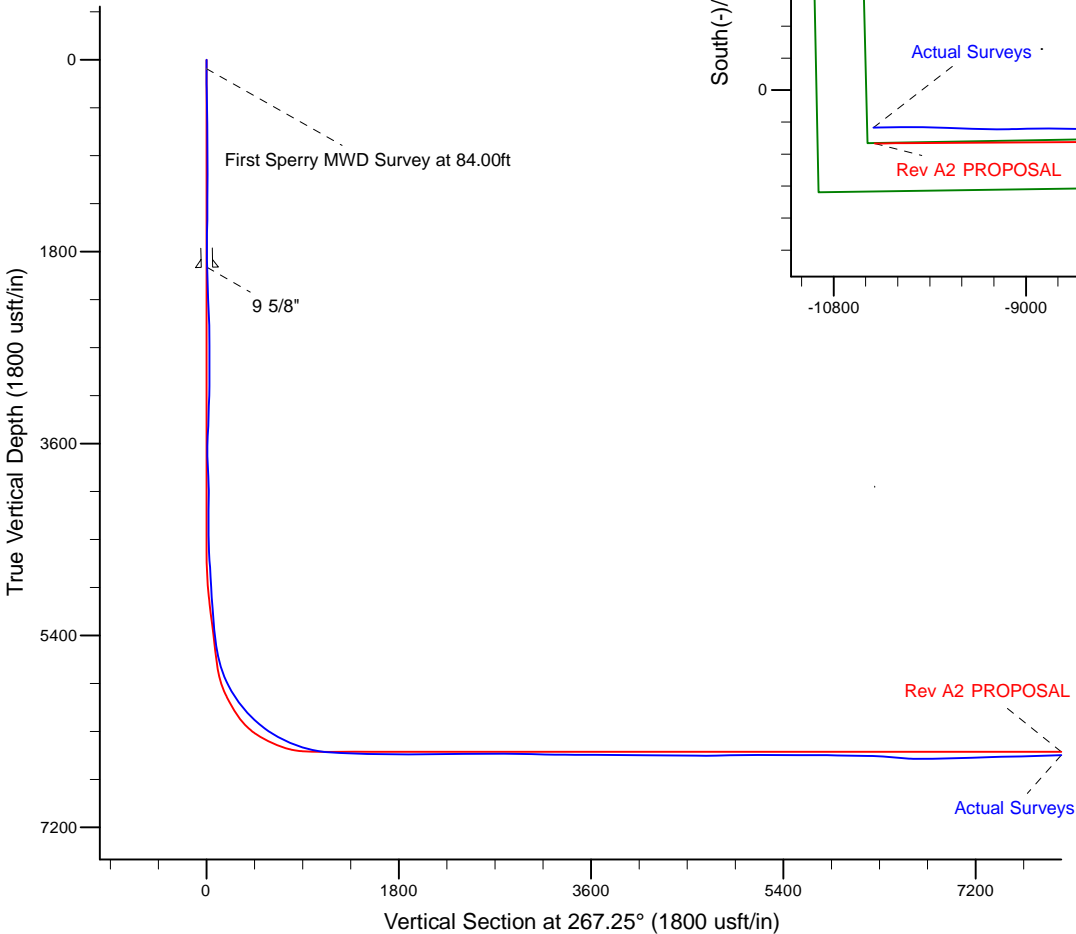
HALLIBURTON

Project: Weld County, CO (NAD 83)
 Site: Sec. 5-T5N-R62W (Wells Ranch BB01)
 Well: Wells Ranch BB01-615
 Wellbore: Plan A
 Design: Actual Surveys



Platted SHL: 751' FSL, 394' FWL
 Platted Lat/Long: 40.42334, -104.35526
 Location: Sec. 5-T5N-R62W

Platted BHL: 450' FSL, 535' FWL
 Platted Lat/Long: 40.422740 N, 104.392515
 State Planes - CO Northern: 1,398,769.81 N, 3,308,334.56 E
 Sec. 1-T5N-R63W



