

Noble Energy

Weld County, CO (NAD 83)

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

Wells Ranch AE32-685

05-123-41731

Plan A

Design: Actual Surveys

Sperry Drilling Services

Final Survey Report

20 October, 2015

Surface UWI : 05-123-41731

Well Coordinates: 1,408,416.47 N, 3,318,870.00 E (40° 26' 55.86" N, 104° 21' 15.23" W)

Ground Level: 4,748.00 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 AE32-685

KB = 24' @ 4772.00usft (H&P 343)

N

Grid

Dec-Deg - API - US Survey Feet - Custom

HALLIBURTON

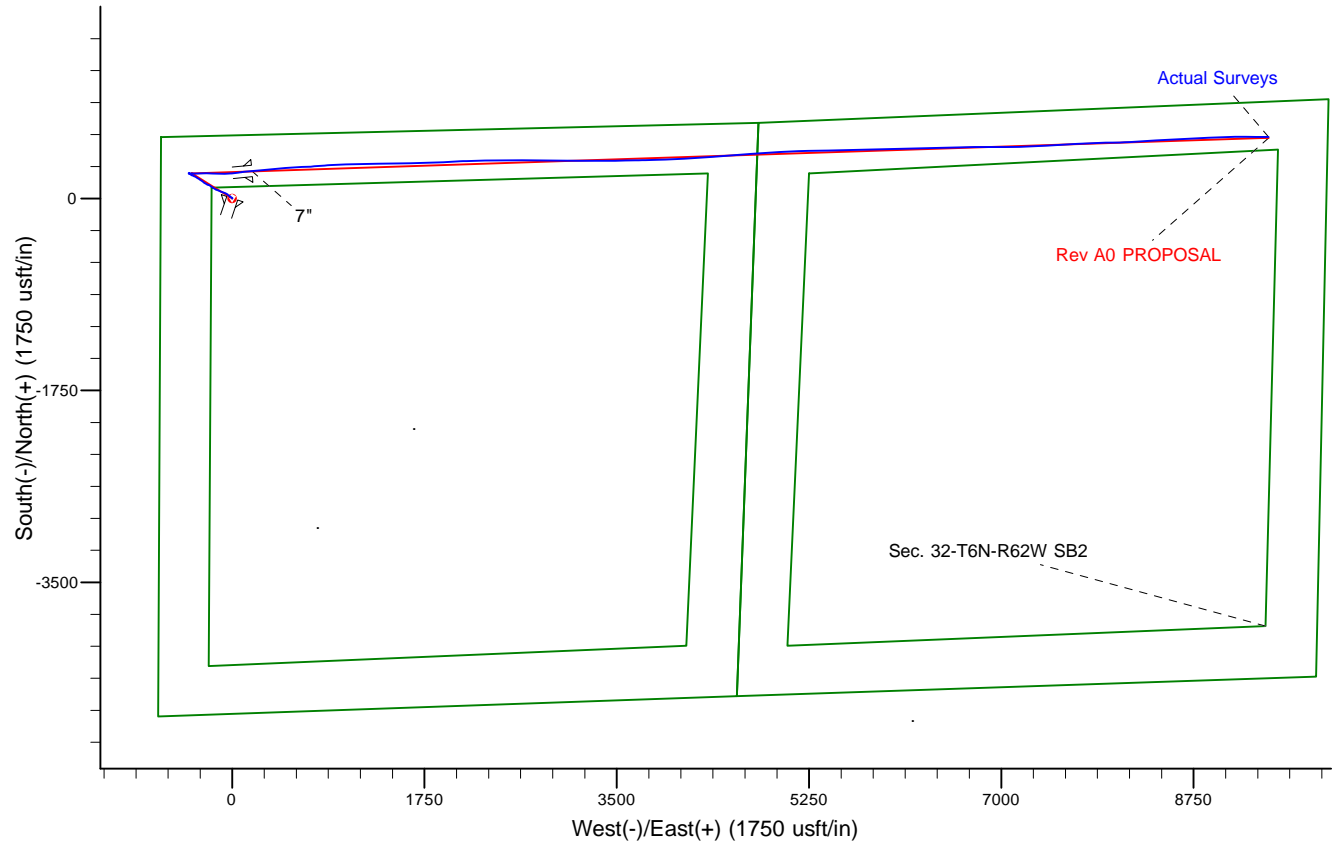
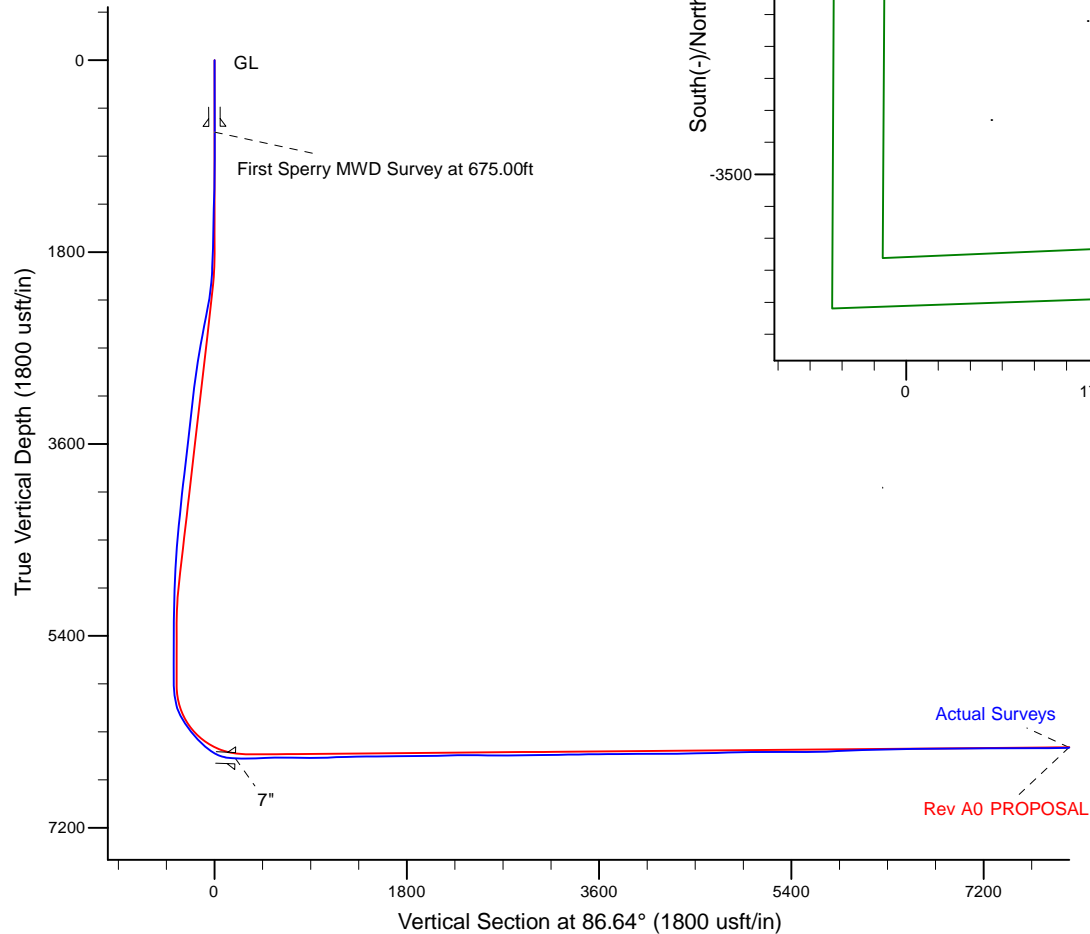
Project: Weld County, CO (NAD 83)
 Site: Sec. 32-T6N-R62W (Wells Ranch AE32)
 Well: Wells Ranch AE32-685
 Wellbore: Plan A
 Design: Actual Surveys



