



Noble Energy Inc.

Weld County, CO
Sec 28, T9N, R59W, 6th PM
Cutthroat LC28-73HNB

Wellbore #1

Design: Wellbore #1 **FINAL**

DDC Survey Report

11 July, 2014



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Cutthroat LC28-73HNB
Project:	Weld County, CO	TVD Reference:	WELL @ 4866.0usft (H&P #326)
Site:	Sec 28, T9N, R59W, 6th PM	MD Reference:	WELL @ 4866.0usft (H&P #326)
Well:	Cutthroat LC28-73HNB	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 28, T9N, R59W, 6th PM			
Site Position:		Northing:	1,506,743.69 usft	Latitude:	40° 42' 52.295 N
From:	Map	Easting:	3,420,557.77 usft	Longitude:	103° 58' 58.302 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.98 °

Well		Cutthroat LC28-73HNB				
Well Position	+N/-S	0.0 usft	Northing:	1,506,955.09 usft	Latitude:	40° 42' 54.108 N
	+E/-W	0.0 usft	Easting:	3,422,187.66 usft	Longitude:	103° 58' 37.092 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	0.0 usft	Ground Level:	4,836.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	6/24/2014	8.05	67.32	53,056

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	354.60	

Survey Program	Date	7/11/2014			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
359.0	600.0	MSS (Wellbore #1)	Flexi-Shot	VES Flexi-Shot Tool	
644.0	6,383.0	MWD Surveys - Vert/Build (Wellbore #1)	MWD default	MWD - Standard	
6,445.0	10,461.0	MWD Surveys - Lateral (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)	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
359.0	0.50	133.36	359.0	-1.1	1.1	-1.2	0.14	0.14	0.00	
TIE IN @ 600' MD / 600' TVD END OF SUR HOLE / BEGIN INT HOLE										
600.0	0.40	180.96	600.0	-2.6	1.9	-2.8	0.16	-0.04	19.75	
644.0	0.62	337.70	644.0	-2.6	1.8	-2.7	2.27	0.50	356.23	
740.0	0.53	350.36	740.0	-1.7	1.5	-1.8	0.16	-0.09	13.19	
833.0	0.62	330.15	833.0	-0.8	1.2	-0.9	0.24	0.10	-21.73	
926.0	0.62	336.47	926.0	0.1	0.8	0.0	0.07	0.00	6.80	
1,019.0	0.44	337.53	1,019.0	0.9	0.4	0.9	0.19	-0.19	1.14	