LEGEND

- ✕ Wells Ranch BB01-615, Plan A, Rev A2 PROPOSAL V0
- Actual Surveys

WELL DETAILS: Wells Ranch BB01-615	
Ground Level:	4662.00
KB = 24' @	4686.00usft (H&P 343)
Created By:	Tatiana Gomez
Created On:	12/22/16



Design Report for Wells Ranch BB01-615 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84.00	0.15	263.81	84.00	-0.01	-0.11	0.11	0.18
First Sperry MWD Survey at 84.00ft							
178.00	0.10	331.05	178.00	0.05	-0.27	0.27	0.15
273.00	1.30	286.31	272.99	0.42	-1.35	1.32	1.30
367.00	1.03	275.51	366.97	0.80	-3.21	3.17	0.37
462.00	1.11	287.56	461.96	1.16	-4.94	4.88	0.25
556.00	0.89	317.28	555.94	1.97	-6.30	6.20	0.59
651.00	0.43	253.07	650.94	2.41	-7.14	7.02	0.84
746.00	0.81	270.04	745.93	2.31	-8.15	8.03	0.44
840.00	0.46	344.04	839.93	2.67	-8.92	8.78	0.87
935.00	0.18	44.51	934.92	3.14	-8.92	8.76	0.42
1,029.00	0.28	141.11	1,028.92	3.07	-8.68	8.52	0.37
1,124.00	0.41	124.32	1,123.92	2.70	-8.25	8.11	0.17
1,219.00	0.25	144.77	1,218.92	2.34	-7.85	7.73	0.21
1,313.00	0.19	136.11	1,312.92	2.06	-7.62	7.51	0.07
1,407.00	0.32	63.27	1,406.92	2.06	-7.28	7.17	0.34
1,502.00	0.46	94.89	1,501.92	2.15	-6.66	6.55	0.26
1,597.00	0.61	51.96	1,596.91	2.43	-5.88	5.76	0.44
1,691.00	0.90	53.61	1,690.90	3.18	-4.90	4.74	0.31
1,786.00	0.74	43.49	1,785.90	4.06	-3.87	3.67	0.23
1,880.00	0.91	285.30	1,879.89	4.70	-4.18	3.95	1.51
1,937.00	1.46	256.10	1,936.88	4.65	-5.32	5.09	1.40
1,947.00	1.50	255.89	1,946.87	4.58	-5.57	5.34	0.44
9 5/8"							
2,216.00	2.69	252.81	2,215.69	1.86	-15.02	14.92	0.44
2,307.00	1.86	269.85	2,306.62	1.22	-18.54	18.46	1.17
2,398.00	2.47	268.31	2,397.55	1.16	-21.98	21.90	0.67
2,490.00	1.19	253.91	2,489.50	0.84	-24.88	24.81	1.47
2,680.00	0.47	196.85	2,679.49	-0.46	-27.00	26.99	0.53
2,774.00	0.25	336.86	2,773.49	-0.64	-27.19	27.19	0.72
2,868.00	0.53	10.03	2,867.48	-0.02	-27.19	27.16	0.37
2,963.00	0.20	8.09	2,962.48	0.58	-27.09	27.04	0.35
3,058.00	0.93	101.98	3,057.48	0.58	-26.32	26.26	1.02
3,152.00	1.94	136.52	3,151.45	-0.73	-24.48	24.48	1.37
3,247.00	1.49	110.47	3,246.41	-2.33	-22.21	22.30	0.94
3,436.00	2.94	99.24	3,435.26	-3.97	-15.13	15.30	0.80
3,531.00	2.48	82.59	3,530.16	-4.09	-10.68	10.87	0.95
3,625.00	2.68	32.93	3,624.07	-1.99	-7.47	7.56	2.31
3,720.00	2.70	310.39	3,719.00	1.33	-7.97	7.90	3.73
3,815.00	2.75	281.79	3,813.89	3.24	-11.90	11.73	1.42
3,909.00	2.70	267.65	3,907.79	3.61	-16.32	16.13	0.72
4,004.00	2.32	246.74	4,002.70	2.76	-20.33	20.17	1.04
4,098.00	1.20	162.79	4,096.67	1.07	-21.78	21.71	2.66
4,193.00	2.71	138.85	4,191.61	-1.57	-20.01	20.06	1.77
4,288.00	1.91	148.97	4,286.53	-4.62	-17.72	17.92	0.94
4,382.00	0.81	248.60	4,380.51	-6.20	-17.53	17.80	2.34
4,477.00	0.82	270.71	4,475.50	-6.44	-18.83	19.12	0.33
4,572.00	2.31	303.07	4,570.47	-5.39	-21.12	21.35	1.76
4,666.00	3.65	250.69	4,664.35	-5.34	-25.53	25.76	3.08

