



Noble Energy Inc.

Weld County, CO

Sec 18, T11N, R60W, 6th PM

Kaufman PC GL20-68HN

Wellbore #1

Survey: MWD FINAL

DDC Survey Report

26 December, 2012



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Kaufman PC GL20-68HN
Project:	Weld County, CO	TVD Reference:	WELL @ 5312.0usft (H&P #326)
Site:	Sec 18, T11N, R60W, 6th PM	MD Reference:	WELL @ 5312.0usft (H&P #326)
Well:	Kaufman PC GL20-68HN	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Single User Db

Project	Weld County, CO		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Northern Zone		

Site		Sec 18, T11N, R60W, 6th PM			
Site Position:		Northing:	1,579,124.76 usft	Latitude:	40° 54' 53.964 N
From:	Lat/Long	Easting:	3,379,742.56 usft	Longitude:	104° 7' 33.708 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.89 °

Well	Kaufman PC GL20-68HN					
Well Position	+N-S	0.0 usft	Northing:	1,579,124.76 usft	Latitude:	40° 54' 53.964 N
	+E-W	0.0 usft	Easting:	3,379,742.56 usft	Longitude:	104° 7' 33.708 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	5,282.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	11/12/2012	8.37	67.52	53,312

Design	Wellbore #1				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N-S (usft)	+E-W (usft)	Direction (°)	
	0.0	0.0	0.0	99.29	

Survey Program		Date	12/26/2012		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
1,316.0	11,290.0	MWD (Wellbore #1)	MWD default	MWD - Standard	

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
TIE IN @ 1289' MD / 1289' TVD									
1,289.0	0.00	0.00	1,289.0	0.0	0.0	0.0	0.00	0.00	0.00
1,316.0	0.40	9.20	1,316.0	0.1	0.0	0.0	1.48	1.48	0.00
1,409.0	0.40	342.30	1,409.0	0.7	0.0	-0.1	0.20	0.00	-28.92
1,504.0	0.40	190.10	1,504.0	0.7	-0.2	-0.3	0.82	0.00	-160.21
1,597.0	3.40	168.50	1,596.9	-2.3	0.3	0.7	3.26	3.23	-23.23
1,690.0	6.00	152.10	1,689.6	-9.3	3.1	4.6	3.12	2.80	-17.63
1,782.0	8.00	137.90	1,780.9	-18.3	9.7	12.5	2.86	2.17	-15.43
1,875.0	10.50	151.60	1,872.7	-30.6	18.0	22.7	3.56	2.69	14.73
1,968.0	13.10	160.10	1,963.8	-47.9	25.7	33.1	3.36	2.80	9.14
2,060.0	16.30	166.60	2,052.7	-70.3	32.2	43.1	3.91	3.48	7.07

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Well:	Kaufman PC GL20-68HN	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Single User Db

