



Noble Energy Inc.

Weld County, CO

Sec 27, T9N, R59W, 6th P.M.

Castor LC27-72HN

Wellbore #1

Survey: MWD FINAL

DDC Survey Report

29 August, 2012



Company:	Noble Energy Inc.	Local Co-ordinate Reference:	Well Castor LC27-72HN
Project:	Weld County, CO	TVD Reference:	WELL @ 4846.0usft (H&P #326)
Site:	Sec 27, T9N, R59W, 6th P.M.	MD Reference:	WELL @ 4846.0usft (H&P #326)
Well:	Castor LC27-72HN	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 27, T9N, R59W, 6th P.M.			
Site Position:		Northing:	1,507,259.67 usft	Latitude:	40° 42' 56.133 N
From:	Map	Easting:	3,427,948.70 usft	Longitude:	103° 57' 22.220 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "	Grid Convergence:	1.00 °

Well	Castor LC27-72HN					
Well Position	+N-S	0.0 usft	Northing:	1,507,259.67 usft	Latitude:	40° 42' 56.133 N
	+E-W	0.0 usft	Easting:	3,427,948.70 usft	Longitude:	103° 57' 22.220 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	4,816.0 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	8/14/2012	8.29	67.39	53,256

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	355.24	

Survey Program		Date	8/29/2012		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
741.0	10,320.0	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 @ 638' MD / 638' TVD									
638.0	0.00	0.00	638.0	0.0	0.0	0.0	0.00	0.00	0.00
741.0	1.10	236.00	741.0	-0.6	-0.8	-0.5	1.07	1.07	0.00
1,021.0	1.00	248.50	1,020.9	-3.0	-5.3	-2.5	0.09	-0.04	4.46
1,300.0	1.10	257.30	1,299.9	-4.4	-10.2	-3.6	0.07	0.04	3.15
1,581.0	1.00	263.80	1,580.9	-5.3	-15.3	-4.0	0.06	-0.04	2.31
1,767.0	0.60	262.70	1,766.8	-5.6	-17.8	-4.1	0.22	-0.22	-0.59
1,862.0	3.60	210.80	1,861.8	-8.2	-19.9	-6.5	3.44	3.16	-54.63
1,957.0	6.00	199.20	1,956.4	-15.5	-23.0	-13.5	2.71	2.53	-12.21
2,052.0	7.40	189.90	2,050.8	-26.2	-25.7	-24.0	1.86	1.47	-9.79
2,147.0	8.60	196.10	2,144.9	-39.0	-28.7	-36.5	1.55	1.26	6.53