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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)	
1,113.0	0.44	341.57	1,113.0	1.6	0.2	1.5	0.03	0.00	4.30	
1,205.0	0.62	5.13	1,205.0	2.4	0.1	2.4	0.30	0.20	25.61	
1,298.0	0.44	339.64	1,298.0	3.2	0.0	3.2	0.31	-0.19	-27.41	
1,390.0	0.35	6.53	1,390.0	3.8	-0.1	3.8	0.22	-0.10	29.23	
1,483.0	0.26	354.05	1,483.0	4.3	-0.1	4.3	0.12	-0.10	-13.42	
1,576.0	2.02	221.16	1,575.9	3.3	-1.2	3.4	2.37	1.89	-142.89	
1,668.0	4.48	225.20	1,667.8	-0.4	-4.8	0.0	2.68	2.67	4.39	
1,760.0	5.80	216.24	1,759.4	-6.7	-10.1	-5.7	1.68	1.43	-9.74	
1,852.0	7.47	221.51	1,850.8	-14.9	-16.8	-13.3	1.93	1.82	5.73	
1,945.0	9.76	218.35	1,942.7	-25.7	-25.7	-23.1	2.51	2.46	-3.40	
2,037.0	11.08	221.51	2,033.2	-38.4	-36.4	-34.8	1.56	1.43	3.43	
2,130.0	12.49	218.88	2,124.3	-52.9	-48.6	-48.1	1.62	1.52	-2.83	
2,225.0	14.16	216.24	2,216.7	-70.3	-61.9	-64.1	1.87	1.76	-2.78	
2,319.0	12.84	215.18	2,308.1	-88.1	-74.8	-80.7	1.43	-1.40	-1.13	
2,413.0	13.89	220.28	2,399.6	-105.2	-88.1	-96.5	1.68	1.12	5.43	
2,508.0	12.40	219.58	2,492.1	-121.8	-101.9	-111.7	1.58	-1.57	-0.74	
2,602.0	13.98	219.40	2,583.6	-138.4	-115.6	-126.9	1.68	1.68	-0.19	
2,697.0	13.98	218.52	2,675.8	-156.2	-130.0	-143.3	0.22	0.00	-0.93	
2,791.0	13.98	216.77	2,767.0	-174.2	-143.9	-159.9	0.45	0.00	-1.86	
2,886.0	13.72	215.71	2,859.2	-192.5	-157.3	-176.9	0.38	-0.27	-1.12	
2,981.0	12.75	214.13	2,951.7	-210.3	-169.8	-193.4	1.09	-1.02	-1.66	
3,075.0	11.34	213.60	3,043.6	-226.6	-180.7	-208.6	1.50	-1.50	-0.56	
3,169.0	8.62	210.61	3,136.2	-240.4	-189.4	-221.5	2.94	-2.89	-3.18	
3,263.0	7.03	212.02	3,229.3	-251.3	-196.1	-231.8	1.70	-1.69	1.50	
3,358.0	7.12	213.08	3,323.6	-261.2	-202.4	-241.0	0.17	0.09	1.12	
3,453.0	6.33	207.80	3,417.9	-270.8	-208.0	-250.0	1.06	-0.83	-5.56	
3,547.0	4.75	192.33	3,511.5	-279.2	-211.3	-258.0	2.30	-1.68	-16.46	
3,642.0	2.81	178.27	3,606.3	-285.3	-212.0	-264.1	2.25	-2.04	-14.80	
3,737.0	1.14	105.67	3,701.2	-287.9	-211.0	-266.8	2.84	-1.76	-76.42	
3,831.0	1.06	83.17	3,795.2	-288.1	-209.3	-267.1	0.46	-0.09	-23.94	
3,926.0	1.23	78.25	3,890.2	-287.7	-207.4	-266.9	0.21	0.18	-5.18	
4,020.0	1.41	72.10	3,984.2	-287.2	-205.3	-266.6	0.24	0.19	-6.54	
4,115.0	1.67	71.92	4,079.1	-286.4	-202.9	-266.0	0.27	0.27	-0.19	
4,209.0	1.85	32.55	4,173.1	-284.7	-200.8	-264.5	1.27	0.19	-41.88	
4,304.0	0.44	359.68	4,268.1	-283.0	-200.0	-263.0	1.58	-1.48	-34.60	
4,398.0	1.23	325.58	4,362.1	-281.8	-200.5	-261.7	0.96	0.84	-36.28	
4,492.0	2.02	306.06	4,456.0	-280.0	-202.4	-259.7	1.01	0.84	-20.77	
4,587.0	1.58	275.83	4,551.0	-278.9	-205.1	-258.4	1.08	-0.46	-31.82	
4,682.0	1.85	303.08	4,646.0	-277.9	-207.7	-257.2	0.89	0.28	28.68	
4,776.0	1.93	318.37	4,739.9	-275.9	-210.0	-254.9	0.54	0.09	16.27	
4,871.0	1.06	51.18	4,834.9	-274.2	-210.4	-253.2	2.37	-0.92	97.69	
4,966.0	1.67	72.27	4,929.9	-273.2	-208.4	-252.4	0.82	0.64	22.20	
5,060.0	1.93	77.90	5,023.8	-272.5	-205.5	-251.9	0.33	0.28	5.99	