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
2,153.0	17.90	167.30	2,141.6	-96.9	38.4	53.5	1.73	1.72	0.75
2,246.0	17.70	166.90	2,230.2	-124.7	44.7	64.3	0.25	-0.22	-0.43
2,339.0	16.40	167.40	2,319.1	-151.2	50.8	74.5	1.41	-1.40	0.54
2,432.0	17.80	167.10	2,408.0	-177.9	56.8	84.8	1.51	1.51	-0.32
2,526.0	15.80	166.20	2,498.0	-204.3	63.1	95.2	2.15	-2.13	-0.96
2,619.0	16.80	165.70	2,587.2	-229.7	69.4	105.6	1.09	1.08	-0.54
2,713.0	16.80	163.70	2,677.2	-255.9	76.6	116.9	0.61	0.00	-2.13
2,806.0	17.60	165.50	2,766.1	-282.4	83.9	128.4	1.03	0.86	1.94
2,900.0	16.90	164.80	2,855.8	-309.3	91.0	139.8	0.78	-0.74	-0.74
2,994.0	17.30	165.30	2,945.7	-336.0	98.2	151.1	0.45	0.43	0.53
3,089.0	16.30	163.60	3,036.6	-362.5	105.5	162.6	1.17	-1.05	-1.79
3,184.0	17.60	164.30	3,127.5	-389.1	113.2	174.5	1.39	1.37	0.74
3,279.0	17.90	163.70	3,218.0	-416.9	121.1	186.9	0.37	0.32	-0.63
3,374.0	18.50	163.70	3,308.2	-445.4	129.5	199.7	0.63	0.63	0.00
3,468.0	17.10	166.60	3,397.7	-473.2	136.9	211.4	1.76	-1.49	3.09
3,563.0	17.60	166.90	3,488.4	-500.8	143.3	222.3	0.53	0.53	0.32
3,658.0	16.50	162.50	3,579.2	-527.6	150.7	233.9	1.78	-1.16	-4.63
3,753.0	15.80	162.30	3,670.5	-552.8	158.6	245.8	0.74	-0.74	-0.21
3,848.0	14.80	160.40	3,762.1	-576.6	166.7	257.5	1.18	-1.05	-2.00
3,943.0	15.50	165.00	3,853.8	-600.2	174.0	268.6	1.46	0.74	4.84
4,038.0	16.40	163.20	3,945.1	-625.3	181.2	279.7	1.08	0.95	-1.89
4,133.0	18.20	166.70	4,035.8	-652.6	188.5	291.3	2.19	1.89	3.68
4,227.0	19.70	167.40	4,124.7	-682.4	195.3	302.9	1.61	1.60	0.74
4,322.0	18.50	163.20	4,214.5	-712.4	203.1	315.5	1.92	-1.26	-4.42
4,417.0	17.10	160.20	4,305.0	-740.0	212.2	328.9	1.76	-1.47	-3.16
4,512.0	16.20	159.90	4,396.0	-765.6	221.5	342.2	0.95	-0.95	-0.32
4,607.0	18.40	160.80	4,486.7	-792.2	231.0	355.9	2.33	2.32	0.95
4,702.0	15.50	164.40	4,577.5	-818.6	239.3	368.4	3.25	-3.05	3.79
4,797.0	16.40	163.40	4,668.9	-843.7	246.6	379.6	0.99	0.95	-1.05
4,891.0	15.70	166.00	4,759.2	-868.7	253.5	390.4	1.07	-0.74	2.77
4,986.0	13.60	163.20	4,851.1	-891.9	259.8	400.4	2.33	-2.21	-2.95
5,081.0	10.60	160.80	4,944.0	-910.8	265.9	409.5	3.20	-3.16	-2.53
5,176.0	7.70	168.30	5,037.8	-925.3	270.1	415.9	3.29	-3.05	7.89
5,271.0	5.10	174.30	5,132.2	-935.8	271.8	419.3	2.82	-2.74	6.32
5,366.0	1.20	163.70	5,227.0	-940.9	272.5	420.8	4.13	-4.11	-11.16
5,461.0	1.00	130.30	5,322.0	-942.4	273.4	421.9	0.70	-0.21	-35.16
5,556.0	1.10	101.70	5,417.0	-943.1	274.9	423.6	0.56	0.11	-30.11
5,651.0	0.80	276.80	5,512.0	-943.2	275.2	423.8	2.00	-0.32	184.32
5,745.0	1.80	275.90	5,606.0	-943.0	273.0	421.7	1.06	1.06	-0.96
5,840.0	1.10	270.10	5,700.9	-942.9	270.6	419.3	0.75	-0.74	-6.11
5,935.0	0.20	234.40	5,795.9	-943.0	269.6	418.3	0.99	-0.95	-37.58
6,030.0	0.70	96.40	5,890.9	-943.1	270.0	418.7	0.90	0.53	-145.26
6,125.0	0.90	123.00	5,985.9	-943.6	271.2	420.0	0.44	0.21	28.00