Design Report for Wells Ranch BB01-615 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
4,761.00	5.02	223.44	4,759.09	-9.36	-31.24	31.65	2.56
4,855.00	5.54	219.04	4,852.69	-15.87	-36.93	37.65	0.70
4,950.00	5.42	220.22	4,947.25	-22.86	-42.71	43.76	0.17
5,045.00	5.39	210.48	5,041.83	-30.13	-47.87	49.26	0.97
5,139.00	6.36	211.23	5,135.34	-38.39	-52.81	54.59	1.04
5,234.00	9.02	214.48	5,229.48	-49.03	-59.76	62.04	2.84
5,329.00	8.56	219.50	5,323.36	-60.62	-68.47	71.30	0.94
5,423.00	9.65	216.90	5,416.18	-72.32	-77.65	81.03	1.24
5,518.00	10.38	227.01	5,509.74	-84.52	-88.69	92.65	2.00
7,119.00	87.22	265.41	6,498.28	-278.75	-1,168.49	1,180.52	4.94
7,214.00	87.28	265.90	6,502.84	-285.94	-1,263.11	1,275.37	0.52
7,308.00	87.78	265.97	6,506.89	-292.59	-1,356.79	1,369.26	0.54
7,403.00	88.39	266.14	6,510.06	-299.13	-1,451.51	1,464.19	0.67
7,498.00	89.01	266.62	6,512.22	-305.12	-1,546.29	1,559.15	0.83
7,592.00	89.63	267.12	6,513.34	-310.26	-1,640.15	1,653.14	0.85
7,687.00	89.38	267.97	6,514.16	-314.32	-1,735.05	1,748.13	0.93
7,781.00	90.49	268.74	6,514.26	-317.02	-1,829.01	1,842.11	1.44
7,876.00	89.38	267.95	6,514.37	-319.77	-1,923.97	1,937.10	1.43
7,970.00	90.31	268.28	6,514.63	-322.86	-2,017.92	2,031.08	1.05
8,065.00	89.88	267.43	6,514.47	-326.41	-2,112.85	2,126.08	1.00
8,160.00	90.25	268.48	6,514.36	-329.80	-2,207.79	2,221.07	1.17
8,255.00	91.05	269.79	6,513.28	-331.24	-2,302.77	2,316.01	1.62
8,349.00	91.30	270.48	6,511.35	-331.02	-2,396.75	2,409.87	0.78
8,444.00	91.36	270.44	6,509.15	-330.25	-2,491.72	2,504.69	0.08
8,538.00	90.37	269.68	6,507.73	-330.16	-2,585.71	2,598.57	1.33
8,633.00	90.37	270.58	6,507.12	-329.94	-2,680.70	2,693.44	0.95
8,728.00	88.76	270.26	6,507.84	-329.24	-2,775.69	2,788.29	1.73
8,822.00	88.27	270.61	6,510.27	-328.53	-2,869.66	2,882.12	0.64
8,917.00	88.70	270.82	6,512.79	-327.35	-2,964.62	2,976.91	0.50
9,011.00	89.20	270.86	6,514.51	-325.97	-3,058.59	3,070.71	0.53
9,109.00	89.44	270.91	6,515.67	-324.45	-3,156.57	3,168.50	0.25
9,201.00	89.38	271.56	6,516.62	-322.47	-3,248.55	3,260.28	0.71
9,295.00	89.81	272.06	6,517.28	-319.50	-3,342.50	3,353.98	0.70
9,389.00	89.07	270.53	6,518.20	-317.38	-3,436.47	3,447.73	1.81
9,484.00	89.63	270.89	6,519.28	-316.20	-3,531.45	3,542.56	0.70
9,579.00	89.63	270.64	6,519.89	-314.93	-3,626.44	3,637.37	0.26
9,673.00	89.51	270.42	6,520.60	-314.06	-3,720.43	3,731.22	0.27
9,767.00	90.12	269.84	6,520.90	-313.85	-3,814.43	3,825.10	0.90
9,862.00	89.14	266.63	6,521.52	-316.77	-3,909.37	3,920.07	3.53
9,957.00	89.69	266.65	6,522.49	-322.34	-4,004.20	4,015.06	0.58
10,051.00	89.75	268.16	6,522.95	-326.60	-4,098.10	4,109.05	1.61
10,146.00	89.26	270.74	6,523.77	-327.51	-4,193.09	4,203.97	2.76
10,240.00	90.06	270.31	6,524.32	-326.65	-4,287.08	4,297.82	0.97
10,335.00	89.51	269.42	6,524.68	-326.87	-4,382.08	4,392.71	1.10
10,429.00	89.44	269.08	6,525.54	-328.10	-4,476.07	4,486.65	0.37
10,524.00	88.89	268.34	6,526.93	-330.24	-4,571.03	4,581.61	0.97
10,618.00	90.49	268.74	6,527.43	-332.64	-4,665.00	4,675.58	1.75
10,713.00	91.17	268.83	6,526.06	-334.65	-4,759.96	4,770.54	0.72
10,807.00	90.99	268.38	6,524.29	-336.94	-4,853.92	4,864.49	0.52
10,902.00	91.17	268.19	6,522.50	-339.78	-4,948.86	4,959.46	0.28
10,996.00	90.86	267.79	6,520.83	-343.08	-5,042.79	5,053.44	0.54