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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)
5,155.0	1.85	66.65	5,118.8	-271.5	-202.6	-251.3	0.40	-0.08	-11.84
5,249.0	1.67	70.87	5,212.7	-270.5	-199.9	-250.5	0.24	-0.19	4.49
5,343.0	1.23	62.61	5,306.7	-269.6	-197.7	-249.8	0.52	-0.47	-8.79
5,438.0	5.36	355.81	5,401.5	-264.7	-197.1	-244.9	5.27	4.35	-70.32
5,533.0	9.58	3.37	5,495.7	-252.3	-197.0	-232.7	4.55	4.44	7.96
5,627.0	13.89	4.07	5,587.7	-233.3	-195.7	-213.8	4.59	4.59	0.74
5,722.0	16.88	3.90	5,679.3	-208.1	-193.9	-188.9	3.15	3.15	-0.18
5,816.0	25.24	7.59	5,766.9	-174.6	-190.4	-155.9	9.00	8.89	3.93
5,911.0	34.47	5.13	5,849.2	-127.6	-185.3	-109.6	9.80	9.72	-2.59
6,005.0	43.88	3.90	5,922.0	-68.5	-180.7	-51.2	10.04	10.01	-1.31
6,100.0	52.14	0.91	5,985.5	2.0	-177.8	18.7	9.00	8.69	-3.15
6,194.0	65.69	354.40	6,034.0	82.2	-181.4	98.9	15.58	14.41	-6.93
6,289.0	82.04	353.00	6,060.3	172.5	-191.5	189.8	17.27	17.21	-1.47
CROSSED 600' HARD LINE @ 6372.8' MD / 6065.8' TVD									
6,372.8	90.51	354.41	6,065.8	255.6	-200.6	273.3	10.24	10.11	1.68
6,383.0	91.54	354.58	6,065.6	265.7	-201.6	283.5	10.24	10.11	1.67
7" CASING POINT @ 6436.0' MD / 6063.8' TVD END OF INT HOLE / BEGIN LATERAL									
6,436.0	92.22	355.03	6,063.8	318.5	-206.4	336.5	1.53	1.27	0.85
6,445.0	92.33	355.11	6,063.5	327.4	-207.2	345.5	1.53	1.27	0.86
6,537.0	90.31	354.76	6,061.4	419.1	-215.3	437.5	2.23	-2.20	-0.38
6,630.0	88.81	354.93	6,062.1	511.7	-223.6	530.5	1.62	-1.61	0.18
6,722.0	89.52	357.22	6,063.4	603.4	-229.9	622.4	2.61	0.77	2.49
6,815.0	89.08	357.22	6,064.6	696.3	-234.5	715.3	0.47	-0.47	0.00
6,910.0	88.81	357.22	6,066.3	791.2	-239.1	810.2	0.28	-0.28	0.00
7,004.0	89.69	357.74	6,067.5	885.1	-243.2	904.1	1.09	0.94	0.55
7,099.0	91.98	358.97	6,066.1	980.0	-245.9	998.8	2.74	2.41	1.29
7,194.0	89.87	358.10	6,064.6	1,075.0	-248.3	1,093.6	2.40	-2.22	-0.92
7,288.0	88.99	357.92	6,065.6	1,168.9	-251.6	1,187.4	0.96	-0.94	-0.19
7,382.0	89.16	357.74	6,067.1	1,262.9	-255.2	1,281.3	0.26	0.18	-0.19
7,477.0	89.25	357.74	6,068.4	1,357.8	-258.9	1,376.1	0.09	0.09	0.00
7,571.0	89.16	357.57	6,069.7	1,451.7	-262.8	1,470.0	0.20	-0.10	-0.18
7,666.0	89.78	357.74	6,070.6	1,546.6	-266.6	1,564.8	0.68	0.65	0.18
7,761.0	89.96	357.22	6,070.8	1,641.5	-270.8	1,659.7	0.58	0.19	-0.55
7,855.0	89.87	356.69	6,070.9	1,735.4	-275.8	1,753.6	0.57	-0.10	-0.56
7,949.0	89.69	356.16	6,071.3	1,829.2	-281.7	1,847.6	0.60	-0.19	-0.56
8,044.0	89.87	355.81	6,071.7	1,924.0	-288.3	1,942.5	0.41	0.19	-0.37
8,138.0	90.40	354.93	6,071.4	2,017.6	-295.9	2,036.5	1.09	0.56	-0.94
8,232.0	90.75	354.76	6,070.5	2,111.3	-304.4	2,130.5	0.41	0.37	-0.18
8,327.0	90.22	354.23	6,069.7	2,205.8	-313.5	2,225.5	0.79	-0.56	-0.56
8,422.0	91.45	354.40	6,068.3	2,300.3	-322.9	2,320.5	1.31	1.29	0.18
8,516.0	89.25	357.39	6,067.7	2,394.1	-329.6	2,414.5	3.95	-2.34	3.18
8,610.0	89.25	357.39	6,069.0	2,488.0	-333.9	2,508.4	0.00	0.00	0.00
8,705.0	90.31	358.10	6,069.3	2,582.9	-337.6	2,603.2	1.34	1.12	0.75
8,799.0	91.36	357.22	6,067.9	2,676.8	-341.5	2,697.1	1.46	1.12	-0.94