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Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
6,219.0	1.30	108.90	6,079.9	-944.3	272.9	421.7	0.51	0.43	-15.00
6,314.0	7.80	79.00	6,174.6	-943.5	280.2	428.8	7.06	6.84	-31.47
CROSSED HARD LINE @ 6324' MD / 6185' TVD									
6,324.2	8.62	80.77	6,184.7	-943.2	281.6	430.2	8.42	8.04	17.36
6,409.0	15.60	88.20	6,267.5	-941.8	299.3	447.5	8.42	8.23	8.76
6,504.0	21.40	94.50	6,357.6	-942.8	329.4	477.3	6.45	6.11	6.63
6,549.0	24.30	91.80	6,399.1	-943.7	346.9	494.7	6.85	6.44	-6.00
6,599.0	27.90	88.70	6,443.9	-943.8	368.8	516.4	7.70	7.20	-6.20
6,644.0	29.80	85.20	6,483.4	-942.6	390.5	537.6	5.65	4.22	-7.78
6,694.0	32.30	85.00	6,526.2	-940.4	416.2	562.6	5.00	5.00	-0.40
6,739.0	35.90	86.40	6,563.5	-938.5	441.4	587.1	8.19	8.00	3.11
6,789.0	40.50	87.30	6,602.7	-936.8	472.2	617.3	9.27	9.20	1.80
6,834.0	44.50	87.80	6,635.9	-935.5	502.6	647.0	8.92	8.89	1.11
6,884.0	50.30	87.40	6,669.7	-934.0	539.4	683.1	11.61	11.60	-0.80
6,929.0	55.80	85.50	6,696.8	-931.7	575.2	718.1	12.68	12.22	-4.22
6,978.0	59.00	84.50	6,723.2	-928.1	616.3	758.1	6.75	6.53	-2.04
7,023.0	58.50	86.60	6,746.5	-925.2	654.7	795.5	4.14	-1.11	4.67
7,073.0	62.20	91.00	6,771.3	-924.3	698.1	838.2	10.64	7.40	8.80
7,118.0	66.70	90.80	6,790.7	-924.9	738.7	878.3	10.01	10.00	-0.44
7,168.0	72.10	89.90	6,808.3	-925.2	785.5	924.5	10.93	10.80	-1.80
7,262.0	86.30	89.70	6,825.8	-924.9	877.6	1,015.4	15.11	15.11	-0.21
CROSSED HARD LINE @ 7275' MD / 6827' TVD									
7,275.3	87.67	88.89	6,826.5	-924.7	890.9	1,028.5	11.98	10.32	-6.08
7,323.0	92.60	86.00	6,826.4	-922.6	938.5	1,075.1	11.98	10.33	-6.06
7,418.0	92.00	86.40	6,822.6	-916.3	1,033.2	1,167.6	0.76	-0.63	0.42
7,513.0	91.70	88.00	6,819.5	-911.6	1,128.0	1,260.4	1.71	-0.32	1.68
7,608.0	92.40	86.60	6,816.1	-907.2	1,222.9	1,353.3	1.65	0.74	-1.47
7,702.0	90.80	86.00	6,813.5	-901.1	1,316.6	1,444.8	1.82	-1.70	-0.64
7,797.0	90.20	87.80	6,812.7	-896.0	1,411.5	1,537.6	2.00	-0.63	1.89
7,892.0	89.30	90.30	6,813.1	-894.4	1,506.5	1,631.1	2.80	-0.95	2.63
7,987.0	89.70	90.40	6,813.9	-895.0	1,601.5	1,724.9	0.43	0.42	0.11
8,081.0	90.60	89.60	6,813.7	-895.0	1,695.5	1,817.7	1.28	0.96	-0.85
8,176.0	90.80	89.00	6,812.5	-893.8	1,790.4	1,911.3	0.67	0.21	-0.63
8,271.0	91.70	89.70	6,810.4	-892.7	1,885.4	2,004.8	1.20	0.95	0.74
8,366.0	89.90	89.70	6,809.1	-892.2	1,980.4	2,098.5	1.89	-1.89	0.00
8,461.0	90.20	89.60	6,809.0	-891.7	2,075.4	2,192.1	0.33	0.32	-0.11
8,556.0	90.20	89.40	6,808.7	-890.8	2,170.4	2,285.7	0.21	0.00	-0.21
8,651.0	91.00	89.40	6,807.7	-889.8	2,265.4	2,379.3	0.84	0.84	0.00
8,746.0	90.90	89.20	6,806.1	-888.7	2,360.4	2,472.9	0.24	-0.11	-0.21
8,840.0	91.90	89.40	6,803.8	-887.5	2,454.3	2,565.4	1.08	1.06	0.21
8,935.0	92.40	89.20	6,800.3	-886.4	2,549.3	2,658.9	0.57	0.53	-0.21
9,030.0	93.40	89.00	6,795.5	-884.9	2,644.1	2,752.3	1.07	1.05	-0.21
9,125.0	91.50	88.00	6,791.4	-882.4	2,739.0	2,845.5	2.26	-2.00	-1.05
9,220.0	91.80	88.00	6,788.7	-879.1	2,833.9	2,938.6	0.32	0.32	0.00

