

15-39761

Nadel & Gussman HEYCO, LLC

Eddy County, New Mexico (NAD83)

Sec 9, T18S, R26E

Iron Duke #2H

Wellbore #1

Survey: MWD

DDC Survey Report

18 September, 2012



email to KS 8-23-16

DDC
Survey Report



Company:	Nadel & Gussman HEYCO, LLC	Local Co-ordinate Reference:	Well Iron Duke #2H
Project:	Eddy County, New Mexico (NAD83)	TVD Reference:	WELL @ 3349.0usft (Patriot #1)
Site:	Sec 9, T18S, R26E	MD Reference:	WELL @ 3349.0usft (Patriot #1)
Well:	Iron Duke #2H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Wellbore #1	Database:	EDM 5000.1 Single User Db

Project	Eddy County, New Mexico (NAD83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	Sec 9, T18S, R26E		
Site Position:		Northing:	640,802.92 usft
From:	Map	Easting:	527,181.30 usft
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 45' 41.738 N
		Longitude:	104° 22' 45.786 W
		Grid Convergence:	-0.02 °

Well	Iron Duke #2H		
Well Position	+N/-S	0.0 usft	Northing: 640,802.92 usft
	+E/-W	0.0 usft	Easting: 527,181.30 usft
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 45' 41.738 N
		Longitude:	104° 22' 45.786 W
		Ground Level:	3,349.0 usft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination
	IGRF2010	6/8/2012	(°)
			7.88
			Dip Angle (°)
			60.52
			Field Strength (nT)
			48,752

Design	Wellbore #1		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction (°)
			269.28

Survey Program	Date	9/18/2012		
From	To	Survey (Wellbore)	Tool Name	Description
(usft)	(usft)			
100.0	2,000.0	Gyro (Wellbore #1)	Good_gyro	Good Gyro
2,028.0	6,975.0	MWD (Wellbore #1)	MWD default	MWD - Standard

Survey									
Measured	Inclination	Azimuth	Vertical	+N/-S	+E/-W	Vertical	Dogleg	Build	Turn
Depth	(°)	(°)	Depth	(usft)	(usft)	Section	Rate	Rate	Rate
(usft)			(usft)			(usft)	(°/100usft)	(°/100usft)	(°/100usft)
TIE IN @ 2000' MD / 2000' TVD									
2,000.0	0.55	86.60	1,999.7	14.9	24.6	-24.7	0.00	0.00	0.00
2,028.0	2.50	294.00	2,027.7	15.1	24.1	-24.3	10.71	6.96	-545.00
2,060.0	5.00	284.50	2,059.6	15.7	22.2	-22.3	8.02	7.81	-29.69
2,091.0	8.20	279.90	2,090.4	16.5	18.7	-18.9	10.45	10.32	-14.84
2,123.0	11.60	277.10	2,121.9	17.2	13.2	-13.4	10.73	10.63	-8.75
2,155.0	14.90	272.50	2,153.1	17.8	5.9	-6.1	10.82	10.31	-14.38
2,187.0	17.50	264.40	2,183.8	17.5	-3.0	2.8	10.75	8.13	-25.31
2,218.0	20.50	259.80	2,213.1	16.1	-13.0	12.8	10.81	9.68	-14.84
2,250.0	24.00	258.70	2,242.7	13.9	-24.9	24.7	11.01	10.94	-3.44

