Noble Energy

Weld County, CO (NAD 83)
Sec. 28-T6N-R66W (Feuerstein 28 PAD)
Feuerstein I28-63-1HN

Design: MWD Survey

Sperry Drilling Services

Final Survey Report

07 October, 2013

Well Coordinates: 1,410,004.28 N, 3,197,218.67 E (40° 27' 24.12" N, 104° 47' 28.61" W)
Ground Level: 4,724.00 ft

Local Coordinate Origin:	Centered on Well Feuerstein I28-63-1HN - Slot A1
Viewing Datum:	KB=16' @ 4740.00ft (Precision 829)
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 Feuerstein I28-63-1HN - MWD Survey

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
625.00	0.00	0.00	625.00	0.00	0.00	0.00	0.00
Surface Casing Assumed Vertical at 625.00ft							
697.00	0.39	76.61	697.00	0.06	0.24	0.23	0.54
First MWD Survey							
966.00	0.43	82.86	965.99	0.39	2.13	2.06	0.02
1,100.00	0.26	20.07	1,099.99	0.74	2.73	2.61	0.29
1,197.00	2.55	208.83	1,196.96	-0.94	1.77	1.88	2.89
1,291.00	4.84	214.90	1,290.76	-6.03	-1.51	-0.66	2.47
1,386.00	6.60	205.70	1,385.29	-14.23	-6.17	-4.15	2.08
1,481.00	8.60	204.58	1,479.45	-25.61	-11.49	-7.85	2.11
1,575.00	11.21	200.69	1,572.04	-40.56	-17.65	-11.89	2.86
1,669.00	12.69	192.03	1,664.01	-59.20	-23.03	-14.64	2.47
1,763.00	15.41	192.96	1,755.19	-81.48	-27.98	-16.48	2.90
1,857.00	16.38	190.85	1,845.59	-106.67	-33.28	-18.25	1.20
1,952.00	14.83	194.06	1,937.09	-131.62	-38.75	-20.23	1.87
2,046.00	14.50	201.41	2,028.03	-154.24	-45.97	-24.26	2.01
2,141.00	15.14	200.67	2,119.87	-176.92	-54.69	-29.77	0.70
2,235.00	15.51	200.45	2,210.53	-200.19	-63.42	-35.21	0.40
2,325.00	15.19	200.59	2,297.32	-222.50	-71.77	-40.40	0.36
2,414.00	15.21	198.92	2,383.21	-244.46	-79.65	-45.19	0.49
2,504.00	15.34	201.22	2,470.03	-266.72	-87.79	-50.17	0.69
2,593.00	15.78	200.59	2,555.77	-289.03	-96.31	-55.54	0.53
2,683.00	17.71	197.42	2,641.95	-313.55	-104.71	-60.48	2.37
2,773.00	16.93	198.94	2,727.87	-339.00	-113.06	-65.24	1.00
2,862.00	15.04	192.79	2,813.43	-362.52	-119.82	-68.69	2.85
2,952.00	15.11	192.38	2,900.33	-385.37	-124.92	-70.60	0.14
3,041.00	15.83	193.90	2,986.11	-408.48	-130.33	-72.76	0.93
3,131.00	14.93	196.30	3,072.88	-431.53	-136.53	-75.73	1.22
3,221.00	14.56	196.02	3,159.92	-453.53	-142.91	-79.01	0.42
3,310.00	15.90	198.99	3,245.79	-475.81	-149.96	-82.92	1.74
3,400.00	15.27	200.20	3,332.48	-498.59	-158.07	-87.81	0.79
3,489.00	13.64	200.02	3,418.66	-519.45	-165.71	-92.50	1.83
3,579.00	15.04	201.26	3,505.86	-540.31	-173.57	-97.42	1.59
3,669.00	15.79	196.64	3,592.62	-562.92	-181.31	-101.97	1.60
3,758.00	18.75	194.63	3,677.60	-588.37	-188.40	-105.47	3.39
3,848.00	18.03	194.71	3,763.00	-615.84	-195.59	-108.81	0.80
3,937.00	16.49	197.95	3,847.99	-641.18	-202.98	-112.63	2.04
4,027.00	12.99	206.91	3,935.03	-662.36	-211.50	-118.15	4.63
4,117.00	10.34	199.71	4,023.17	-678.99	-218.80	-123.09	3.35
4,206.00	9.01	203.57	4,110.90	-692.89	-224.28	-126.60	1.66
4,296.00	7.59	208.60	4,199.96	-704.57	-229.94	-130.60	1.77
4,385.00	5.16	206.09	4,288.40	-713.33	-234.52	-133.92	2.75
4,475.00	4.26	203.07	4,378.10	-720.04	-237.61	-136.06	1.04
4,565.00	3.74	198.32	4,467.88	-725.90	-239.84	-137.46	0.68
4,655.00	1.29	186.52	4,557.78	-729.69	-240.88	-137.97	2.77
4,744.00	0.59	358.34	4,646.78	-730.23	-241.01	-138.02	2.11
5,013.00	1.36	358.65	4,915.74	-725.66	-241.12	-138.76	0.29
5,282.00	0.74	223.55	5,184.71	-723.72	-242.39	-140.29	0.73
5,551.00	0.35	174.52	5,453.70	-725.80	-243.51	-141.11	0.21