Design Report for Wells Ranch BB01-615 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
11,091.00	89.81	267.83	6,520.28	-346.71	-5,137.71	5,148.43	1.11
11,185.00	89.81	268.65	6,520.59	-349.59	-5,231.67	5,242.42	0.87
11,280.00	89.20	268.27	6,521.41	-352.15	-5,326.63	5,337.39	0.76
11,374.00	89.75	267.97	6,522.27	-355.23	-5,420.58	5,431.38	0.67
11,469.00	89.69	267.73	6,522.73	-358.80	-5,515.51	5,526.37	0.26
11,563.00	90.00	267.04	6,522.99	-363.08	-5,609.41	5,620.37	0.80
11,658.00	89.88	267.25	6,523.09	-367.82	-5,704.29	5,715.37	0.25
11,752.00	89.51	268.17	6,523.59	-371.57	-5,798.21	5,809.36	1.05
11,847.00	89.26	268.02	6,524.61	-374.73	-5,893.15	5,904.35	0.31
11,942.00	89.07	269.03	6,525.99	-377.17	-5,988.11	5,999.31	1.08
12,036.00	88.77	269.48	6,527.76	-378.40	-6,082.09	6,093.24	0.58
12,131.00	89.01	270.83	6,529.60	-378.14	-6,177.07	6,188.10	1.44
12,167.00	88.61	270.79	6,530.35	-377.63	-6,213.06	6,224.02	1.12
12,259.00	86.60	271.63	6,534.20	-375.69	-6,304.95	6,315.71	2.37
12,442.00	84.53	272.38	6,548.35	-369.31	-6,487.28	6,497.53	1.20
12,491.00	84.84	272.48	6,552.89	-367.24	-6,536.02	6,546.12	0.66
12,537.00	87.72	272.99	6,555.87	-365.05	-6,581.87	6,591.80	6.36
12,585.00	89.45	273.50	6,557.06	-362.33	-6,629.78	6,639.52	3.76
12,632.00	90.40	272.54	6,557.12	-359.86	-6,676.71	6,686.29	2.87
12,680.00	90.03	271.61	6,556.94	-358.12	-6,724.68	6,734.11	2.09
12,726.00	90.99	270.29	6,556.53	-357.36	-6,770.67	6,780.02	3.55
12,774.00	91.60	269.96	6,555.44	-357.25	-6,818.65	6,827.94	1.44
12,821.00	91.48	269.76	6,554.18	-357.37	-6,865.64	6,874.88	0.50
12,869.00	91.73	269.44	6,552.83	-357.70	-6,913.62	6,922.82	0.85
12,915.00	91.60	268.58	6,551.50	-358.50	-6,959.59	6,968.78	1.89
13,104.00	91.39	267.43	6,546.57	-365.07	-7,148.41	7,157.69	0.62
13,199.00	92.22	267.91	6,543.57	-368.93	-7,243.28	7,252.64	1.01
13,293.00	91.51	270.12	6,540.52	-370.55	-7,337.21	7,346.54	2.47
13,388.00	91.97	269.49	6,537.63	-370.87	-7,432.17	7,441.40	0.82
13,577.00	90.89	270.72	6,532.91	-370.53	-7,621.10	7,630.10	0.87
13,767.00	92.19	269.71	6,527.81	-369.81	-7,811.02	7,819.77	0.87
13,861.00	91.91	269.47	6,524.45	-370.48	-7,904.96	7,913.63	0.39
13,956.00	90.52	270.15	6,522.43	-370.80	-7,999.94	8,008.51	1.63
14,050.00	90.46	269.92	6,521.63	-370.74	-8,093.93	8,102.40	0.25
14,145.00	89.01	268.64	6,522.07	-371.94	-8,188.92	8,197.33	2.04
14,239.00	88.40	271.85	6,524.19	-371.53	-8,282.88	8,291.17	3.48
14,334.00	89.63	272.47	6,525.82	-367.95	-8,377.80	8,385.80	1.45
14,429.00	90.25	271.80	6,525.92	-364.41	-8,472.73	8,480.46	0.96
14,523.00	89.35	270.57	6,526.25	-362.47	-8,566.71	8,574.23	1.62
14,618.00	89.60	270.63	6,527.12	-361.48	-8,661.70	8,669.07	0.27
14,712.00	90.49	270.39	6,527.05	-360.64	-8,755.69	8,762.91	0.98
14,807.00	89.78	269.79	6,526.82	-360.49	-8,850.69	8,857.80	0.98
14,902.00	90.28	268.98	6,526.77	-361.51	-8,945.69	8,952.73	1.00
14,996.00	90.31	269.13	6,526.29	-363.06	-9,039.67	9,046.68	0.16
15,091.00	89.20	267.85	6,526.70	-365.56	-9,134.63	9,141.65	1.78
15,186.00	91.02	270.84	6,526.51	-366.65	-9,229.61	9,236.58	3.68
15,280.00	89.91	269.88	6,525.75	-366.06	-9,323.61	9,330.43	1.56
15,375.00	89.51	270.73	6,526.23	-365.55	-9,418.60	9,425.30	0.99
15,469.00	90.96	272.06	6,525.85	-363.26	-9,512.57	9,519.04	2.09
15,564.00	90.43	271.72	6,524.69	-360.13	-9,607.51	9,613.73	0.66
15,659.00	89.78	273.04	6,524.52	-356.19	-9,702.43	9,708.34	1.55