DDC
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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)
2,282.0	27.60	259.50	2,271.5	11.2	-38.5	38.4	11.30	11.25	2.50
2,314.0	31.20	260.10	2,299.4	8.4	-54.0	53.9	11.29	11.25	1.88
2,345.0	33.90	260.50	2,325.5	5.6	-70.4	70.4	8.74	8.71	1.29
2,377.0	36.80	260.30	2,351.6	2.6	-88.7	88.7	9.07	9.06	-0.63
CROSSED HARD LINE @ 2409' MD / 2377' TVD									
2,409.0	40.00	259.40	2,376.7	-1.0	-108.3	108.3	10.15	10.00	-2.81
2,440.0	43.10	258.10	2,399.9	-5.0	-128.4	128.5	10.38	10.00	-4.19
2,472.0	46.30	257.00	2,422.6	-9.8	-150.4	150.5	10.29	10.00	-3.44
2,504.0	48.80	257.30	2,444.2	-15.1	-173.4	173.6	7.84	7.81	0.94
2,535.0	51.70	257.80	2,464.0	-20.2	-196.7	196.9	9.44	9.35	1.61
2,567.0	54.60	257.80	2,483.2	-25.6	-221.7	222.0	9.06	9.06	0.00
2,599.0	57.30	257.90	2,501.2	-31.2	-247.6	248.0	8.44	8.44	0.31
2,630.0	59.60	259.00	2,517.4	-36.5	-273.5	273.9	8.01	7.42	3.55
2,662.0	62.00	260.40	2,533.0	-41.5	-301.0	301.5	8.42	7.50	4.38
2,694.0	65.00	262.60	2,547.3	-45.7	-329.3	329.9	11.21	9.38	6.88
2,726.0	68.30	264.80	2,559.9	-48.9	-358.5	359.1	12.09	10.31	6.88
2,757.0	70.30	266.40	2,570.9	-51.1	-387.4	388.0	8.06	6.45	5.16
2,789.0	73.70	267.80	2,580.8	-52.7	-417.8	418.4	11.41	10.63	4.38
2,821.0	77.30	268.40	2,588.8	-53.7	-448.8	449.4	11.40	11.25	1.88
2,843.0	80.00	268.80	2,593.1	-54.2	-470.3	471.0	12.40	12.27	1.82
2,941.0	90.70	274.40	2,601.1	-51.5	-567.8	568.4	12.31	10.92	5.71
2,973.0	90.90	274.00	2,600.6	-49.1	-599.7	600.3	1.40	0.63	-1.25
3,004.0	90.50	273.60	2,600.2	-47.1	-630.6	631.2	1.82	-1.29	-1.29
3,036.0	90.00	273.00	2,600.1	-45.2	-662.6	663.1	2.44	-1.56	-1.88
3,068.0	89.40	272.30	2,600.3	-43.8	-694.5	695.0	2.88	-1.88	-2.19
3,100.0	89.00	272.20	2,600.7	-42.5	-726.5	727.0	1.29	-1.25	-0.31
3,132.0	89.80	271.50	2,601.1	-41.5	-758.5	758.9	3.32	2.50	-2.19
3,164.0	90.20	271.50	2,601.1	-40.6	-790.5	790.9	1.25	1.25	0.00
3,196.0	90.80	271.00	2,600.8	-39.9	-822.5	822.9	2.44	1.88	-1.56
3,228.0	90.40	270.20	2,600.4	-39.6	-854.5	854.9	2.79	-1.25	-2.50
3,259.0	89.80	270.10	2,600.4	-39.5	-885.5	885.9	1.96	-1.94	-0.32
3,291.0	89.10	269.50	2,600.7	-39.6	-917.5	917.9	2.88	-2.19	-1.88
3,323.0	90.00	268.80	2,600.9	-40.1	-949.5	949.9	3.56	2.81	-2.19
3,355.0	90.00	268.50	2,600.9	-40.9	-981.4	981.9	0.94	0.00	-0.94
3,387.0	89.30	268.60	2,601.1	-41.7	-1,013.4	1,013.9	2.21	-2.19	0.31
3,419.0	90.80	268.10	2,601.1	-42.6	-1,045.4	1,045.9	4.94	4.69	-1.56
3,450.0	90.60	267.90	2,600.7	-43.7	-1,076.4	1,076.9	0.91	-0.65	-0.65
3,482.0	91.20	267.20	2,600.2	-45.0	-1,108.4	1,108.8	2.88	1.88	-2.19
3,514.0	91.00	266.40	2,599.6	-46.8	-1,140.3	1,140.8	2.58	-0.63	-2.50
3,546.0	91.50	265.90	2,598.9	-49.0	-1,172.2	1,172.8	2.21	1.56	-1.56
3,578.0	90.90	265.40	2,598.2	-51.4	-1,204.1	1,204.7	2.44	-1.88	-1.56
3,610.0	90.60	265.10	2,597.8	-54.0	-1,236.0	1,236.6	1.33	-0.94	-0.94
3,642.0	91.50	266.00	2,597.2	-56.5	-1,267.9	1,268.5	3.98	2.81	2.81