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Well:	Castor LC27-72HN	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)
2,242.0	10.30	187.10	2,238.6	-54.3	-31.8	-51.5	2.37	1.79	-9.47
2,337.0	12.60	191.30	2,331.7	-72.9	-34.8	-69.7	2.57	2.42	4.42
2,432.0	11.90	190.40	2,424.5	-92.7	-38.6	-89.1	0.76	-0.74	-0.95
2,527.0	11.90	189.40	2,517.5	-112.0	-42.0	-108.1	0.22	0.00	-1.05
2,622.0	13.40	195.60	2,610.2	-132.2	-46.6	-127.9	2.13	1.58	6.53
2,717.0	13.20	195.70	2,702.6	-153.3	-52.5	-148.4	0.21	-0.21	0.11
2,812.0	12.90	194.70	2,795.2	-174.0	-58.1	-168.6	0.40	-0.32	-1.05
2,907.0	12.80	199.80	2,887.8	-194.1	-64.3	-188.1	1.20	-0.11	5.37
3,002.0	11.60	198.70	2,980.6	-213.1	-71.0	-206.5	1.29	-1.26	-1.16
3,096.0	11.30	194.90	3,072.8	-230.9	-76.4	-223.8	0.86	-0.32	-4.04
3,191.0	12.80	195.00	3,165.7	-250.1	-81.5	-242.5	1.58	1.58	0.11
3,286.0	14.10	206.30	3,258.1	-270.6	-89.3	-262.3	3.08	1.37	11.89
3,381.0	14.30	205.00	3,350.2	-291.7	-99.4	-282.4	0.40	0.21	-1.37
3,476.0	12.70	202.10	3,442.5	-312.0	-108.3	-301.9	1.83	-1.68	-3.05
3,571.0	12.60	201.20	3,535.2	-331.3	-116.0	-320.5	0.23	-0.11	-0.95
3,667.0	12.10	199.60	3,629.0	-350.5	-123.1	-339.1	0.63	-0.52	-1.67
3,762.0	9.80	201.90	3,722.3	-367.4	-129.5	-355.4	2.46	-2.42	2.42
3,856.0	6.30	196.10	3,815.3	-379.8	-133.9	-367.4	3.82	-3.72	-6.17
3,952.0	3.40	196.80	3,911.0	-387.6	-136.2	-374.9	3.02	-3.02	0.73
4,047.0	1.00	194.00	4,005.9	-391.1	-137.2	-378.4	2.53	-2.53	-2.95
4,142.0	0.30	146.50	4,100.9	-392.1	-137.3	-379.4	0.87	-0.74	-50.00
4,236.0	0.40	55.80	4,194.9	-392.1	-136.9	-379.4	0.54	0.11	-96.49
4,521.0	2.50	36.50	4,479.8	-386.6	-132.4	-374.2	0.75	0.74	-6.77
4,617.0	1.90	80.90	4,575.7	-384.6	-129.5	-372.6	1.83	-0.63	46.25
4,712.0	2.50	112.80	4,670.7	-385.2	-126.1	-373.4	1.41	0.63	33.58
4,807.0	3.20	147.00	4,765.6	-388.2	-122.7	-376.7	1.90	0.74	36.00
4,902.0	1.10	174.10	4,860.5	-391.4	-121.2	-379.9	2.40	-2.21	28.53
4,997.0	1.00	151.60	4,955.5	-393.0	-120.7	-381.6	0.44	-0.11	-23.68
5,092.0	1.00	146.20	5,050.5	-394.4	-119.8	-383.1	0.10	0.00	-5.68
5,187.0	0.70	121.20	5,145.4	-395.4	-118.9	-384.2	0.50	-0.32	-26.32
5,278.0	1.00	107.30	5,236.4	-395.9	-117.6	-384.8	0.40	0.33	-15.27
5,374.0	5.50	336.50	5,332.3	-391.9	-118.7	-380.7	6.46	4.69	-136.25
5,419.0	10.80	342.00	5,376.8	-386.0	-120.8	-374.6	11.89	11.78	12.22
5,469.0	16.60	348.00	5,425.4	-374.5	-123.8	-362.9	11.93	11.60	12.00
5,514.0	20.80	351.10	5,468.0	-360.3	-126.4	-348.6	9.59	9.33	6.89
5,564.0	26.20	355.70	5,513.8	-340.5	-128.6	-328.7	11.40	10.80	9.20
5,609.0	31.00	357.80	5,553.3	-319.0	-129.7	-307.1	10.90	10.67	4.67
5,659.0	36.70	358.90	5,594.9	-291.2	-130.5	-279.4	11.47	11.40	2.20
5,704.0	39.00	356.40	5,630.4	-263.6	-131.7	-251.8	6.14	5.11	-5.56
5,754.0	42.50	355.90	5,668.3	-231.1	-133.9	-219.1	7.03	7.00	-1.00
5,799.0	44.00	357.80	5,701.0	-200.3	-135.6	-188.3	4.41	3.33	4.22
5,849.0	46.10	356.60	5,736.4	-164.9	-137.3	-153.0	4.53	4.20	-2.40
5,894.0	50.10	358.00	5,766.4	-131.5	-138.9	-119.5	9.19	8.89	3.11