Design Report for Feuerstein I28-63-1HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
5,820.00	1.05	279.64	5,722.69	-726.21	-245.86	-143.38	0.44
6,089.00	0.52	288.63	5,991.66	-725.40	-249.45	-147.05	0.20
6,268.00	0.88	109.91	6,170.66	-725.61	-248.93	-146.50	0.78
6,313.00	5.45	112.67	6,215.58	-726.55	-246.63	-144.09	10.16
6,358.00	10.48	106.33	6,260.13	-728.53	-240.73	-137.98	11.33
6,403.00	17.09	99.63	6,303.81	-730.79	-230.27	-127.31	15.09
6,448.00	22.68	92.64	6,346.12	-732.30	-215.07	-112.04	13.48
6,492.00	29.03	88.03	6,385.70	-732.32	-195.90	-93.06	15.13
6,537.00	32.53	87.41	6,424.35	-731.40	-172.90	-70.40	7.81
6,582.00	35.70	88.29	6,461.60	-730.46	-147.68	-45.55	7.13
6,627.00	37.96	90.83	6,497.62	-730.27	-120.71	-18.87	6.05
6,672.00	39.05	90.12	6,532.84	-730.50	-92.70	8.91	2.61
6,717.00	42.48	88.82	6,566.91	-730.21	-63.32	37.97	7.85
6,761.00	47.82	87.37	6,597.94	-729.16	-32.16	68.69	12.36
6,806.00	50.45	87.62	6,627.38	-727.67	1.84	102.15	5.86
6,851.00	52.78	88.23	6,655.32	-726.40	37.09	136.89	5.29
6,896.00	55.64	88.20	6,681.63	-725.26	73.57	172.86	6.36
6,941.00	57.00	89.13	6,706.58	-724.39	111.00	209.82	3.48
6,986.00	57.43	89.27	6,730.95	-723.86	148.83	247.22	0.99
7,030.00	58.39	88.73	6,754.33	-723.21	186.10	284.04	2.42
7,075.00	60.02	88.05	6,777.36	-722.12	224.74	322.16	3.85
7,120.00	60.79	87.70	6,799.59	-720.67	263.84	360.69	1.84
7,165.00	61.90	88.03	6,821.17	-719.20	303.30	399.57	2.55
7,210.00	65.30	88.10	6,841.17	-717.84	343.58	439.28	7.56
7,255.00	68.26	88.29	6,858.91	-716.54	384.91	480.03	6.59
7,299.00	70.62	88.62	6,874.36	-715.43	426.09	520.66	5.41
7,344.00	72.78	88.93	6,888.49	-714.52	468.80	562.84	4.84
7,389.00	73.45	89.32	6,901.56	-713.86	511.86	605.40	1.70
7,434.00	78.72	87.38	6,912.38	-712.59	555.50	648.45	12.44
7,479.00	82.13	87.62	6,919.87	-710.66	599.82	692.08	7.60
7,487.00	83.11	87.98	6,920.89	-710.36	607.75	699.89	13.04
7,528.00	84.37	87.32	6,925.37	-708.69	648.47	739.99	3.45
Estimated 7" Casing Point: 998' FSL, 955' FWL (Not a Survey Station)							
7,564.00	85.47	86.75	6,928.55	-706.83	684.28	775.20	3.45
7,654.00	86.76	86.94	6,934.65	-701.89	773.94	863.32	1.45
7,744.00	88.98	87.28	6,938.00	-697.36	863.75	951.66	2.50
7,833.00	89.08	86.94	6,939.50	-692.87	952.63	1,039.06	0.40
7,923.00	89.14	88.78	6,940.90	-689.51	1,042.55	1,127.66	2.05
8,013.00	91.47	88.43	6,940.42	-687.32	1,132.52	1,216.47	2.62
8,102.00	91.73	90.00	6,937.94	-686.10	1,221.47	1,304.40	1.79
8,237.00	90.86	89.03	6,934.89	-684.96	1,356.43	1,437.92	0.97
8,326.00	90.03	88.89	6,934.19	-683.34	1,445.41	1,525.82	0.95
8,416.00	89.57	90.95	6,934.51	-683.22	1,535.40	1,614.94	2.35
8,506.00	89.29	92.05	6,935.40	-685.57	1,625.37	1,704.37	1.26
8,595.00	88.58	91.39	6,937.06	-688.24	1,714.31	1,792.83	1.09
8,685.00	89.97	92.81	6,938.20	-691.54	1,804.24	1,882.36	2.21
8,775.00	88.83	91.21	6,939.14	-694.70	1,894.17	1,971.87	2.18
8,864.00	89.08	90.23	6,940.76	-695.81	1,983.15	2,060.15	1.14
8,954.00	88.58	89.01	6,942.60	-695.22	2,073.13	2,149.19	1.46
9,044.00	88.80	87.23	6,944.66	-692.27	2,163.05	2,237.84	1.99
9,133.00	89.23	86.98	6,946.19	-687.77	2,251.93	2,325.25	0.56