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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)	
8,894.0	92.86	357.39	6,064.5	2,771.6	-345.9	2,791.9	1.59	1.58	0.18	
8,989.0	88.20	358.45	6,063.6	2,866.5	-349.4	2,886.7	5.03	-4.91	1.12	
9,083.0	88.46	357.74	6,066.3	2,960.4	-352.5	2,980.5	0.80	0.28	-0.76	
9,178.0	89.16	357.04	6,068.3	3,055.3	-356.8	3,075.3	1.04	0.74	-0.74	
9,272.0	89.96	357.39	6,069.0	3,149.2	-361.4	3,169.2	0.93	0.85	0.37	
9,367.0	91.45	357.57	6,067.8	3,244.1	-365.6	3,264.1	1.58	1.57	0.19	
9,462.0	89.52	357.22	6,067.0	3,339.0	-369.9	3,359.0	2.06	-2.03	-0.37	
9,556.0	89.69	356.86	6,067.7	3,432.9	-374.7	3,452.9	0.42	0.18	-0.38	
9,650.0	90.31	356.16	6,067.7	3,526.7	-380.5	3,546.9	0.99	0.66	-0.74	
9,745.0	90.31	358.80	6,067.2	3,621.6	-384.6	3,641.7	2.78	0.00	2.78	
9,839.0	90.48	358.80	6,066.5	3,715.6	-386.6	3,735.5	0.18	0.18	0.00	
9,934.0	90.92	358.80	6,065.4	3,810.5	-388.6	3,830.2	0.46	0.46	0.00	
10,028.0	90.13	359.68	6,064.5	3,904.5	-389.8	3,923.9	1.26	-0.84	0.94	
10,123.0	90.84	359.50	6,063.7	3,999.5	-390.5	4,018.5	0.77	0.75	-0.19	
10,217.0	91.01	359.15	6,062.2	4,093.5	-391.6	4,112.2	0.41	0.18	-0.37	
10,312.0	91.63	359.85	6,060.0	4,188.5	-392.5	4,206.8	0.98	0.65	0.74	
10,406.0	91.28	359.85	6,057.6	4,282.4	-392.7	4,300.4	0.37	-0.37	0.00	
10,414.0	91.54	359.85	6,057.4	4,290.4	-392.7	4,308.4	3.25	3.25	0.00	
TD @ 10461.0 MD / 6056.1 TVD										
10,461.0	91.54	359.85	6,056.1	4,337.4	-392.9	4,355.2	0.00	0.00	0.00	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
600.0	600.0	-2.6	1.9	TIE IN @ 600' MD / 600' TVD END OF SUR HOLE / BEGIN INT HOLE	
6,372.8	6,065.8	255.6	-200.6	CROSSED 600' HARD LINE @ 6372.8' MD / 6065.8' TVD	
6,436.0	6,063.8	318.5	-206.4	7" CASING POINT @ 6436.0' MD / 6063.8' TVD END OF INT HOLE / BEGIN L	
10,461.0	6,056.1	4,337.4	-392.9	TD @ 10461.0 MD / 6056.1 TVD	