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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)
5,944.0	51.40	358.00	5,798.0	-92.8	-140.2	-80.8	2.60	2.60	0.00
5,989.0	51.30	354.10	5,826.2	-57.7	-142.6	-45.7	6.77	-0.22	-8.67
6,039.0	55.80	353.20	5,855.9	-17.8	-147.1	-5.5	9.12	9.00	-1.80
6,084.0	60.60	353.80	5,879.6	20.2	-151.4	32.7	10.73	10.67	1.33
6,134.0	63.10	354.80	5,903.1	64.1	-155.8	76.8	5.30	5.00	2.00
CROSSED HARD LINE @ 61169' MD / 5919' TVD									
6,169.0	64.27	355.66	5,918.7	95.3	-158.4	108.2	3.99	3.33	2.45
6,179.0	64.60	355.90	5,923.0	104.3	-159.1	117.2	3.99	3.34	2.42
6,229.0	65.70	355.70	5,944.0	149.6	-162.4	162.5	2.23	2.20	-0.40
6,274.0	68.10	356.60	5,961.6	190.9	-165.2	203.9	5.64	5.33	2.00
6,324.0	72.40	358.70	5,978.5	237.9	-167.1	250.9	9.46	8.60	4.20
6,369.0	77.00	359.20	5,990.4	281.3	-167.9	294.2	10.28	10.22	1.11
6,417.0	81.10	1.50	5,999.5	328.4	-167.6	341.2	9.75	8.54	4.79
6,457.0	84.70	359.70	6,004.5	368.1	-167.2	380.7	10.05	9.00	-4.50
6,502.0	87.80	358.10	6,007.4	413.0	-168.0	425.5	7.75	6.89	-3.56
6,552.0	90.30	359.40	6,008.2	462.9	-169.1	475.4	5.64	5.00	2.60
6,647.0	90.00	358.50	6,008.0	557.9	-170.8	570.2	1.00	-0.32	-0.95
6,742.0	89.70	358.30	6,008.2	652.9	-173.5	665.0	0.38	-0.32	-0.21
6,837.0	90.10	357.80	6,008.4	747.8	-176.7	759.9	0.67	0.42	-0.53
6,932.0	90.00	357.80	6,008.3	842.7	-180.4	854.8	0.11	-0.11	0.00
7,027.0	90.10	357.10	6,008.2	937.7	-184.6	949.7	0.74	0.11	-0.74
7,122.0	91.40	357.50	6,007.0	1,032.5	-189.1	1,044.7	1.43	1.37	0.42
7,217.0	90.70	357.10	6,005.3	1,127.4	-193.6	1,139.6	0.85	-0.74	-0.42
7,312.0	90.80	358.50	6,004.0	1,222.3	-197.2	1,234.5	1.48	0.11	1.47
7,407.0	88.90	358.10	6,004.3	1,317.3	-200.0	1,329.3	2.04	-2.00	-0.42
7,502.0	90.40	358.90	6,004.8	1,412.2	-202.5	1,424.2	1.79	1.58	0.84
7,597.0	88.80	358.90	6,005.5	1,507.2	-204.3	1,519.0	1.68	-1.68	0.00
7,692.0	89.30	358.30	6,007.1	1,602.2	-206.7	1,613.8	0.82	0.53	-0.63
7,787.0	89.20	357.50	6,008.3	1,697.1	-210.1	1,708.7	0.85	-0.11	-0.84
7,882.0	89.10	356.90	6,009.7	1,792.0	-214.8	1,803.6	0.64	-0.11	-0.63
7,977.0	90.80	356.90	6,009.8	1,886.8	-219.9	1,898.6	1.79	1.79	0.00
8,072.0	90.40	355.90	6,008.8	1,981.7	-225.9	1,993.6	1.13	-0.42	-1.05
8,167.0	90.80	355.90	6,007.8	2,076.4	-232.7	2,088.6	0.42	0.42	0.00
8,262.0	91.70	355.90	6,005.8	2,171.1	-239.5	2,183.5	0.95	0.95	0.00
8,356.0	92.30	356.00	6,002.5	2,264.8	-246.1	2,277.5	0.65	0.64	0.11
8,451.0	91.80	356.40	5,999.1	2,359.6	-252.4	2,372.4	0.67	-0.53	0.42
8,546.0	90.20	356.90	5,997.4	2,454.4	-257.9	2,467.3	1.76	-1.68	0.53
8,641.0	90.80	356.70	5,996.6	2,549.2	-263.2	2,562.3	0.67	0.63	-0.21
8,736.0	89.60	357.60	5,996.3	2,644.1	-268.0	2,657.2	1.58	-1.26	0.95
8,831.0	90.20	358.00	5,996.4	2,739.0	-271.6	2,752.1	0.76	0.63	0.42
8,926.0	91.10	358.10	5,995.3	2,834.0	-274.8	2,847.0	0.95	0.95	0.11
9,021.0	92.20	358.10	5,992.6	2,928.9	-278.0	2,941.9	1.16	1.16	0.00
9,116.0	90.80	358.90	5,990.1	3,023.8	-280.5	3,036.7	1.70	-1.47	0.84