DDC
Survey Report



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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)
3,674.0	92.10	265.90	2,596.2	-58.8	-1,299.8	1,300.5	1.90	1.88	-0.31
3,705.0	91.60	265.70	2,595.2	-61.1	-1,330.7	1,331.4	1.74	-1.61	-0.65
3,738.0	90.90	265.00	2,594.5	-63.7	-1,363.6	1,364.3	3.00	-2.12	-2.12
3,769.0	91.00	264.40	2,594.0	-66.6	-1,394.5	1,395.2	1.96	0.32	-1.94
3,801.0	90.70	265.60	2,593.5	-69.4	-1,426.3	1,427.1	3.87	-0.94	3.75
3,833.0	90.30	267.00	2,593.2	-71.4	-1,458.3	1,459.1	4.55	-1.25	4.38
3,865.0	90.30	266.60	2,593.1	-73.2	-1,490.2	1,491.0	1.25	0.00	-1.25
3,897.0	91.20	268.00	2,592.7	-74.7	-1,522.2	1,523.0	5.20	2.81	4.38
3,929.0	91.00	270.60	2,592.0	-75.1	-1,554.2	1,555.0	8.15	-0.63	8.13
3,961.0	90.40	271.10	2,591.7	-74.7	-1,586.2	1,587.0	2.44	-1.88	1.56
3,992.0	90.20	271.10	2,591.5	-74.1	-1,617.2	1,618.0	0.65	-0.65	0.00
4,024.0	90.10	271.30	2,591.4	-73.4	-1,649.1	1,649.9	0.70	-0.31	0.63
4,056.0	90.20	271.00	2,591.3	-72.8	-1,681.1	1,681.9	0.99	0.31	-0.94
4,088.0	90.10	271.00	2,591.2	-72.2	-1,713.1	1,713.9	0.31	-0.31	0.00
4,120.0	89.60	270.50	2,591.3	-71.8	-1,745.1	1,745.9	2.21	-1.56	-1.56
4,152.0	89.20	270.20	2,591.7	-71.6	-1,777.1	1,777.9	1.56	-1.25	-0.94
4,184.0	90.30	270.40	2,591.8	-71.4	-1,809.1	1,809.9	3.49	3.44	0.63
4,216.0	90.70	270.40	2,591.5	-71.2	-1,841.1	1,841.9	1.25	1.25	0.00
4,247.0	91.30	270.40	2,591.0	-71.0	-1,872.1	1,872.9	1.94	1.94	0.00
4,279.0	91.50	270.50	2,590.2	-70.7	-1,904.1	1,904.9	0.70	0.63	0.31
4,311.0	91.40	270.40	2,589.4	-70.5	-1,936.1	1,936.8	0.44	-0.31	-0.31
4,343.0	91.60	270.80	2,588.5	-70.1	-1,968.1	1,968.8	1.40	0.63	1.25
4,375.0	91.70	271.10	2,587.6	-69.6	-2,000.1	2,000.8	0.99	0.31	0.94
4,406.0	91.50	270.40	2,586.8	-69.2	-2,031.1	2,031.8	2.35	-0.65	-2.26
4,438.0	89.90	270.40	2,586.4	-69.0	-2,063.1	2,063.8	5.00	-5.00	0.00
4,469.0	89.10	269.90	2,586.6	-68.9	-2,094.0	2,094.8	3.04	-2.58	-1.61
4,500.0	88.80	269.50	2,587.2	-69.1	-2,125.0	2,125.7	1.61	-0.97	-1.29
4,532.0	88.40	268.70	2,588.0	-69.6	-2,157.0	2,157.7	2.79	-1.25	-2.50
4,564.0	89.30	268.30	2,588.6	-70.4	-2,189.0	2,189.7	3.08	2.81	-1.25
4,596.0	89.60	268.30	2,588.9	-71.3	-2,221.0	2,221.7	0.94	0.94	0.00
4,628.0	90.20	268.00	2,589.0	-72.4	-2,253.0	2,253.7	2.10	1.88	-0.94
4,659.0	90.20	267.60	2,588.9	-73.6	-2,284.0	2,284.7	1.29	0.00	-1.29
4,691.0	89.90	267.50	2,588.9	-74.9	-2,315.9	2,316.7	0.99	-0.94	-0.31
4,722.0	89.50	267.90	2,589.0	-76.2	-2,346.9	2,347.7	1.82	-1.29	1.29
4,754.0	89.40	267.70	2,589.3	-77.4	-2,378.9	2,379.7	0.70	-0.31	-0.63
4,786.0	89.90	267.90	2,589.5	-78.6	-2,410.9	2,411.7	1.68	1.56	0.63
4,818.0	89.90	268.00	2,589.6	-79.8	-2,442.8	2,443.6	0.31	0.00	0.31
4,850.0	90.10	268.30	2,589.6	-80.8	-2,474.8	2,475.6	1.13	0.63	0.94
4,881.0	91.50	269.30	2,589.1	-81.5	-2,505.8	2,506.6	5.55	4.52	3.23
4,913.0	91.70	269.50	2,588.3	-81.8	-2,537.8	2,538.6	0.88	0.63	0.63
4,945.0	91.40	268.70	2,587.4	-82.3	-2,569.8	2,570.6	2.67	-0.94	-2.50
4,976.0	90.90	268.70	2,586.8	-83.0	-2,600.8	2,601.6	1.61	-1.61	0.00
5,008.0	90.90	268.50	2,586.3	-83.8	-2,632.7	2,633.6	0.62	0.00	-0.63
5,039.0	91.00	267.90	2,585.8	-84.8	-2,663.7	2,664.6	1.96	0.32	-1.94