Platted SHL: 576' FNL, 650' FWL
 Platted Lat/Long: 40.44885, -104.35423
 Location: Sec. 32-T6N-R62W

~7" Casing: 325' FNL, 829 FWL
 Lat/Long: 40.449529 N, -104.353572 W
 State Planes - CO Northern: 1,408,666.10 N, 3,319,049.89 E
 Sec. 32-T6N-R62W

Platted BHL: 330' FNL, 535' FEL
 Platted Lat/Long: 40.450057, -104.320556
 State Planes - CO Northern: 1,408,978.83 N, 3,328,235.10 E
 Location: Sec. 33-T6N-R62W



LEGEND

- Wells Ranch AE32-685, Plan A, Rev A0 PROPOSAL V0
- Actual Surveys

WELL DETAILS: Wells Ranch AE32-685

Ground Level: 4748.00

KB = 24' @ 4772.00usft (H&P 343)

Created By: Tatiana Gomez
 Created On: 10/20/2015

Design Report for Wells Ranch AE32-685 - 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
620.00	0.37	18.71	620.00	1.88	0.64	0.75	0.06
9 5/8"							
675.00	0.40	18.71	674.99	2.23	0.76	0.89	0.06
First Sperry MWD Survey at 675.00ft							
739.00	0.49	30.71	738.99	2.68	0.97	1.12	0.20
833.00	0.25	7.29	832.99	3.23	1.20	1.39	0.30
928.00	0.39	345.32	927.99	3.75	1.14	1.36	0.19
1,207.00	1.62	302.47	1,206.94	6.78	-2.43	-2.02	0.49
1,299.00	1.71	296.82	1,298.90	8.10	-4.75	-4.26	0.20
1,484.00	1.64	305.19	1,483.83	10.87	-9.37	-8.72	0.14
1,576.00	1.73	302.19	1,575.79	12.37	-11.63	-10.88	0.14
1,763.00	1.68	300.21	1,762.70	15.25	-16.38	-15.46	0.04
1,854.00	1.83	298.01	1,853.66	16.61	-18.82	-17.81	0.18
1,947.00	3.69	316.43	1,946.55	19.47	-22.19	-21.01	2.19
2,040.00	5.82	308.39	2,039.23	24.57	-27.95	-26.46	2.39
2,133.00	8.40	308.98	2,131.50	31.77	-36.93	-35.00	2.78
2,224.00	11.25	305.06	2,221.16	41.05	-49.37	-46.88	3.22
2,317.00	12.19	292.00	2,312.24	49.94	-65.90	-62.86	3.02
2,409.00	11.62	290.67	2,402.26	56.85	-83.57	-80.10	0.69
2,502.00	11.51	290.34	2,493.37	63.38	-101.04	-97.15	0.14
2,595.00	11.42	290.69	2,584.51	69.86	-118.35	-114.05	0.12
2,688.00	11.38	290.57	2,675.68	76.34	-135.55	-130.85	0.05
2,780.00	11.30	300.98	2,765.89	84.17	-151.78	-146.59	2.22
2,872.00	10.59	302.16	2,856.22	93.31	-166.66	-160.91	0.81
2,966.00	9.21	302.11	2,948.82	101.91	-180.35	-174.07	1.47
3,061.00	9.37	302.93	3,042.57	110.15	-193.28	-186.49	0.22
3,155.00	9.13	305.47	3,135.35	118.64	-205.78	-198.47	0.50
3,250.00	7.61	282.88	3,229.36	124.42	-218.05	-210.39	3.78
3,344.00	6.58	301.49	3,322.65	128.62	-228.71	-220.78	2.66
3,439.00	6.34	299.18	3,417.05	134.02	-237.93	-229.67	0.37
3,534.00	7.69	300.23	3,511.33	139.77	-248.01	-239.39	1.43
3,628.00	8.39	307.48	3,604.41	147.11	-258.88	-249.82	1.31
3,723.00	8.59	305.76	3,698.37	155.48	-270.14	-260.57	0.34
3,817.00	8.96	305.58	3,791.27	163.84	-281.79	-271.71	0.39
3,912.00	8.86	304.49	3,885.12	172.29	-293.84	-283.24	0.21
4,007.00	8.35	302.79	3,979.05	180.17	-305.67	-294.58	0.60
4,101.00	7.88	302.35	4,072.11	187.31	-316.85	-305.33	0.50
4,196.00	6.95	299.39	4,166.32	193.61	-327.36	-315.45	1.06
4,290.00	6.43	297.65	4,259.68	198.85	-336.97	-324.75	0.59
4,385.00	6.19	296.99	4,354.10	203.64	-346.25	-333.72	0.26
4,479.00	5.29	292.76	4,447.63	207.62	-354.76	-341.99	1.06
4,574.00	4.55	289.92	4,542.28	210.60	-362.34	-349.38	0.82
4,763.00	4.30	305.00	4,730.72	217.21	-375.20	-361.83	0.63
4,858.00	3.75	302.62	4,825.49	220.93	-380.73	-367.13	0.60
4,952.00	4.17	293.89	4,919.26	223.97	-386.44	-372.66	0.78
5,047.00	1.65	285.50	5,014.13	225.74	-390.92	-377.02	2.68
5,141.00	1.86	259.81	5,108.09	225.83	-393.73	-379.82	0.86
5,236.00	0.49	16.72	5,203.08	225.95	-395.13	-381.21	2.24
5,330.00	0.80	47.19	5,297.07	226.78	-394.53	-380.57	0.48