Design Report for Feuerstein I28-63-1HN - MWD Survey

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)
9,223.00	88.58	86.46	6,947.91	-682.62	2,341.76	2,413.52	0.92
9,313.00	88.21	85.29	6,950.43	-676.15	2,431.49	2,501.50	1.36
9,402.00	84.47	82.56	6,956.11	-666.76	2,519.79	2,587.65	5.20
9,492.00	85.03	83.14	6,964.35	-655.60	2,608.71	2,674.19	0.89
9,581.00	86.67	84.15	6,970.79	-645.78	2,696.93	2,760.21	2.16
9,671.00	88.86	85.48	6,974.30	-637.65	2,786.49	2,847.79	2.85
9,760.00	90.59	86.34	6,974.72	-631.31	2,875.25	2,934.84	2.17
9,850.00	90.22	87.77	6,974.09	-626.68	2,965.13	3,023.22	1.64
9,940.00	90.93	88.91	6,973.18	-624.08	3,055.09	3,111.95	1.49
10,030.00	91.35	88.16	6,971.39	-621.78	3,145.04	3,200.73	0.95
10,119.00	90.12	89.68	6,970.25	-620.10	3,234.01	3,288.62	2.20
10,254.00	91.51	90.06	6,968.33	-619.79	3,368.99	3,422.27	1.07
10,299.00	91.60	90.20	6,967.11	-619.90	3,413.98	3,466.84	0.37
10,388.00	89.72	89.45	6,966.09	-619.62	3,502.96	3,554.94	2.27
10,478.00	91.26	91.52	6,965.32	-620.38	3,592.95	3,644.17	2.87
10,568.00	90.59	89.02	6,963.86	-620.81	3,682.93	3,733.35	2.88
10,657.00	88.55	90.03	6,964.53	-620.07	3,771.92	3,821.39	2.56
10,702.00	87.22	87.99	6,966.19	-619.29	3,816.88	3,865.81	5.41
10,792.00	85.90	85.92	6,971.59	-614.52	3,906.58	3,954.00	2.72
10,881.00	88.12	85.56	6,976.23	-607.92	3,995.21	4,040.87	2.53
10,971.00	88.98	87.76	6,978.51	-602.68	4,085.02	4,129.10	2.62
11,061.00	88.00	88.56	6,980.88	-599.79	4,174.94	4,217.77	1.41
11,151.00	88.98	91.21	6,983.26	-599.61	4,264.90	4,306.84	3.14
11,224.00	89.14	87.55	6,984.45	-598.82	4,337.88	4,379.01	5.02
Final MWD Survey							
11,288.00	89.14	87.55	6,985.41	-596.09	4,401.81	4,441.96	0.00
Survey Projection to TD - Estimated BHL: 1014' FSL, 586' FEL							