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Project:	Weld County, CO	TVD Reference:	WELL @ 4846.0usft (H&P #326)
Site:	Sec 27, T9N, R59W, 6th P.M.	MD Reference:	WELL @ 4846.0usft (H&P #326)
Well:	Castor LC27-72HN	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)	
9,211.0	89.30	0.10	5,990.0	3,118.8	-281.3	3,131.4	2.02	-1.58	1.26	
9,306.0	88.40	358.70	5,991.9	3,213.8	-282.3	3,226.1	1.75	-0.95	-1.47	
9,401.0	88.00	358.50	5,994.9	3,308.7	-284.6	3,320.9	0.47	-0.42	-0.21	
9,496.0	88.10	358.10	5,998.2	3,403.6	-287.4	3,415.7	0.43	0.11	-0.42	
9,592.0	88.40	358.00	6,001.1	3,499.5	-290.7	3,511.6	0.33	0.31	-0.10	
9,686.0	88.60	356.00	6,003.6	3,593.4	-295.6	3,605.5	2.14	0.21	-2.13	
9,781.0	89.80	355.90	6,004.9	3,688.1	-302.3	3,700.5	1.27	1.26	-0.11	
9,876.0	90.40	356.60	6,004.7	3,782.9	-308.5	3,795.5	0.97	0.63	0.74	
9,971.0	89.90	355.00	6,004.5	3,877.6	-315.5	3,890.4	1.76	-0.53	-1.68	
10,066.0	89.80	354.00	6,004.7	3,972.2	-324.6	3,985.4	1.06	-0.11	-1.05	
10,161.0	89.70	352.90	6,005.1	4,066.6	-335.4	4,080.4	1.16	-0.11	-1.16	
10,256.0	89.80	354.00	6,005.5	4,161.0	-346.3	4,175.3	1.16	0.11	1.16	
10,275.0	90.00	355.00	6,005.6	4,179.9	-348.1	4,194.3	5.37	1.05	5.26	
TD @ 10320' MD / 6006' TVD										
10,320.0	90.00	355.00	6,005.6	4,224.7	-352.0	4,239.3	0.00	0.00	0.00	

Survey Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
638.0	638.0	0.0	0.0	TIE IN @ 638' MD / 638' TVD	
6,169.0	5,918.7	95.3	-158.4	CROSSED HARD LINE @ 61169' MD / 5919' TVD	
10,320.0	6,005.6	4,224.7	-352.0	TD @ 10320' MD / 6006' TVD	

Checked By: _____	Approved By: _____	Date: _____
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Survey Certification Sheet