Design Report for Wells Ranch AE32-685 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
5,425.00	0.64	22.12	5,392.06	227.72	-393.84	-379.83	0.37
5,520.00	0.87	0.02	5,487.05	228.93	-393.64	-379.55	0.39
5,614.00	0.99	346.61	5,581.04	230.44	-393.83	-379.65	0.26
5,709.00	0.81	319.60	5,676.03	231.75	-394.46	-380.20	0.48
5,803.00	0.33	297.33	5,770.03	232.38	-395.13	-380.83	0.55
5,898.00	0.17	114.91	5,865.03	232.44	-395.24	-380.95	0.53
5,993.00	8.58	98.73	5,959.66	231.30	-388.10	-373.88	8.86
6,087.00	13.67	98.13	6,051.87	228.67	-370.16	-356.13	5.42
6,182.00	26.22	89.37	6,141.01	227.31	-337.93	-324.03	13.54
6,276.00	34.85	85.86	6,221.90	229.48	-290.28	-276.34	9.37
6,371.00	39.94	91.46	6,297.37	230.66	-232.67	-218.76	6.44
6,465.00	43.54	92.64	6,367.50	228.40	-170.14	-156.47	3.92
6,560.00	47.09	91.57	6,434.30	225.94	-102.66	-89.24	3.82
6,654.00	57.22	85.78	6,491.93	227.91	-28.60	-15.20	11.82
6,749.00	73.51	82.13	6,531.40	237.15	56.94	70.74	17.50
6,818.00	85.43	85.17	6,543.99	244.60	124.24	138.35	17.81
6,874.00	87.41	84.48	6,547.49	249.64	179.90	194.21	3.74
7"							
6,971.00	90.83	83.29	6,548.99	259.97	276.32	291.07	3.74
7,065.00	91.51	84.91	6,547.07	269.63	369.80	384.96	1.87
7,159.00	91.42	86.18	6,544.66	276.93	463.48	478.91	1.35
7,254.00	91.29	86.74	6,542.42	282.80	558.27	573.88	0.60
7,349.00	90.49	87.42	6,540.94	287.64	653.14	668.86	1.11
7,443.00	88.46	85.55	6,541.80	293.40	746.95	762.85	2.94
7,538.00	88.77	85.09	6,544.10	301.15	841.60	857.80	0.58
7,632.00	91.48	87.17	6,543.89	307.49	935.37	951.78	3.63
7,821.00	92.34	88.45	6,537.59	314.71	1,124.12	1,140.63	0.82
7,915.00	91.20	89.44	6,534.69	316.44	1,218.06	1,234.51	1.61
8,010.00	91.66	89.62	6,532.32	317.22	1,313.03	1,329.36	0.52
8,104.00	90.43	89.79	6,530.60	317.70	1,407.01	1,423.20	1.32
8,199.00	90.15	88.39	6,530.12	319.21	1,501.99	1,518.11	1.50
8,293.00	90.34	87.80	6,529.72	322.34	1,595.94	1,612.08	0.66
8,388.00	90.68	89.03	6,528.88	324.96	1,690.90	1,707.03	1.34
8,483.00	90.52	88.56	6,527.88	326.96	1,785.87	1,801.96	0.52
8,577.00	91.08	88.50	6,526.57	329.37	1,879.83	1,895.90	0.60
8,672.00	90.46	86.71	6,525.29	333.34	1,974.73	1,990.87	1.99
8,767.00	90.83	86.53	6,524.22	338.94	2,069.56	2,085.87	0.43
8,861.00	91.32	88.67	6,522.46	342.88	2,163.46	2,179.83	2.34
8,956.00	91.88	88.57	6,519.81	345.16	2,258.39	2,274.74	0.60
9,051.00	89.54	89.78	6,518.63	346.53	2,353.37	2,369.63	2.77
9,145.00	89.75	89.68	6,519.21	346.98	2,447.36	2,463.49	0.25
9,239.00	88.98	89.13	6,520.25	347.95	2,541.35	2,557.37	1.01
9,334.00	90.12	90.27	6,521.00	348.45	2,636.35	2,652.23	1.70
9,428.00	90.43	90.25	6,520.55	348.02	2,730.34	2,746.04	0.33
9,523.00	90.28	89.78	6,519.96	348.00	2,825.34	2,840.88	0.52
9,617.00	90.19	90.01	6,519.57	348.17	2,919.34	2,934.72	0.26
9,712.00	90.00	90.93	6,519.42	347.39	3,014.34	3,029.51	0.99
9,807.00	91.79	91.60	6,517.93	345.29	3,109.30	3,124.19	2.01
9,901.00	91.32	90.27	6,515.38	343.76	3,203.25	3,217.88	1.50
9,996.00	91.88	89.83	6,512.73	343.68	3,298.21	3,312.68	0.75
10,091.00	90.18	89.33	6,511.02	344.37	3,393.19	3,407.53	1.87