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates +N/-S (ft)	Local Coordinates +E/-W (ft)	Comment
625.00	625.00	0.00	0.00	Surface Casing Assumed Vertical at 625.00ft
697.00	697.00	0.06	0.24	First MWD Survey
7,528.00	6,925.37	-708.69	648.47	Estimated 7" Casing Point: 998' FSL, 955' FWL (Not a Survey Station)
11,224.00	6,984.45	-598.82	4,337.88	Final MWD Survey
11,288.00	6,985.41	-596.09	4,401.81	Survey Projection to TD
11,288.00	6,985.41	-596.09	4,401.81	Estimated BHL: 1014' FSL, 586' FEL

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
Target	Feuerstein I28-63-1HN_PlanA - Rev0_BHL Tgt	97.93	Slot	0.00	0.00	0.00

Design Report for Feuerstein I28-63-1HN - MWD Survey

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
625.00	7,528.00	Sperry MWD Surveys	MWD
7,528.00	11,288.00	Sperry MWD Surveys	MWD

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
625.00	625.00	9 5/8" Csg	9-5/8	13-3/4
7,528.00	6,925.37	7" Csg	7	8-3/4

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
Feuerstein	0.00	0.00	0.00	0.00	0.00	1,410,004.28	3,197,218.67	40° 27' 24.120 N	104° 47' 28.608 W
- actual wellpath hits target center									
- Polygon									
Point 1				-761.00	-1,269.00	1,408,735.33	3,196,457.70		
Point 2				-5,166.00	-1,450.00	1,408,554.33	3,192,052.86		
Point 3				-5,202.00	2,920.00	1,412,924.17	3,192,016.86		
Point 4				-797.00	3,075.00	1,413,079.17	3,196,421.70		
Point 5				-761.00	-1,269.00	1,408,735.33	3,196,457.70		
Feuerstein	0.00	0.00	0.00	0.00	0.00	1,410,004.28	3,197,218.67	40° 27' 24.120 N	104° 47' 28.608 W
- actual wellpath hits target center									
- Polygon									
Point 1				-301.00	-1,729.00	1,408,275.34	3,196,917.68		
Point 2				-5,626.00	-1,910.00	1,408,094.35	3,191,592.88		
Point 3				-5,662.00	3,380.00	1,413,384.16	3,191,556.88		
Point 4				-337.00	3,535.00	1,413,539.15	3,196,881.68		
Point 5				-301.00	-1,729.00	1,408,275.34	3,196,917.68		
Feuerstein	0.00	0.00	0.00	0.00	0.00	1,410,004.28	3,197,218.67	40° 27' 24.120 N	104° 47' 28.608 W
- actual wellpath hits target center									
- Polygon									
Point 1				159.00	-1,269.00	1,408,735.33	3,197,377.67		
Point 2				123.00	3,075.00	1,413,079.17	3,197,341.67		
Point 3				4,497.00	3,223.00	1,413,227.16	3,201,715.51		
Point 4				4,532.00	-1,139.00	1,408,865.32	3,201,750.51		
Point 5				159.00	-1,269.00	1,408,735.33	3,197,377.67		
Feuerstein	0.00	0.00	0.00	0.00	0.00	1,410,004.28	3,197,218.67	40° 27' 24.120 N	104° 47' 28.608 W
- actual wellpath hits target center									
- Polygon									
Point 1				-301.00	-1,729.00	1,408,275.34	3,196,917.68		
Point 2				-337.00	3,535.00	1,413,539.15	3,196,881.68		
Point 3				4,957.00	3,683.00	1,413,687.15	3,202,175.49		
Point 4				4,992.00	-1,599.00	1,408,405.34	3,202,210.49		
Point 5				-301.00	-1,729.00	1,408,275.34	3,196,917.68		
Feuerstein	0.00	0.00	6,973.55	-619.80	4,452.25	1,409,384.50	3,201,670.76	40° 27' 17.640 N	104° 46' 31.080 W
- actual wellpath misses target center by 56.99ft at 11288.00ft MD (6985.41 TVD, -596.09 N, 4401.81 E)									
- Point									

