

# Noble Energy

Weld County, CO (NAD 83)

Sec. 32-T6N-R62W (Wells Ranch AE32)

Wells Ranch AE32-655

05-123-41730

Plan A

Design: Actual Surveys

## Sperry Drilling Services

### Final Survey Report

06 October, 2015

Surface UWI : 05-123-41730

Well Coordinates: 1,406,944.49 N, 3,318,863.96 E (40° 26' 41.32" N, 104° 21' 15.55" W)

Ground Level: 4,727.00 usft

Local Coordinate Origin:

Viewing Datum:

TVDs to System:

North Reference:

Unit System:

Geodetic Scale Factor Applied

Version: 5000.1 Build: 73

Centered on Well Wells Ranch AE32-655

KB = 30' @ 4757.00usft (H&P 321)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

**HALLIBURTON**

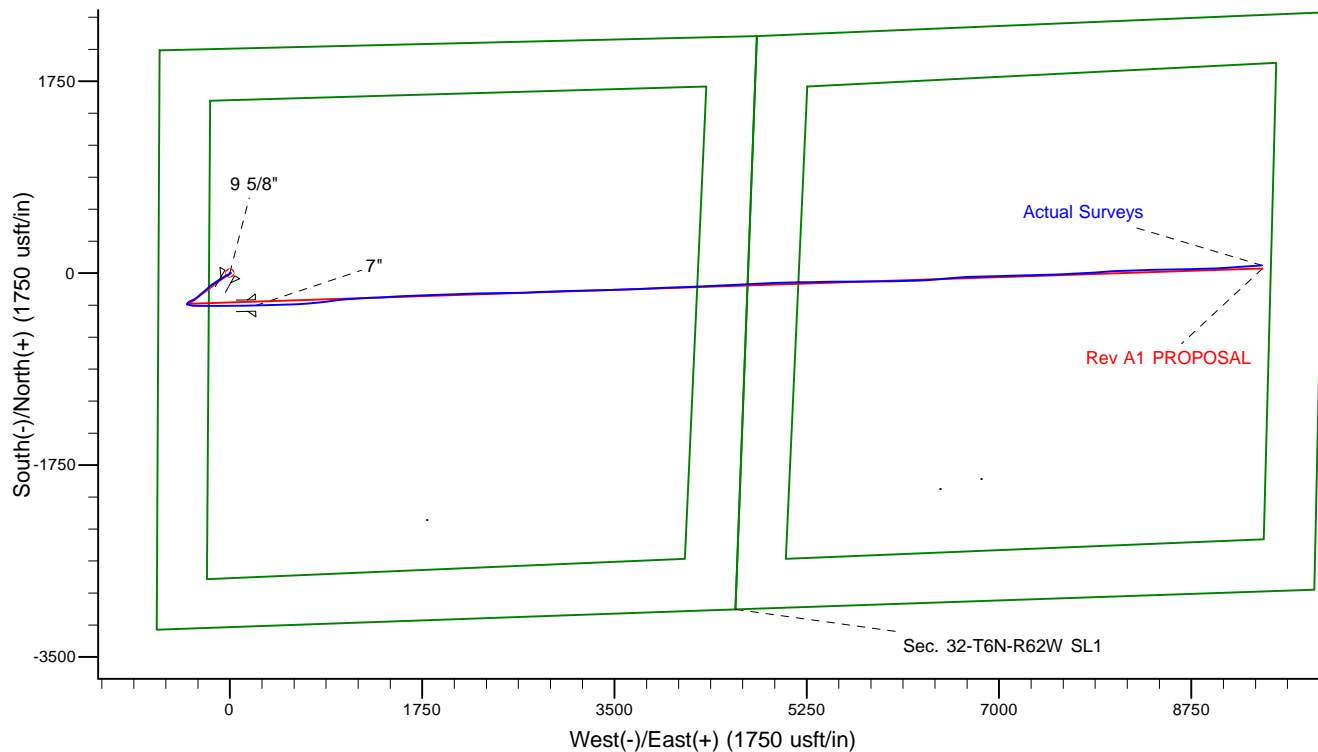
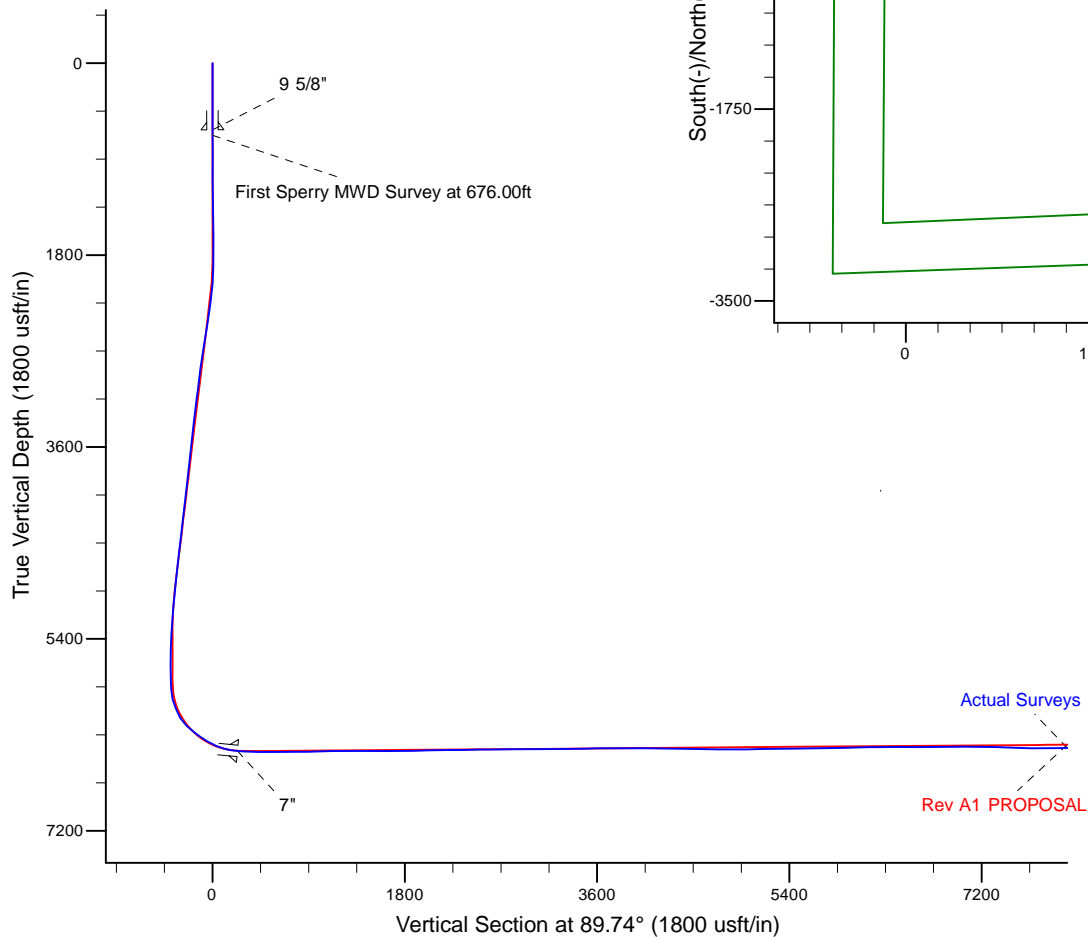
Project: Weld County, CO (NAD 83)  
 Site: Sec. 32-T6N-R62W (Wells Ranch AE32)  
 Well: Wells Ranch AE32-655  
 Wellbore: Plan A  
 Design: Actual Surveys