Design Report for Wells Ranch AE32-685 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
10,184.00	90.71	89.52	6,510.30	345.31	3,486.18	3,500.42	0.61
10,276.00	90.18	88.78	6,509.58	346.67	3,578.17	3,592.33	0.99
10,368.00	91.05	89.51	6,508.60	348.04	3,670.15	3,684.24	1.23
10,459.00	90.18	87.35	6,507.62	350.54	3,761.10	3,775.18	2.56
10,552.00	90.15	88.35	6,507.35	354.03	3,854.04	3,868.16	1.08
10,644.00	90.03	88.07	6,507.21	356.90	3,945.99	3,960.12	0.33
10,738.00	91.57	87.85	6,505.90	360.25	4,039.92	4,054.09	1.65
10,831.00	90.03	86.99	6,504.60	364.43	4,132.81	4,147.06	1.90
10,922.00	89.57	85.75	6,504.91	370.19	4,223.63	4,238.06	1.45
11,015.00	90.28	86.16	6,505.04	376.75	4,316.39	4,331.05	0.88
11,108.00	91.60	86.40	6,503.51	382.79	4,409.18	4,424.04	1.44
11,201.00	91.48	85.55	6,501.01	389.31	4,501.92	4,517.00	0.92
11,292.00	90.58	85.18	6,499.38	396.66	4,592.61	4,607.96	1.07
11,385.00	91.33	85.14	6,497.83	404.51	4,685.26	4,700.91	0.81
11,477.00	91.69	85.92	6,495.40	411.68	4,776.95	4,792.86	0.93
11,570.00	92.10	85.75	6,492.33	418.43	4,869.65	4,885.80	0.48
11,663.00	92.28	87.72	6,488.77	423.72	4,962.43	4,978.73	2.13
11,756.00	89.75	87.51	6,487.12	427.59	5,055.33	5,071.69	2.73
11,848.00	89.35	88.19	6,487.85	431.04	5,147.26	5,163.67	0.86
11,940.00	89.54	88.74	6,488.74	433.51	5,239.22	5,255.62	0.63
12,035.00	90.28	88.71	6,488.89	435.62	5,334.20	5,350.56	0.78
12,129.00	89.69	88.42	6,488.91	437.97	5,428.17	5,444.50	0.70
12,224.00	91.14	88.64	6,488.22	440.41	5,523.13	5,539.44	1.54
12,318.00	90.15	88.08	6,487.17	443.10	5,617.08	5,633.40	1.21
12,413.00	92.62	88.81	6,484.87	445.68	5,712.01	5,728.31	2.71
12,508.00	92.93	88.96	6,480.27	447.52	5,806.88	5,823.13	0.36
12,602.00	92.06	89.34	6,476.18	448.92	5,900.78	5,916.95	1.01
12,697.00	92.12	88.45	6,472.71	450.75	5,995.70	6,011.81	0.94
12,791.00	91.97	88.45	6,469.36	453.29	6,089.61	6,105.70	0.16
12,886.00	91.26	89.18	6,466.68	455.25	6,184.55	6,200.60	1.07
12,981.00	90.89	88.16	6,464.90	457.46	6,279.50	6,295.52	1.14
13,075.00	91.14	87.26	6,463.23	461.21	6,373.41	6,389.49	0.99
13,170.00	91.11	89.79	6,461.37	463.66	6,468.36	6,484.41	2.66
13,265.00	90.43	88.51	6,460.09	465.07	6,563.33	6,579.31	1.53
13,359.00	91.67	88.92	6,458.37	467.17	6,657.29	6,673.23	1.39
13,454.00	91.63	89.13	6,455.63	468.79	6,752.24	6,768.11	0.22
13,549.00	89.51	90.31	6,454.69	469.25	6,847.23	6,862.96	2.55
13,643.00	90.15	90.07	6,454.97	468.94	6,941.22	6,956.78	0.73
13,738.00	89.81	89.28	6,455.00	469.48	7,036.22	7,051.64	0.91
13,832.00	90.12	89.15	6,455.06	470.77	7,130.21	7,145.55	0.36
13,927.00	89.11	87.88	6,455.70	473.23	7,225.18	7,240.49	1.71
14,022.00	90.37	86.69	6,456.13	477.73	7,320.07	7,335.48	1.82
14,117.00	90.40	86.08	6,455.49	483.72	7,414.87	7,430.48	0.64
14,211.00	90.52	87.70	6,454.74	488.82	7,508.73	7,524.47	1.73
14,305.00	90.59	87.84	6,453.82	492.48	7,602.65	7,618.45	0.17
14,400.00	90.77	86.41	6,452.70	497.24	7,697.52	7,713.43	1.52
14,495.00	90.52	86.30	6,451.63	503.28	7,792.33	7,808.43	0.29
14,590.00	91.23	89.05	6,450.18	507.13	7,887.23	7,903.39	2.99
14,684.00	90.22	88.18	6,448.99	509.41	7,981.19	7,997.33	1.42
14,779.00	91.33	88.84	6,447.70	511.88	8,076.15	8,092.26	1.36
14,874.00	90.86	87.64	6,445.89	514.79	8,171.08	8,187.21	1.36