Design Report for Wells Ranch BB01-615 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
15,753.00	90.68	272.21	6,524.14	-351.88	-9,796.32	9,801.93	1.30
15,848.00	90.22	271.73	6,523.40	-348.62	-9,891.26	9,896.60	0.70
15,943.00	89.32	270.30	6,523.78	-346.93	-9,986.25	9,991.39	1.78
16,037.00	91.54	270.57	6,523.07	-346.22	-10,080.23	10,085.24	2.38
16,132.00	90.55	268.85	6,521.34	-346.70	-10,175.21	10,180.13	2.09
16,227.00	89.78	268.80	6,521.07	-348.65	-10,270.19	10,275.09	0.81
16,326.00	89.38	269.10	6,521.79	-350.46	-10,369.17	10,374.05	0.51
Final Sperry MWD Survey at 16326.00ft							
16,386.00	89.38	269.10	6,522.44	-351.41	-10,429.16	10,434.01	0.00
Straight Line Projection to TD at 16386.00ft							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	+E/-W (usft)	Comment
84.00	84.00	-0.01	-0.11	First Sperry MWD Survey at 84.00ft
16,326.00	6,521.79	-350.46	-10,369.17	Final Sperry MWD Survey at 16326.00ft
16,386.00	6,522.44	-351.41	-10,429.16	Straight Line Projection to TD at 16386.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (usft)	+E/-W (usft)	Start TVD (usft)
Target	Wells Ranch BB01-615_Rev A2_BHL	267.25	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
84.00	7,025.00	Intermediate Sperry MWD Surveys	MWD
7,119.00	16,386.00	Production Sperry MWD Surveys	MWD+IFR1+MS_WY