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Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Single User Db

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
9,315.0	90.70	87.40	6,786.6	-875.3	2,928.8	3,031.7	1.32	-1.16	-0.63
9,410.0	91.60	86.90	6,784.7	-870.5	3,023.7	3,124.5	1.08	0.95	-0.53
9,505.0	90.50	87.30	6,782.9	-865.7	3,118.5	3,217.4	1.23	-1.16	0.42
9,599.0	90.00	87.60	6,782.5	-861.6	3,212.4	3,309.4	0.62	-0.53	0.32
9,694.0	91.50	88.20	6,781.3	-858.1	3,307.4	3,402.5	1.70	1.58	0.63
9,789.0	90.00	88.50	6,780.0	-855.3	3,402.3	3,495.8	1.61	-1.58	0.32
9,884.0	90.00	88.30	6,780.0	-852.7	3,497.3	3,589.0	0.21	0.00	-0.21
9,979.0	90.40	87.60	6,779.7	-849.3	3,592.2	3,682.2	0.85	0.42	-0.74
10,074.0	91.90	88.20	6,777.8	-845.8	3,687.1	3,775.3	1.70	1.58	0.63
10,169.0	90.00	87.30	6,776.2	-842.1	3,782.0	3,868.4	2.21	-2.00	-0.95
10,263.0	91.50	88.70	6,775.0	-838.8	3,876.0	3,960.5	2.18	1.60	1.49
10,358.0	90.00	88.20	6,773.8	-836.2	3,970.9	4,053.8	1.66	-1.58	-0.53
10,453.0	90.20	87.60	6,773.6	-832.8	4,065.8	4,146.9	0.67	0.21	-0.63
10,548.0	91.70	88.00	6,772.0	-829.1	4,160.8	4,240.0	1.63	1.58	0.42
10,643.0	91.20	88.00	6,769.6	-825.8	4,255.7	4,333.2	0.53	-0.53	0.00
10,738.0	90.40	88.50	6,768.3	-822.9	4,350.6	4,426.4	0.99	-0.84	0.53
10,833.0	91.10	90.10	6,767.0	-821.7	4,445.6	4,519.9	1.84	0.74	1.68
10,927.0	90.80	90.10	6,765.5	-821.9	4,539.6	4,612.7	0.32	-0.32	0.00
11,022.0	87.80	90.40	6,766.6	-822.3	4,634.6	4,706.5	3.17	-3.16	0.32
11,117.0	88.40	90.10	6,769.8	-822.7	4,729.5	4,800.3	0.71	0.63	-0.32
11,212.0	88.60	89.90	6,772.3	-822.7	4,824.5	4,894.0	0.30	0.21	-0.21
11,235.0	89.10	89.90	6,772.7	-822.7	4,847.5	4,916.7	2.17	2.17	0.00
TD @ 11290' MD / 6773' TVD									
11,290.0	91.50	89.90	6,772.5	-822.6	4,902.5	4,971.0	4.36	4.36	0.00