Platted SHL: 2047' FNL, 650' FWL  
 Platted Lat/Long: 40.444810, -104.354320  
 Location: Sec. 32-T6N-R62W

~7" Casing: 2352' FNL, 900' FWL  
 Lat/Long: 40.443992 N, -104.353492 W  
 State Planes - CO Northern: 1,406,649.48 N, 3,319,098.34 E  
 Sec. 32-T6N-R62W

Platted BHL: 2310' FNL, 535' FEL  
 Platted Lat/Long: 40.444656 N, -104.320807 W  
 State Planes - CO Northern: 1,407,010.56 N, 3,328,191.56 E  
 Location: Sec. 33-T6N-R62W



# LEGEND

- Wells Ranch AE32-655, Plan A, Rev A1 PROPOSAL V0
- Actual Surveys

WELL DETAILS: Wells Ranch AE32-655

Ground Level: 4727.00  
 KB = 30' @ 4757.00usft (H&P 321)

Created By: Tatiana Gomez  
 Created On: 10/6/2015

## Design Report for Wells Ranch AE32-655 - 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
626.00	0.17	29.95	626.00	0.79	0.45	0.46	0.03
<b>9 5/8"</b>							
676.00	0.18	29.95	676.00	0.92	0.53	0.53	0.03
<b>First Sperry MWD Survey at 676.00ft</b>							
825.00	0.15	53.88	825.00	1.24	0.80	0.81	0.05
917.00	0.24	39.39	917.00	1.46	1.02	1.03	0.11
1,010.00	0.46	43.77	1,010.00	1.88	1.41	1.41	0.24
1,104.00	0.51	60.36	1,103.99	2.36	2.03	2.04	0.16
1,209.00	0.61	68.70	1,208.99	2.79	2.96	2.97	0.12
1,303.00	0.63	62.93	1,302.98	3.21	3.88	3.90	0.07
1,396.00	0.66	61.04	1,395.98	3.70	4.81	4.82	0.04
1,488.00	0.75	82.92	1,487.97	4.03	5.87	5.89	0.31
1,580.00	0.69	83.72	1,579.96	4.17	7.02	7.04	0.07
1,673.00	0.61	80.80	1,672.96	4.31	8.06	8.08	0.09
1,766.00	0.46	111.46	1,765.95	4.25	8.90	8.92	0.34
1,859.00	1.55	228.08	1,858.94	3.27	8.31	8.32	1.94
1,951.00	2.89	227.11	1,950.87	0.86	5.68	5.69	1.46
2,044.00	5.12	228.33	2,043.64	-3.49	0.87	0.85	2.40
2,136.00	6.60	232.21	2,135.15	-9.46	-6.38	-6.42	1.66
2,230.00	7.88	245.20	2,228.41	-15.48	-16.50	-16.57	2.20
2,323.00	9.65	246.95	2,320.32	-21.20	-29.46	-29.56	1.92
2,415.00	10.19	239.50	2,410.95	-28.35	-43.57	-43.70	1.51
2,508.00	10.32	239.09	2,502.46	-36.81	-57.80	-57.97	0.16
2,600.00	10.23	238.44	2,592.99	-45.32	-71.83	-72.04	0.16
2,692.00	10.00	237.99	2,683.56	-53.83	-85.57	-85.81	0.26
2,787.00	9.75	237.12	2,777.15	-62.56	-99.32	-99.60	0.31
2,881.00	9.34	235.91	2,869.85	-71.16	-112.32	-112.64	0.49
2,976.00	9.06	236.19	2,963.63	-79.64	-124.92	-125.28	0.30
3,071.00	8.52	235.42	3,057.51	-87.80	-136.93	-137.33	0.58
3,165.00	8.11	238.06	3,150.52	-95.26	-148.29	-148.72	0.60
3,260.00	8.79	240.86	3,244.49	-102.34	-160.31	-160.78	0.84
3,355.00	8.55	232.79	3,338.41	-110.15	-172.28	-172.78	1.30
3,450.00	8.13	226.62	3,432.40	-119.03	-182.79	-183.33	1.04
3,639.00	8.02	227.25	3,619.53	-137.16	-202.18	-202.81	0.07
3,734.00	8.33	227.66	3,713.57	-146.29	-212.13	-212.80	0.33
3,828.00	8.70	227.60	3,806.53	-155.67	-222.42	-223.13	0.39
3,923.00	8.63	227.73	3,900.44	-165.31	-233.00	-233.75	0.08
4,018.00	8.99	231.43	3,994.32	-174.73	-244.07	-244.87	0.71
4,112.00	8.46	232.36	4,087.24	-183.53	-255.29	-256.13	0.58
4,207.00	7.60	230.42	4,181.30	-191.81	-265.67	-266.54	0.95
4,302.00	7.81	227.35	4,275.45	-200.18	-275.26	-276.17	0.49
4,491.00	9.23	233.54	4,462.36	-217.89	-296.89	-297.89	0.89
4,586.00	8.05	233.02	4,556.28	-226.42	-308.34	-309.37	1.24
4,680.00	7.83	233.01	4,649.38	-234.23	-318.71	-319.78	0.23
4,775.00	7.18	237.33	4,743.57	-241.33	-328.87	-329.98	0.91
4,870.00	6.86	248.01	4,837.86	-246.66	-339.13	-340.26	1.41
4,964.00	6.61	249.89	4,931.21	-250.62	-349.42	-350.56	0.35
5,154.00	5.94	242.74	5,120.07	-258.88	-368.43	-369.61	0.54
5,343.00	3.90	218.10	5,308.39	-268.42	-381.09	-382.32	1.53