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,947.00	1,946.87	9 5/8"	9-5/8	13-3/4

Design Report for Wells Ranch BB01-615 - Actual Surveys

Wellbore Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Wells Ranch BB01-615 - actual wellpath misses target center by 110.69usft at 7400.38usft MD (6509.99 TVD, -298.95 N, -1448.90 E) - Point	0.00	0.00	6,486.51	-406.92	-1,442.24	1,398,713.36	3,317,261.14	40.422274	-104.360458
Wells Ranch BB01-615 - actual wellpath misses target center by 152.50usft at 16374.85usft MD (6522.32 TVD, -351.23 N, -10418.01 E) - Point	0.00	0.00	6,490.00	-500.25	-10,416.02	1,398,620.03	3,308,287.71	40.422330	-104.392690
Wells Ranch BB01-615 - actual wellpath misses target center by 152.50usft at 16374.85usft MD (6522.32 TVD, -351.23 N, -10418.01 E) - Point	0.00	0.00	6,490.00	-500.25	-10,416.02	1,398,620.03	3,308,287.71	40.422330	-104.392690
Wells Ranch BB01-615 - actual wellpath misses target center by 152.50usft at 16374.85usft MD (6522.32 TVD, -351.23 N, -10418.01 E) - Point	0.00	0.00	6,490.00	-500.25	-10,416.02	1,398,620.03	3,308,287.71	40.422330	-104.392690

Directional Difficulty Index

Average Dogleg over Survey:	1.46 °/100usft	Maximum Dogleg over Survey:	6.36 °/100usft at 12,537.00 usft
Net Tortosity applicable to Plans:	0.86 °/100usft	Directional Difficulty Index:	6.802

Audit Info

**North Reference Sheet for Sec. 5-T5N-R62W (Wells Ranch BB01) - Wells Ranch
BB01-615 - Plan A**

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

Vertical Depths are relative to KB = 24' @ 4686.00usft (H&P 343). Northing and Easting are relative to Wells Ranch BB01-615

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: 3,000,000.00usft, False Northing: 1,000,000.00usft, Scale Reduction: 0.99996137

Grid Coordinates of Well: 1,399,120.26 usft N, 3,318,703.33 usft E

Geographical Coordinates of Well: 40° 25' 24.02" N, 104° 21' 18.94" W

Grid Convergence at Surface is: 0.74°

Based upon Minimum Curvature type calculations, at a Measured Depth of 16,386.00usft
the Bottom Hole Displacement is 10,435.08usft in the Direction of 268.07° (Grid).

Magnetic Convergence at surface is: -7.52° (7 February 2016, , BGGM2015)