North Reference Sheet for Sec. 28-T6N-R66W (Feuerstein 28 PAD) - Feuerstein I28-63-1HN

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

Vertical Depths are relative to KB=16' @ 4740.00ft (Precision 829). Northing and Easting are relative to Feuerstein I28-63-1HN - 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° 30' 0.000 W°, 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: 0.99996329

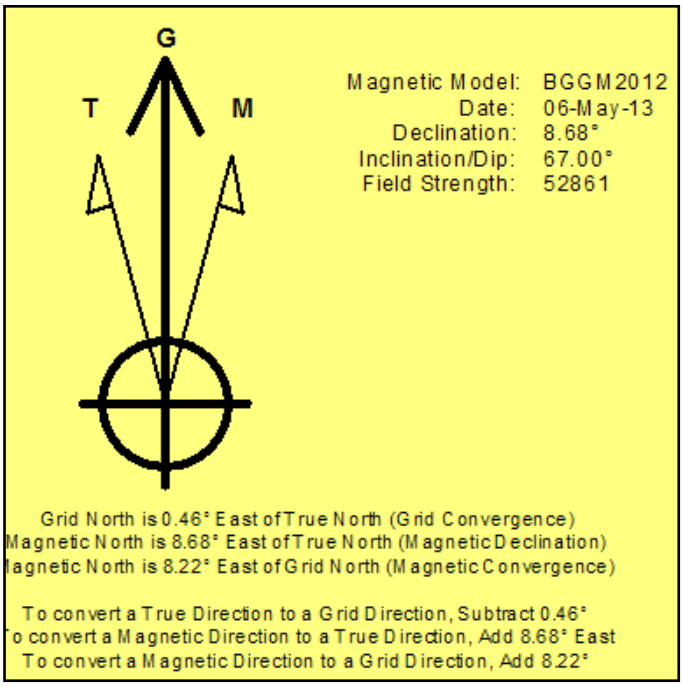
Grid Coordinates of Well: 1,410,004.28 ft N, 3,197,218.67 ft E

Geographical Coordinates of Well: 40° 27' 24.12" N, 104° 47' 28.61" W

Grid Convergence at Surface is: 0.46°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,288.00ft
the Bottom Hole Displacement is 4,441.99ft in the Direction of 97.71° (Grid).

Magnetic Convergence at surface is: -8.22° (6 May 2013, , BGGM2012)



Project: Weld County, CO (NAD 83)
Site: Sec. 28-T6N-R66W (Feuerstein 28 PAD)
Well: Feuerstein I28-63-1HN

Noble Energy

HALLIBURTON
Sperry Drilling

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Azimuths to Grid North
True North: -0.46°
Magnetic North: 8.22°