Survey Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,289.0	1,289.0	0.0	0.0	TIE IN @ 1289' MD / 1289' TVD
6,324.2	6,184.7	-943.2	281.6	CROSSED HARD LINE @ 6324' MD / 6185' TVD
7,275.3	6,826.5	-924.7	890.9	CROSSED HARD LINE @ 7275' MD / 6827' TVD
11,290.0	6,772.5	-822.6	4,902.5	TD @ 11290' MD / 6773' TVD

Checked By: _____ Approved By: _____ Date: _____



Survey Certification Sheet

Noble Energy
Company

RM-12938
Job Number

12/26/2012
Date

Sec18,T11N,R60W,6th PM
Lease

Kaufman PC GL20-68HN
Well Name

Weld,CO
County & State

Surveyed from a depth of: 1289 feet to 11290 feet MD

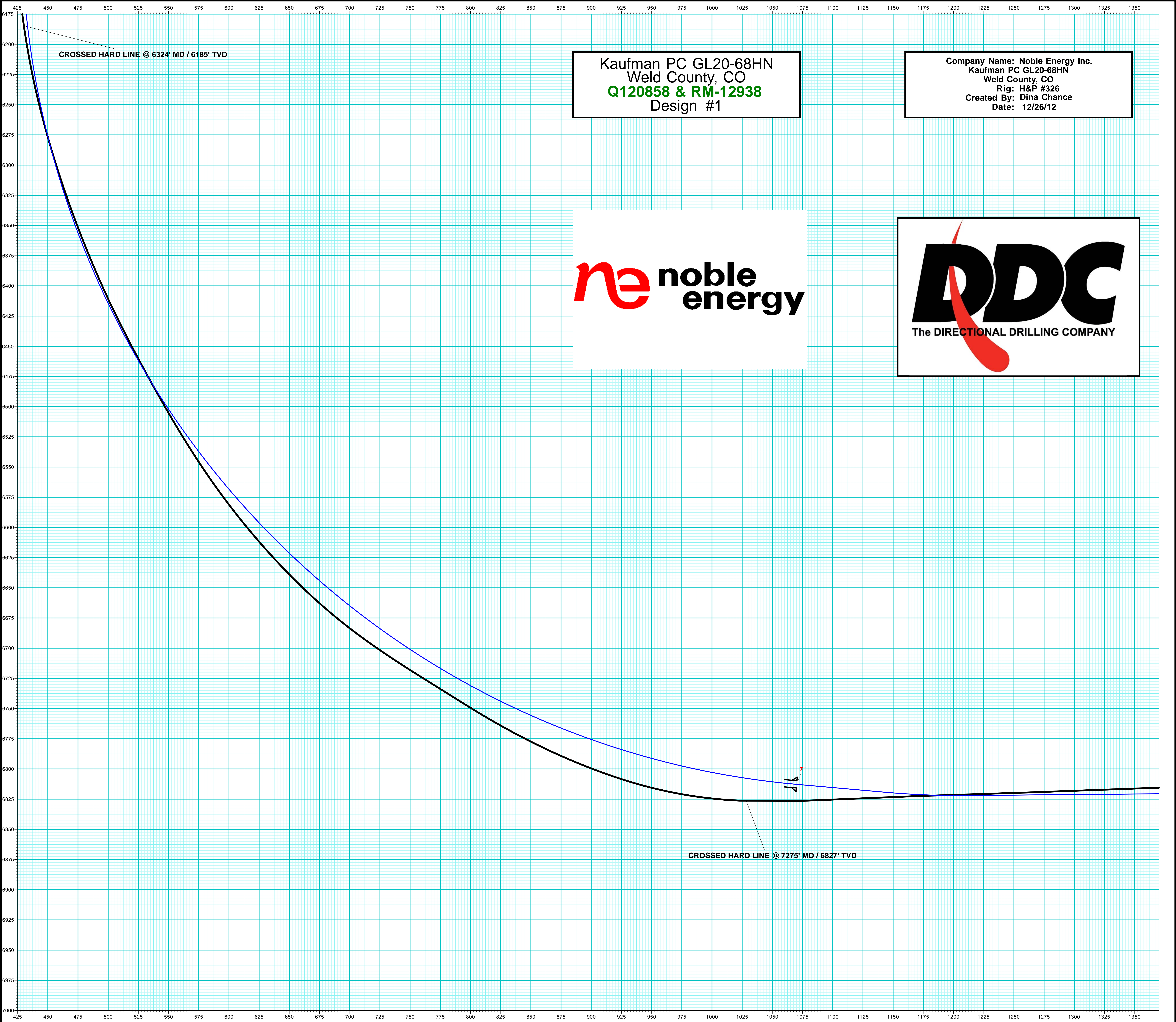
Type of Survey: MWD

Directional Supervisor/Surveyor: Chris Abbott