## Design Report for Wells Ranch AE32-655 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,533.00	3.10	217.31	5,498.03	-277.59	-388.19	-389.46	0.42
5,627.00	1.79	219.51	5,591.94	-280.75	-390.67	-391.95	1.40
5,722.00	1.30	213.74	5,686.91	-282.79	-392.21	-393.50	0.54
5,911.00	4.34	108.64	5,875.73	-286.86	-386.62	-387.93	2.56
6,006.00	14.58	103.79	5,969.31	-290.87	-371.56	-372.89	10.80
6,101.00	22.98	98.55	6,059.18	-296.49	-341.55	-342.91	9.01
6,195.00	31.54	89.95	6,142.69	-299.20	-298.73	-300.10	10.00
6,290.00	46.47	90.30	6,216.31	-299.36	-239.10	-240.47	15.72
6,337.00	49.42	90.12	6,247.79	-299.49	-204.21	-205.58	6.28
6,385.00	53.07	90.09	6,277.83	-299.56	-166.79	-168.16	7.60
6,432.00	54.01	89.77	6,305.76	-299.51	-128.99	-130.36	2.07
6,479.00	55.10	90.46	6,333.02	-299.59	-90.70	-92.07	2.61
6,526.00	59.29	89.16	6,358.47	-299.45	-51.20	-52.57	9.21
6,574.00	62.66	88.65	6,381.76	-298.64	-9.25	-10.61	7.08
6,621.00	66.35	88.64	6,401.99	-297.64	33.16	31.79	7.85
6,669.00	71.31	88.90	6,419.32	-296.68	77.90	76.53	10.35
6,716.00	75.14	90.11	6,432.88	-296.29	122.88	121.52	8.51
6,784.00	83.42	89.10	6,445.52	-295.83	189.64	188.28	12.26
6,829.00	84.62	88.82	6,450.20	-295.02	234.38	233.03	2.74
7"							
7,013.00	89.54	87.70	6,459.57	-289.44	418.00	416.67	2.74
7,107.00	89.88	88.07	6,460.05	-285.97	511.94	510.62	0.53
7,202.00	90.49	87.77	6,459.74	-282.52	606.87	605.57	0.72
7,296.00	90.25	85.79	6,459.13	-277.24	700.72	699.44	2.12
7,391.00	90.43	84.20	6,458.57	-268.95	795.35	794.11	1.68
7,485.00	90.71	82.45	6,457.63	-258.03	888.70	887.51	1.89
7,579.00	91.88	83.80	6,455.51	-246.78	982.00	980.86	1.90
7,673.00	92.50	85.50	6,451.92	-238.02	1,075.52	1,074.42	1.92
7,767.00	91.48	86.46	6,448.65	-231.44	1,169.23	1,168.16	1.49
7,861.00	89.01	87.11	6,448.25	-226.17	1,263.07	1,262.02	2.72
7,956.00	88.95	87.02	6,449.94	-221.30	1,357.93	1,356.90	0.11
8,050.00	88.98	86.83	6,451.64	-216.26	1,451.78	1,450.78	0.20
8,145.00	89.88	87.69	6,452.58	-211.72	1,546.67	1,545.68	1.31
8,333.00	91.14	87.53	6,450.91	-203.88	1,734.49	1,733.54	0.68
8,427.00	91.14	87.17	6,449.04	-199.53	1,828.37	1,827.44	0.38
8,521.00	90.65	87.24	6,447.57	-194.95	1,922.25	1,921.34	0.53
8,616.00	91.11	88.52	6,446.11	-191.44	2,017.17	2,016.27	1.43
8,710.00	91.05	88.94	6,444.34	-189.35	2,111.13	2,110.24	0.45
8,803.00	91.11	88.78	6,442.59	-187.50	2,204.10	2,203.21	0.18
8,898.00	90.92	88.86	6,440.91	-185.55	2,299.06	2,298.19	0.22
8,993.00	90.65	88.55	6,439.60	-183.40	2,394.03	2,393.16	0.43
9,088.00	90.71	88.93	6,438.48	-181.31	2,489.00	2,488.14	0.40
9,182.00	90.58	88.69	6,437.42	-179.36	2,582.97	2,582.12	0.29
9,277.00	90.74	89.29	6,436.33	-177.69	2,677.95	2,677.11	0.65
9,372.00	90.37	87.50	6,435.40	-175.03	2,772.90	2,772.07	1.92
9,467.00	90.52	86.95	6,434.67	-170.43	2,867.79	2,866.98	0.60
9,561.00	90.49	87.56	6,433.84	-165.93	2,961.68	2,960.89	0.65
9,656.00	90.25	87.68	6,433.22	-161.98	3,056.59	3,055.82	0.28
9,750.00	90.49	89.74	6,432.62	-159.86	3,150.56	3,149.80	2.21
9,845.00	89.54	88.70	6,432.59	-158.57	3,245.55	3,244.79	1.48
9,938.00	90.80	88.63	6,432.32	-156.40	3,338.52	3,337.77	1.36