Checked By: _____ Approved By: _____ Date: _____



Survey Certification Sheet

Noble Energy Inc.
Company

RM-140624
Job Number

7/18/14
Date

Sec 28,T9N,R59W,6th PM
Lease

Cutthroat LC28-73HNB
Well Name

Weld, CO
County & State

API: 05-123-38604

Surveyed from a depth of: 600 feet to 10461 feet MD

Type of Survey: MWD

Directional Supervisor/Surveyor: Bob Kubistek

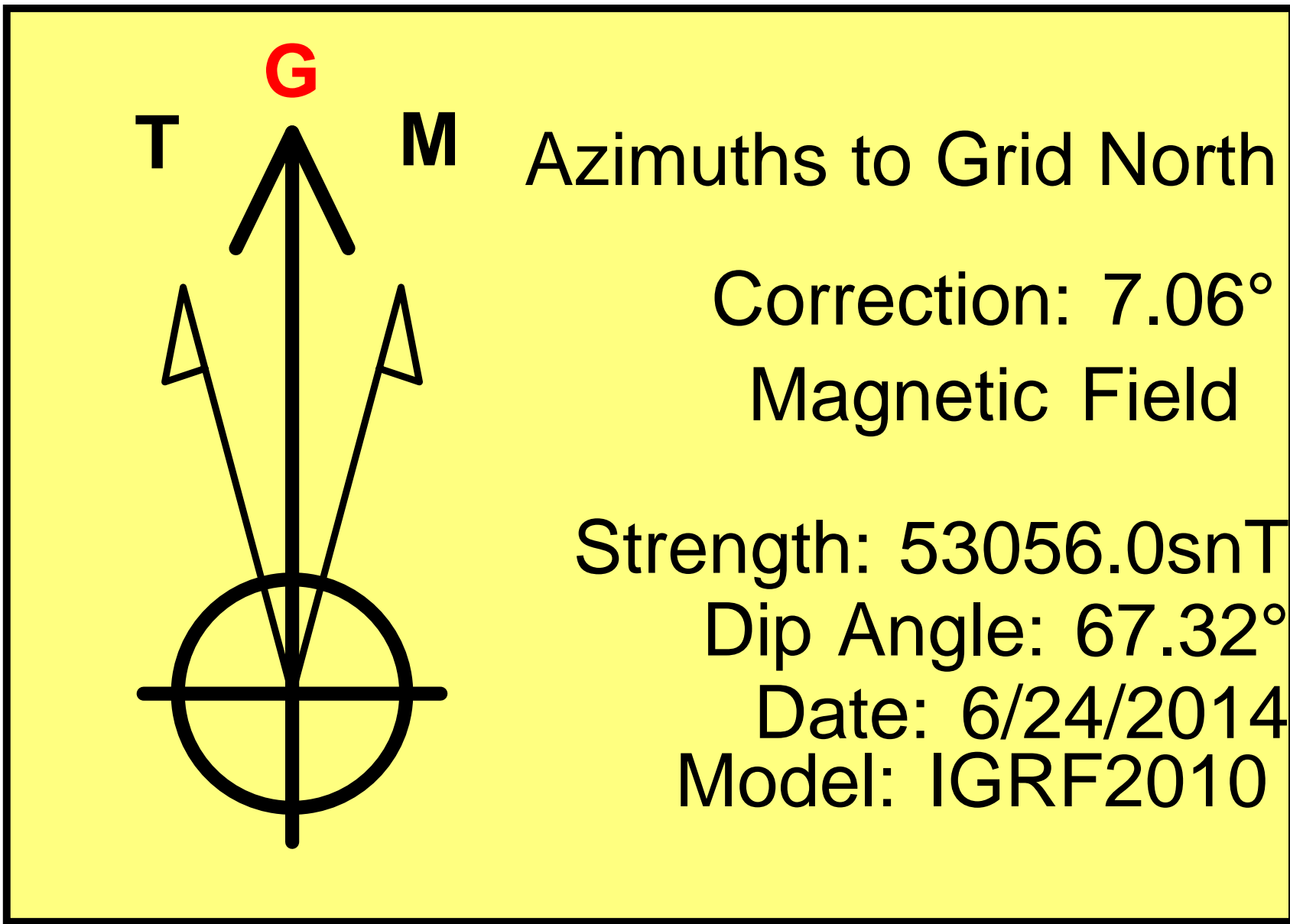
The data and calculations for this survey have been checked by me and conform to the standards and procedures set forth by **The Directional Drilling Company (DDC)**. This report represents a true and correct Directional survey of this well based on the original data obtained at the well site. Wellbore 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.co
m, c=US
Date: 2014.07.30 14:36:10 -05'00'

Larry Wright
MWD General Manager

Company Name: Noble Energy Inc.
Cutthroat LC28-73HNB
Weld County, CO
Rig: H&P #326
Created By: Kris Ray
Date: 7/11/2014