The data and calculations for this survey have been checked by me and conform to the standards and procedures set forth by **The Directional Drilling Company (DDC)**. This report represents a true and correct Directional survey of this well based on the original data obtained at the well site. Wellbore Coordinates are calculated using minimum curvature.

Digitally signed by Larry Wright
DN: cn=Larry Wright, o=The
Directional Drilling Company,
ou=GM of Guidance Services,
email=larryw@directionaldrillers.
com, c=US
Date: 2012.12.26 16:52:05 -06'00'

Larry Wright
MWD General Manager



CROSSED HARD LINE @ 6324' MD / 6185' TVD

Kaufman PC GL20-68HN
Weld County, CO
Q120858 & RM-12938
Design #1

Company Name: Noble Energy Inc.
Kaufman PC GL20-68HN
Weld County, CO
Rig: H&P #326
Created By: Dina Chance
Date: 12/26/12



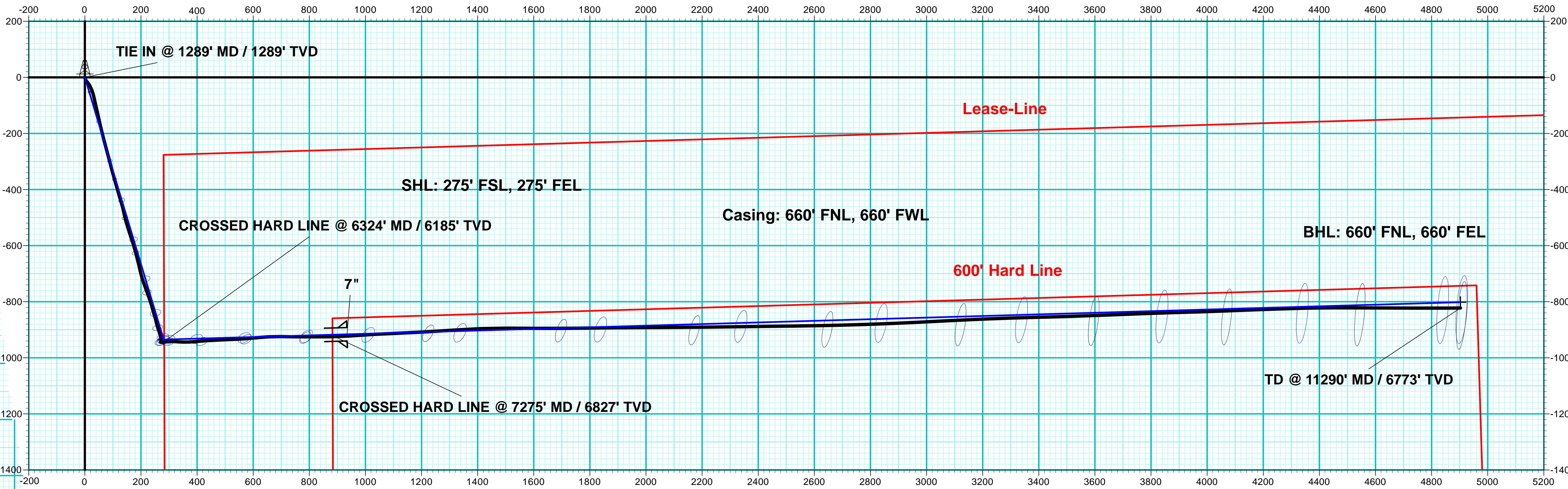
CROSSED HARD LINE @ 7275' MD / 6827' TVD