## Design Report for Wells Ranch AE32-655 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
10,125.00	91.88	88.48	6,427.94	-151.69	3,525.41	3,524.68	0.58
10,217.00	90.46	87.90	6,426.07	-148.78	3,617.34	3,616.62	1.67
10,309.00	89.69	87.41	6,425.95	-145.02	3,709.26	3,708.56	0.99
10,402.00	89.94	87.18	6,426.25	-140.63	3,802.16	3,801.48	0.37
10,495.00	89.75	87.17	6,426.50	-136.05	3,895.05	3,894.38	0.20
10,588.00	89.78	87.66	6,426.88	-131.85	3,987.95	3,987.30	0.53
10,681.00	91.36	88.68	6,425.95	-128.88	4,080.89	4,080.26	2.02
10,773.00	88.92	87.43	6,425.73	-125.76	4,172.83	4,172.21	2.98
10,959.00	89.23	87.33	6,428.73	-117.26	4,358.61	4,358.03	0.18
11,052.00	88.77	87.26	6,430.35	-112.87	4,451.50	4,450.93	0.50
11,144.00	88.06	87.34	6,432.90	-108.54	4,543.36	4,542.81	0.78
11,237.00	88.77	87.10	6,435.47	-104.03	4,636.21	4,635.69	0.81
11,329.00	89.97	87.45	6,436.48	-99.66	4,728.10	4,727.59	1.36
11,516.00	89.78	87.81	6,436.89	-91.92	4,914.94	4,914.47	0.22
11,611.00	91.17	87.43	6,436.10	-87.98	5,009.85	5,009.40	1.52
11,705.00	92.56	87.83	6,433.04	-84.09	5,103.72	5,103.28	1.54
11,800.00	90.83	89.64	6,430.23	-82.00	5,198.65	5,198.22	2.63
11,894.00	90.34	89.37	6,429.27	-81.19	5,292.64	5,292.21	0.60
11,989.00	90.06	89.14	6,428.94	-79.95	5,387.63	5,387.21	0.38
12,084.00	89.60	88.97	6,429.22	-78.39	5,482.62	5,482.20	0.52
12,179.00	90.92	89.85	6,428.79	-77.41	5,577.61	5,577.19	1.67
12,273.00	91.42	89.93	6,426.87	-77.23	5,671.59	5,671.17	0.54
12,368.00	92.19	90.09	6,423.88	-77.24	5,766.54	5,766.12	0.83
12,462.00	90.74	88.98	6,421.48	-76.48	5,860.50	5,860.09	1.94
12,557.00	91.20	89.13	6,419.87	-74.91	5,955.47	5,955.07	0.51
12,651.00	92.10	89.21	6,417.16	-73.55	6,049.42	6,049.02	0.96
12,746.00	90.40	88.86	6,415.09	-71.95	6,144.38	6,143.99	1.83
12,840.00	90.52	87.84	6,414.34	-69.25	6,238.34	6,237.96	1.09
12,935.00	90.43	86.43	6,413.55	-64.50	6,333.22	6,332.85	1.49
13,030.00	90.52	85.38	6,412.76	-57.71	6,427.97	6,427.64	1.11
13,124.00	89.14	84.40	6,413.04	-49.34	6,521.59	6,521.30	1.80
13,219.00	89.17	86.13	6,414.44	-41.50	6,616.25	6,615.99	1.82
13,314.00	89.85	86.39	6,415.25	-35.31	6,711.05	6,710.82	0.77
13,503.00	91.85	88.65	6,412.45	-27.13	6,899.83	6,899.63	1.60
13,598.00	90.89	90.23	6,410.18	-26.20	6,994.79	6,994.60	1.95
13,692.00	89.11	89.63	6,410.18	-26.09	7,088.79	7,088.59	2.00
14,072.00	88.09	86.99	6,419.46	-14.88	7,468.47	7,468.32	0.74
14,166.00	88.24	86.79	6,422.47	-9.79	7,562.28	7,562.16	0.27
14,261.00	88.34	86.78	6,425.31	-4.46	7,657.09	7,656.99	0.11
14,545.00	92.03	86.48	6,424.39	12.23	7,940.55	7,940.52	1.30
14,640.00	91.88	87.59	6,421.15	17.14	8,035.37	8,035.36	1.18
14,735.00	92.10	87.30	6,417.85	21.37	8,130.21	8,130.23	0.38
14,829.00	91.23	88.48	6,415.12	24.83	8,224.11	8,224.14	1.56
14,924.00	90.59	88.26	6,413.61	27.53	8,319.06	8,319.10	0.71
15,113.00	88.06	88.89	6,415.84	32.23	8,507.97	8,508.03	1.38
15,303.00	88.18	88.77	6,422.07	36.11	8,697.83	8,697.90	0.09
15,398.00	89.63	88.35	6,423.89	38.50	8,792.78	8,792.86	1.59
15,492.00	90.89	88.69	6,423.46	40.93	8,886.74	8,886.84	1.39
15,587.00	88.86	86.69	6,423.67	44.75	8,981.66	8,981.77	3.00
15,681.00	89.08	86.73	6,425.36	50.15	9,075.49	9,075.62	0.24
15,776.00	89.08	86.54	6,426.88	55.72	9,170.31	9,170.47	0.20