Noble Energy
Company

RM-12605
Job Number

8/22/2012
Date

Sec 27,T9N,R59W,6thPM
Lease

Castor LC27-72HN
Well Name

Weld, CO
County & State

Surveyed from a depth of: 638 feet to 10320 feet MD

Type of Survey: MWD

Directional Supervisor/Surveyor: Worth Barham

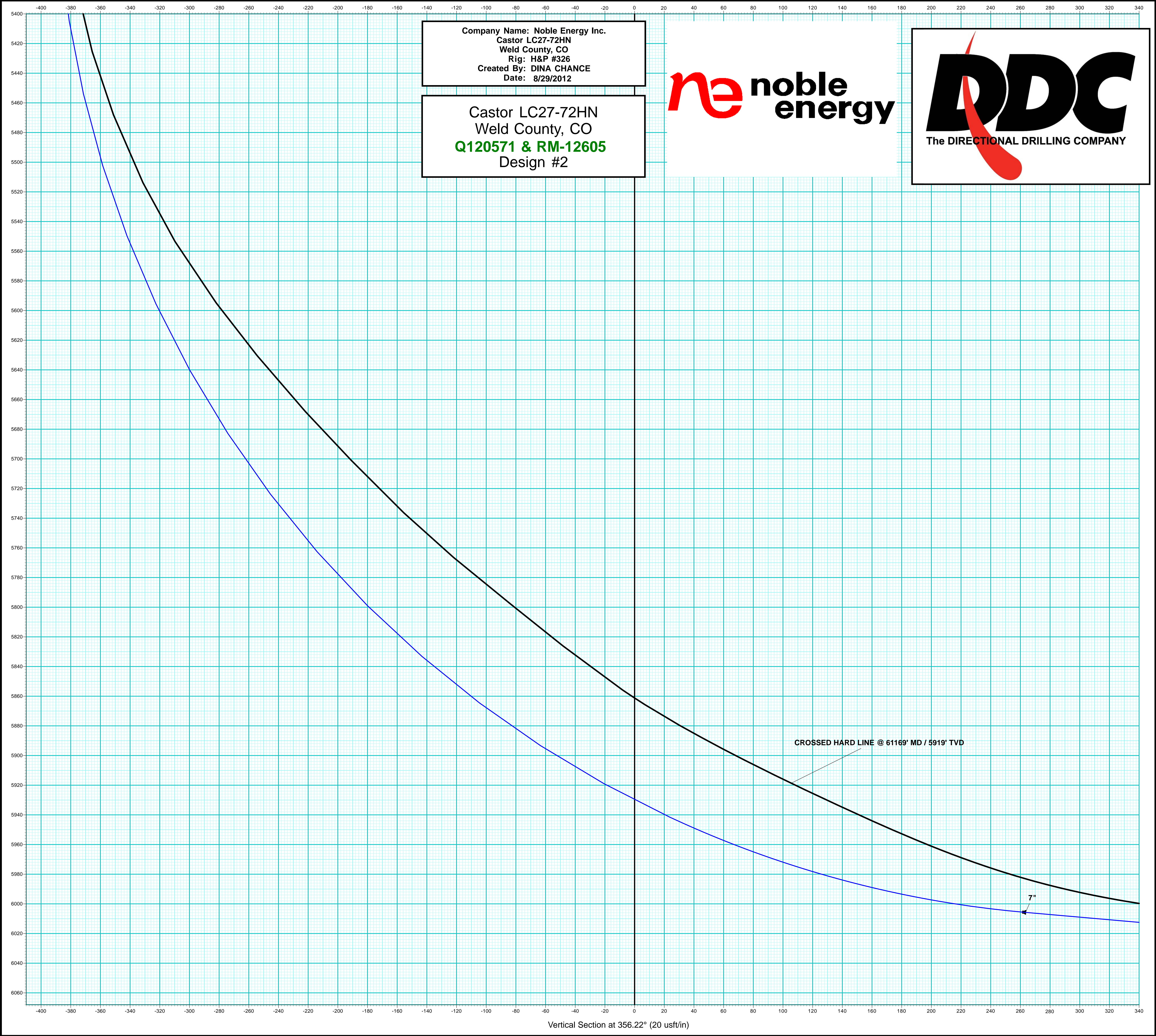
The data and calculations for this survey have been checked by me and conform to the standards and procedures set forth by **The Directional Drilling Company (DDC)**. This report represents a true and correct Directional survey of this well based on the original data obtained at the well site. Wellbore 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@directionaldrill
ers.com, c=US
Date: 2012.08.31 10:34:57
-05'00'

Larry Wright
MWD General Manager

Company Name: Noble Energy Inc.
Castor LC27-72HN
Weld County, CO
Rig: H&P #326
Created By: DINA CHANCE
Date: 8/29/2012

Castor LC27-72HN
Weld County, CO
Q120571 & RM-12605
Design #2



Company Name: Noble Energy Inc.
Castor LC27-72HN
Weld County, CO
Rig: H&P #326
Created By: DINA CHANCE
Date: 8/29/2012