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PROJECT DETAILS: Weld County, CO	
Geodetic System:	US State Plane 1983
Datum:	North American Datum 1983
Ellipsoid:	GRS 1980
Zone:	Colorado Northern Zone
System Datum:	Mean Sea Level



DESIGN TARGET DETAILS								
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	
TIE IN @ 1289' MD / 1289' TVD	1289.0	0.0	0.0	1579124.77	3379742.57	40° 54' 53.964 N	104° 7' 33.708 W	
- plan hits target center								
VP Kaufman PC GL20-68HN	5375.0	-935.0	281.0	1578189.76	3380023.57	40° 54' 44.684 N	104° 7' 30.237 W	
- plan hits target center								
PBHL Kaufman PC GL20-68HN	6788.5	-801.7	4902.6	1578323.03	3384645.17	40° 54' 45.288 N	104° 6' 30.024 W	
- plan hits target center								

ANNOTATIONS									
MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Departure	Annotation	
6324.2	8.62	80.77	6184.7	-943.2	281.6	430.2	1008.8	CROSSED HARD LINE @ 6324' MD / 6185' TVD	
7275.3	87.67	88.89	6826.5	-924.7	890.9	1028.5	1618.3	CROSSED HARD LINE @ 7275' MD / 6827' TVD	
11290.0	91.50	89.90	6772.5	-822.6	4902.5	4971.0	5632.0	TD @ 11290' MD / 6773' TVD	

WELL DETAILS: Kaufman PC GL20-68HN							
Ground Level:				5282.0			
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude		
0.0	0.0	1579124.76	3379742.57	40° 54' 53.964 N	104° 7' 33.708 W		

T

G

M

Azimuths to Grid North

Magnetic North: 7.48°

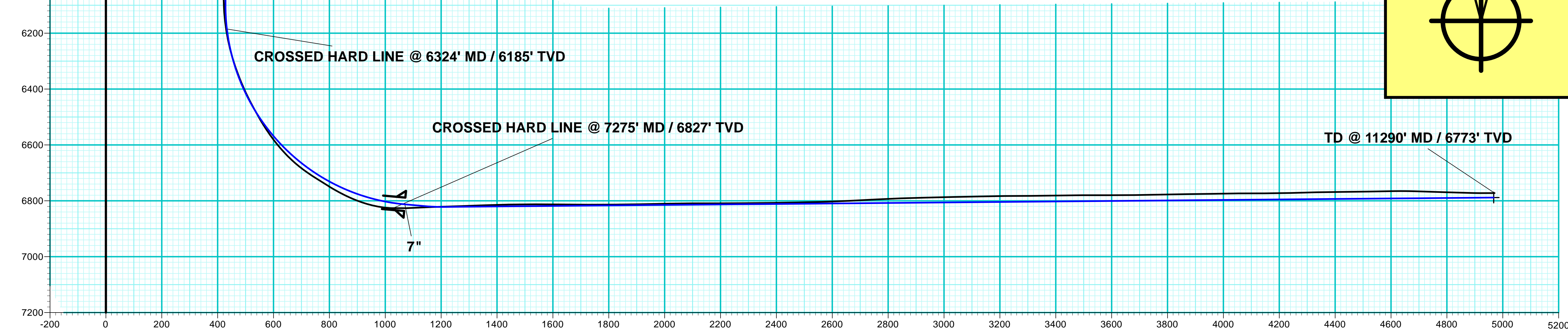
Magnetic Field

Strength: 53312.2snT

Dip Angle: 67.52°

Date: 11/12/2012

Model: IGRF2010



Vertical Section at 99.29° (200 usft/in)