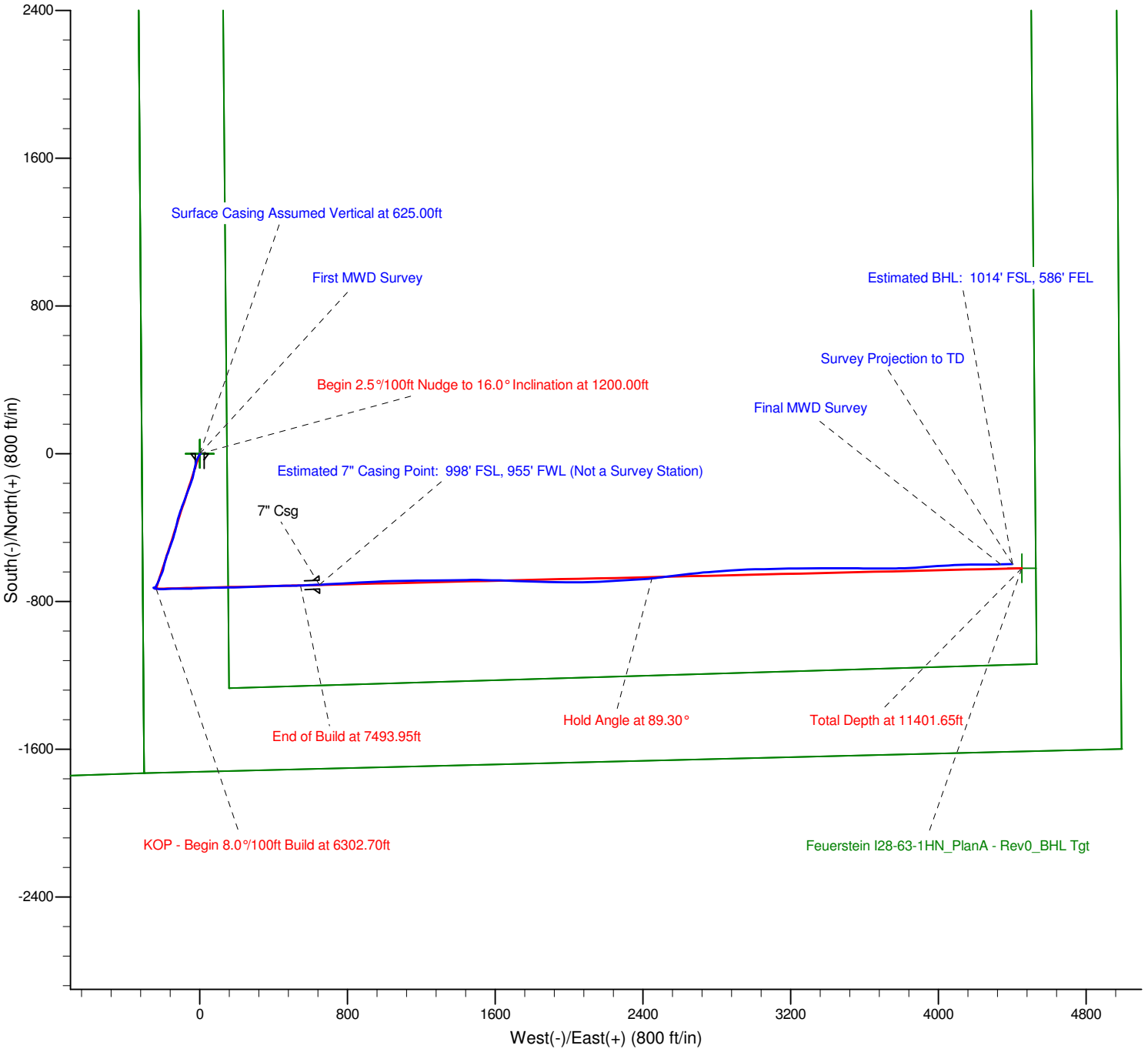
Magnetic Field
Strength: 52861.4snT
Dip Angle: 67.00°
Date: 5/6/2013
Model: BGGM2012

LEGEND

Feuerstein I28-63-1HN, Plan A, Plan A - Rev 0 Proposal V0
MWD Survey

Halliburton Energy Services, Inc. ("Halliburton") recently completed directional drilling and MWD operations at the Feuerstein I28-63-1HN 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.

Permitted BHL: 990' FSL, 535' FEL



Project: Weld County, CO (NAD 83)
Site: Sec. 28-T6N-R66W (Feuerstein 28 PAD)
Well: Feuerstein I28-63-1HN

Noble Energy

HALLIBURTON
Sperry Drilling

Azimuths to Grid North
True North: -0.46°
Magnetic North: 8.22°

Magnetic Field
Strength: 52861.4snT
Dip Angle: 67.00°
Date: 5/6/2013
Model: BGGM2012

LEGEND

Feuerstein I28-63-1HN, Plan A, Plan A - Rev 0 Proposal V0
MWD Survey

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