Design Report for Wells Ranch AE32-685 - Actual Surveys

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)
14,968.00	90.80	85.72	6,444.53	520.24	8,264.91	8,281.19	2.04
15,063.00	91.23	86.96	6,442.84	526.30	8,359.70	8,376.18	1.38
15,158.00	89.63	85.01	6,442.13	532.95	8,454.46	8,471.16	2.66
15,252.00	91.39	88.24	6,441.29	538.48	8,548.27	8,565.14	3.91
15,443.00	91.79	87.29	6,435.99	545.93	8,739.05	8,756.03	0.54
15,538.00	92.07	86.47	6,432.79	551.10	8,833.86	8,850.97	0.91
15,636.00	92.31	87.64	6,429.05	556.13	8,931.65	8,948.89	1.22
15,733.00	90.58	87.34	6,426.60	560.37	9,028.53	9,045.85	1.81
15,831.00	90.77	88.95	6,425.45	563.55	9,126.47	9,143.81	1.65
15,928.00	89.69	90.83	6,425.06	563.73	9,223.46	9,240.64	2.24
16,024.00	90.22	90.38	6,425.13	562.72	9,319.45	9,336.41	0.72
16,070.00	90.71	90.46	6,424.76	562.38	9,365.45	9,382.31	1.08
Final Sperry MWD Survey at 16070.00ft							
16,137.00	90.71	90.46	6,423.93	561.84	9,432.44	9,449.16	0.00
Straight Line Projection to TD at 16137.00ft							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	+E/-W (usft)	Comment
675.00	674.99	2.23	0.76	First Sperry MWD Survey at 675.00ft
16,070.00	6,424.76	562.38	9,365.45	Final Sperry MWD Survey at 16070.00ft
16,137.00	6,423.93	561.84	9,432.44	Straight Line Projection to TD at 16137.00ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/-S (usft)	+E/-W (usft)	Start TVD (usft)
Target	Wells Ranch AE32-685_Rev A0_BHL	86.64	Slot	0.00	0.00	0.00

Survey tool program

From (usft)	To (usft)	Survey/Plan	Survey Tool
675.00	6,818.00	Intermediate Surveys	MWD
6,971.00	16,137.00	Production Surveys	MWD+IFR1+MS_WY

Casing Details

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
620.00		9 5/8"	9-5/8	13-3/4
6,874.00	6,547.49	7"	7	8-3/4

Design Report for Wells Ranch AE32-685 - 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 AE32-685 - 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	1,408,416.48	3,318,870.00	40.448850	-104.354230
Wells Ranch AE32-685 - actual wellpath misses target center by 11.61usft at 16137.00usft MD (6423.93 TVD, 561.84 N, 9432.44 E) - Point	0.00	0.00	6,432.00	553.65	9,434.08	1,408,970.10	3,328,303.73	40.450030	-104.320310

Directional Difficulty Index

Average Dogleg over Survey:	1.60 °/100usft	Maximum Dogleg over Survey:	17.81 °/100usft at 6,818.00 usft
Net Tortosity applicable to Plans:	0.94 °/100usft	Directional Difficulty Index:	6.817

Audit Info