## Design Report for Wells Ranch AE32-655 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
15,869.00	89.04	86.17	6,428.41	61.64	9,263.11	9,263.29	0.40
15,934.00	89.08	85.99	6,429.48	66.08	9,327.95	9,328.15	0.28
<b>Final Sperry MWD Survey at 15934.00ft</b>							
16,000.00	89.08	85.99	6,430.53	70.69	9,393.78	9,394.00	0.00
<b>Straight Line Projection to TD at 16000.00ft - Wells Ranch AE32-655_Rev A0_BHL - Wells Ranch AE32-655_Rev A1_BHL</b>							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
676.00	676.00	0.92	0.53	First Sperry MWD Survey at 676.00ft
15,934.00	6,429.48	66.08	9,327.95	Final Sperry MWD Survey at 15934.00ft
16,000.00	6,430.53	70.69	9,393.78	Straight Line Projection to TD at 16000.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (usft)	Origin +E/-W (usft)	Start TVD (usft)
Target	Wells Ranch AE32-655_Rev A1_BHL	89.74	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
676.00	6,788.00	Intermediate Survey	MWD
6,973.00	16,000.00	Production Surveys	MWD+IFR1+MS_WY

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
626.00		9 5/8"	9-5/8	13-3/4
6,829.00	6,449.49	7"	7	8-3/4

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 AE32-655_Rev A1_BHL - actual wellpath misses target center by 0.02usft at 0.00usft MD (0.00 TVD, 0.00 N, 0.00 E) - Point	0.00	0.00	0.00	0.02	0.00	1,406,944.51	3,318,863.96	40.444810	-104.354320
Wells Ranch AE32-655_Rev A1_BHL - actual wellpath misses target center by 56.80usft at 16000.00usft MD (6430.53 TVD, 70.69 N, 9393.78 E) - Point	0.00	0.00	6,381.00	43.07	9,396.90	1,406,987.55	3,328,260.52	40.444590	-104.320560
Wells Ranch AE32-655_Rev A1_BHL - actual wellpath misses target center by 56.80usft at 16000.00usft MD (6430.53 TVD, 70.69 N, 9393.78 E) - Point	0.00	0.00	6,381.00	43.07	9,396.90	1,406,987.55	3,328,260.52	40.444590	-104.320560

**Design Report for Wells Ranch AE32-655 - Actual Surveys**

**Directional Difficulty Index**

Average Dogleg over Survey:	1.37 °/100usft	Maximum Dogleg over Survey:	15.72 °/100usft at 6,290.00 usft
Net Tortosity applicable to Plans:	0.69 °/100usft	Directional Difficulty Index:	6.747

**Audit Info**