Castor LC27-72HN
Weld County, CO
Q120571 & RM-12605
Design #2



T

G

M

Azimuths to Grid North

Magnetic North: 7.29°

Magnetic Field

Strength: 53256.5snT

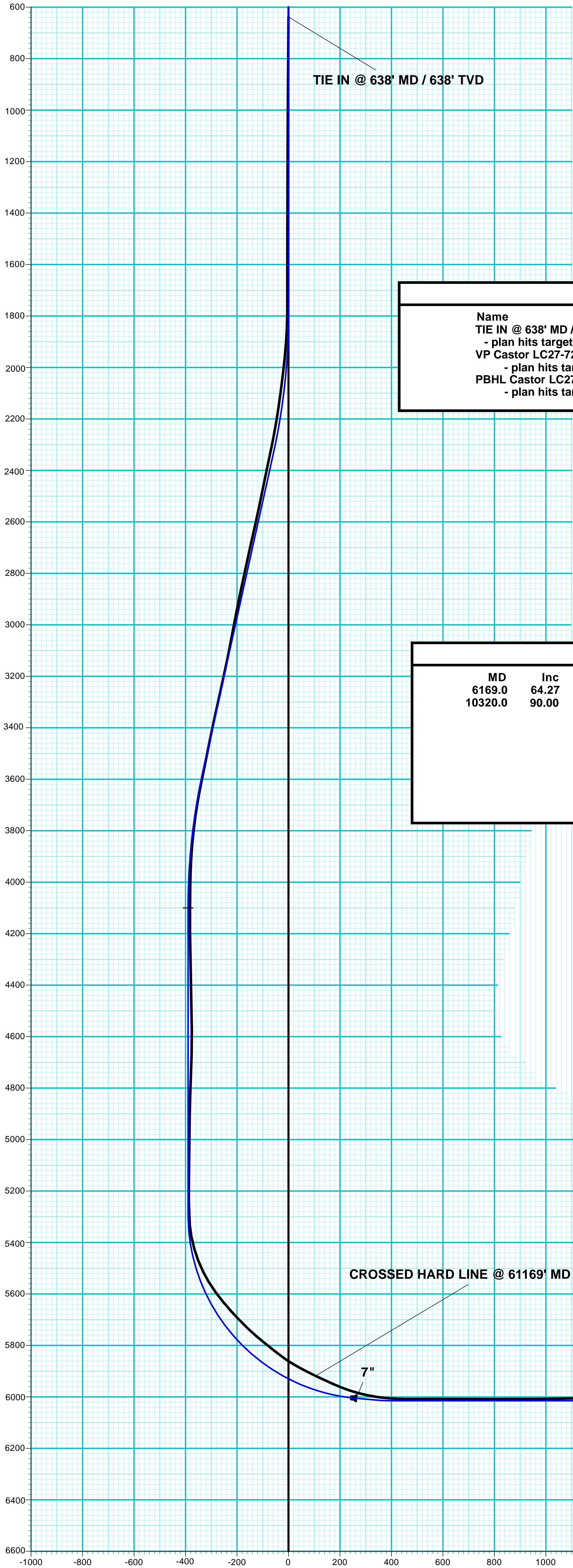
Dip Angle: 67.39°

Date: 8/14/2012

Model: IGRF2010

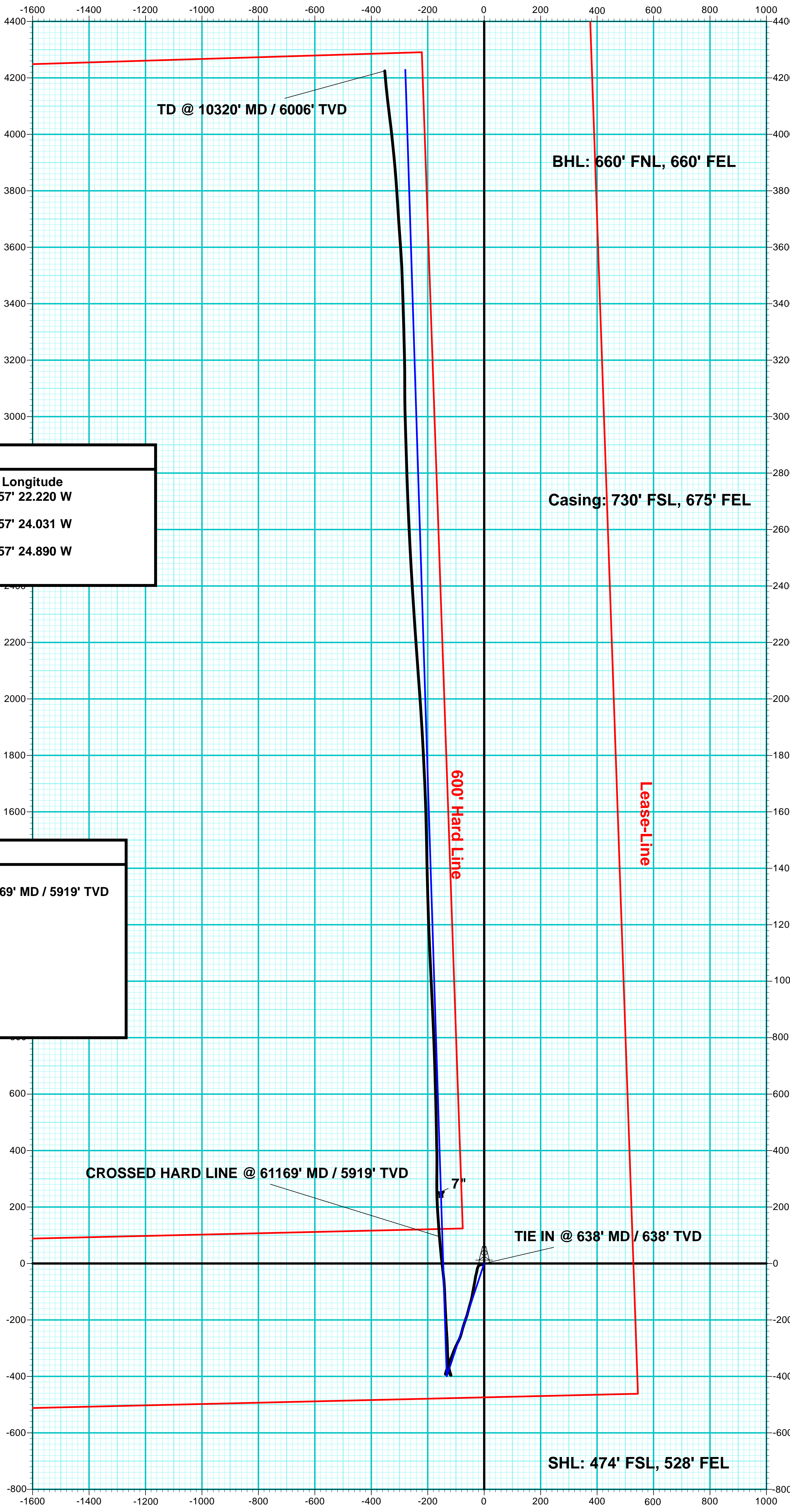
WELL DETAILS: Castor LC27-72HN					
+N/-S 0.0	+E/-W 0.0	Ground Level:		4816.0	
		Northing	Easting	Latitude	Longitude
		1507259.67	3427948.70	40° 42' 56.133 N	103° 57' 22.220 W

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 @ 638' MD / 638' TVD	638.0	0.0	0.0	1507259.67	3427948.70	40° 42' 56.133 N	103° 57' 22.220 W
- plan hits target center							
VP Castor LC27-72HN Design #2	100.0	-399.5	-132.5	1506860.17	3427816.20	40° 42' 52.209 N	103° 57' 24.031 W
- plan hits target center							
PBHL Castor LC27-72HN Design #2	425.0	4228.8	-279.2	1511488.46	3427669.48	40° 43' 37.960 N	103° 57' 24.890 W
- plan hits target center							

ANNOTATIONS									
MD	Inc	Azi	TVD	+N/-S	+E/-W	VSec	Departure	Annotation	
6169.0	64.27	355.66	5918.7	95.3	-158.4	108.2	950.4	CROSSED HARD LINE @ 61169' MD / 5919' TVD	
10320.0	90.00	355.00	6005.6	4224.7	-352.0	4239.3	5085.7	TD @ 10320' MD / 6006' TVD	



Vertical Section at 356.22° (200 usft/in)