Cutthroat LC28-73HNB
Weld County, CO
Q140670 & RM-140624
Design #1

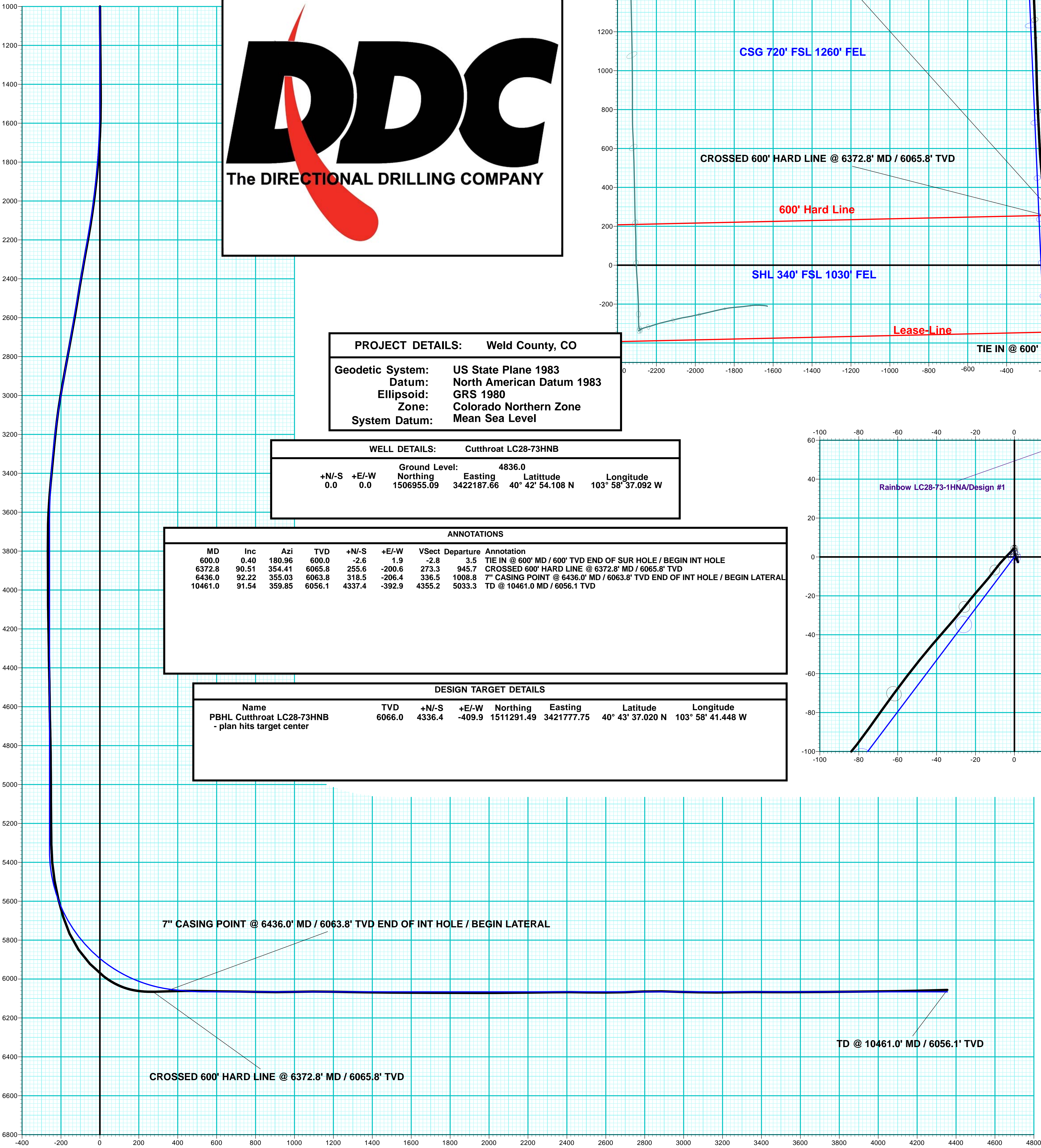
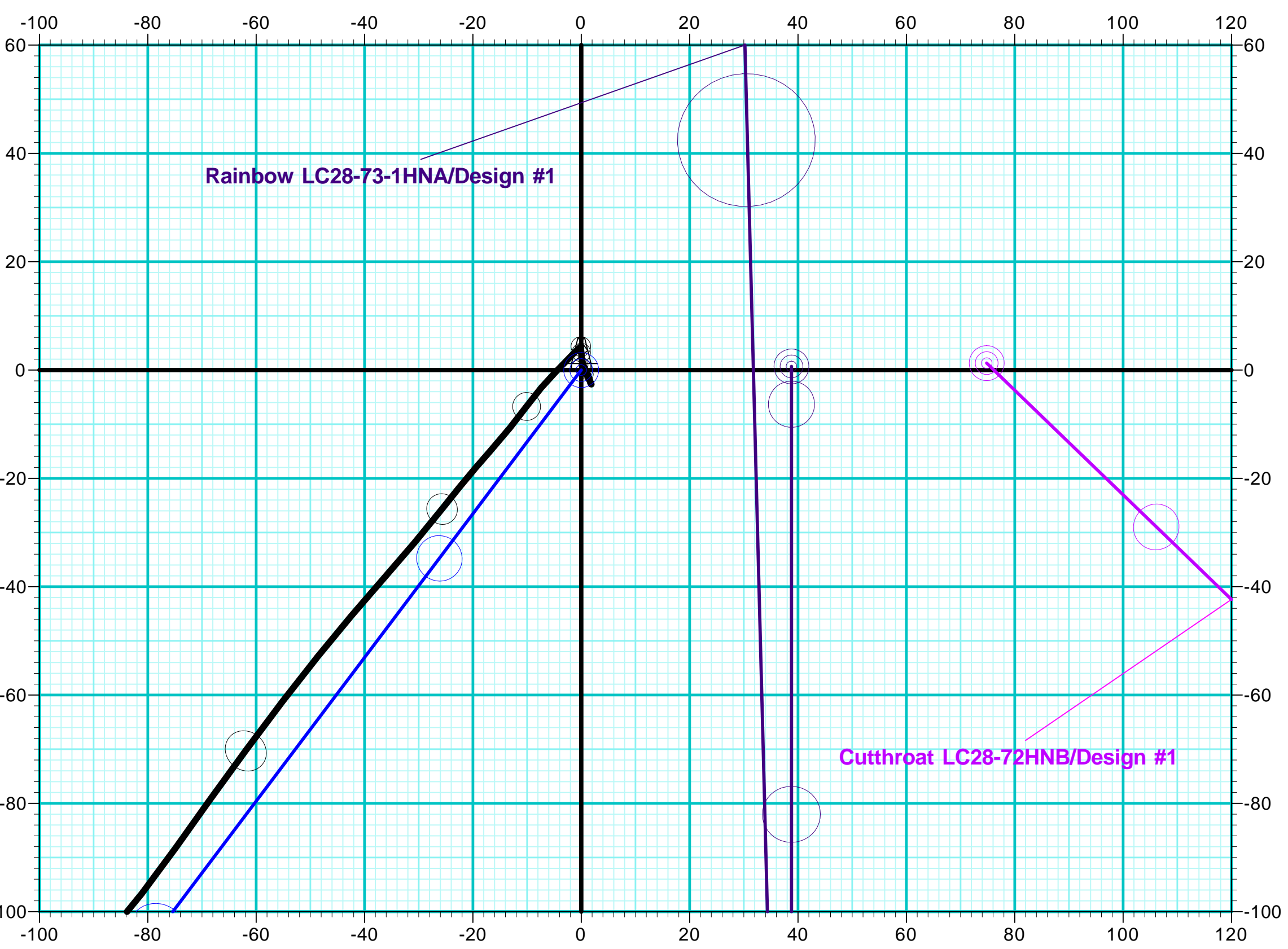
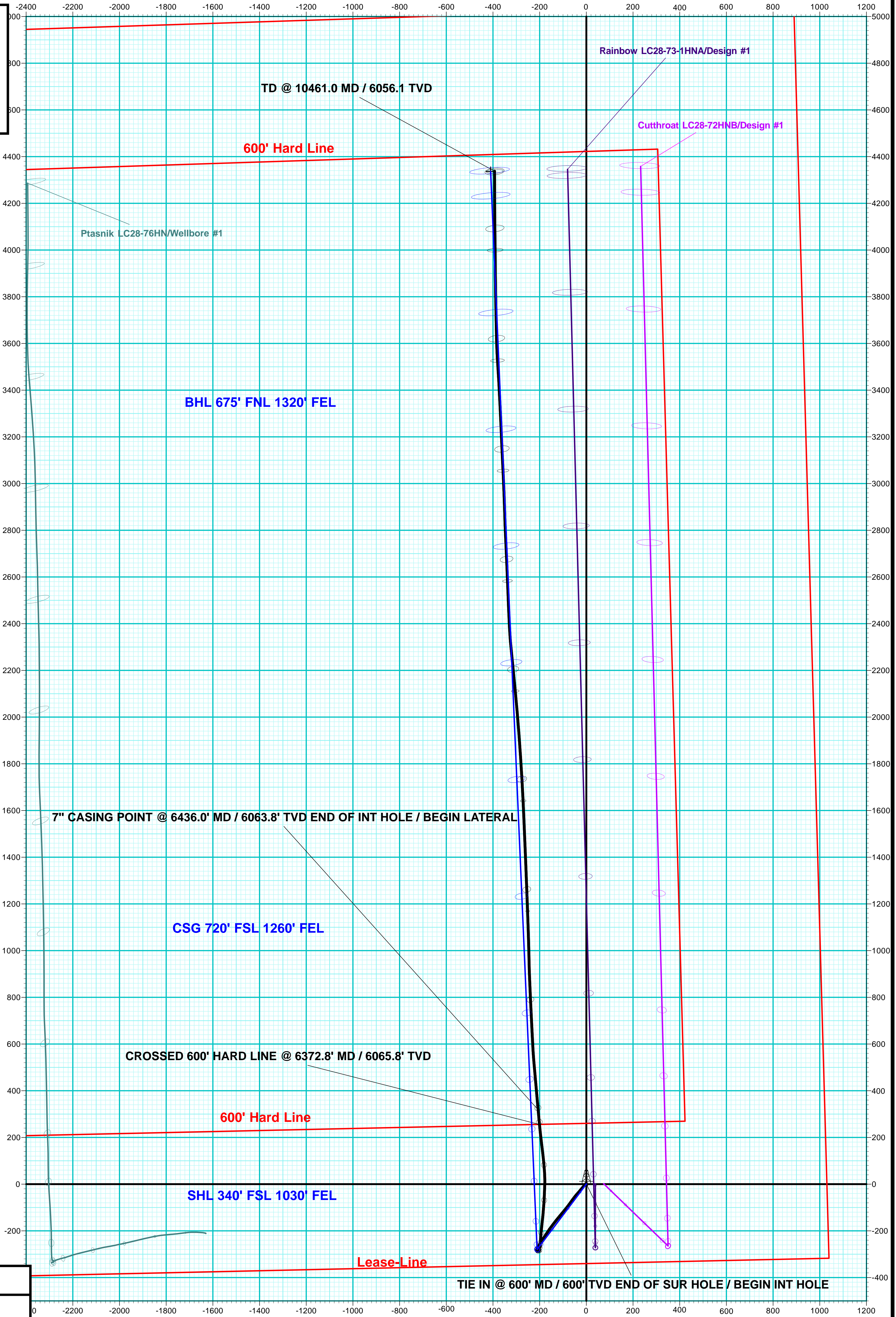


PROJECT DETAILS:		Weld County, CO
Geodetic System:	US State Plane 1983	
Datum:	North American Datum 1983	
Ellipsoid:	GRS 1980	
Zone:	Colorado Northern Zone	
System Datum:	Mean Sea Level	

WELL DETAILS:		Cutthroat LC28-73HNB
Ground Level:	4836.0	
+N/-S	+E/-W	
0.0	0.0	
Northing	Easting	Latitude
1506955.09	3422187.66	40° 42' 54.108 N
		Longitude
		103° 58' 37.092 W

ANNOTATIONS									
MD	Inc	Azi	TVD	+N/-S	+E/-W	Vsect	Departure	Annotation	
600.0	0.40	180.96	600.0	-2.6	1.9	-2.8	3.5	TIE IN @ 600' MD / 600' TVD END OF SUR HOLE / BEGIN INT HOLE	
6372.8	90.51	354.41	6065.8	255.6	-200.6	273.3	945.7	CROSSED 600' HARD LINE @ 6372.8' MD / 6065.8' TVD	
6436.0	92.22	355.03	6063.8	318.5	-206.4	336.5	1008.8	7" CASING POINT @ 6436.0' MD / 6063.8' TVD END OF INT HOLE / BEGIN LATERAL	
10461.0	91.54	359.85	6056.1	4337.4	-392.9	4355.2	5033.3	TD @ 10461.0 MD / 6056.1 TVD	

DESIGN TARGET DETAILS						
Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude
PBHL Cutthroat LC28-73HNB	6066.0	4336.4	-409.9	1511291.49	3421777.75	40° 43' 37.020 N
- plan hits target center						
Longitude						
103° 58' 41.448 W						



Vertical Section at 354.60° (200 usft/in)