DDC
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5,070.0	91.10	268.20	2,585.2	-85.8	-2,694.7	2,695.6	1.02	0.32	0.97
5,101.0	91.40	268.60	2,584.5	-86.7	-2,725.7	2,726.6	1.61	0.97	1.29
5,132.0	91.70	269.00	2,583.7	-87.3	-2,756.7	2,757.5	1.61	0.97	1.29
5,163.0	91.90	269.40	2,582.7	-87.8	-2,787.6	2,788.5	1.44	0.65	1.29
5,193.0	90.40	270.00	2,582.1	-87.9	-2,817.6	2,818.5	5.38	-5.00	2.00
5,224.0	90.20	269.70	2,581.9	-88.0	-2,848.6	2,849.5	1.16	-0.65	-0.97
5,255.0	90.20	270.10	2,581.8	-88.1	-2,879.6	2,880.5	1.29	0.00	1.29
5,285.0	90.40	270.60	2,581.7	-87.9	-2,909.6	2,910.5	1.80	0.67	1.67
5,317.0	90.30	270.40	2,581.5	-87.6	-2,941.6	2,942.5	0.70	-0.31	-0.63
5,348.0	90.20	269.90	2,581.3	-87.5	-2,972.6	2,973.5	1.64	-0.32	-1.61
5,378.0	90.20	270.00	2,581.2	-87.5	-3,002.6	3,003.5	0.33	0.00	0.33
5,409.0	89.70	270.00	2,581.3	-87.5	-3,033.6	3,034.5	1.61	-1.61	0.00
5,440.0	89.50	269.70	2,581.5	-87.6	-3,064.6	3,065.5	1.16	-0.65	-0.97
5,471.0	90.20	270.10	2,581.6	-87.7	-3,095.6	3,096.5	2.60	2.26	1.29
5,502.0	90.20	270.00	2,581.4	-87.6	-3,126.6	3,127.5	0.32	0.00	-0.32
5,532.0	90.30	269.90	2,581.3	-87.7	-3,156.6	3,157.5	0.47	0.33	-0.33
5,563.0	90.60	270.30	2,581.1	-87.6	-3,187.6	3,188.5	1.61	0.97	1.29
5,594.0	90.60	270.40	2,580.7	-87.4	-3,218.6	3,219.5	0.32	0.00	0.32
5,625.0	90.90	271.00	2,580.3	-87.0	-3,249.6	3,250.5	2.16	0.97	1.94
5,655.0	91.80	271.00	2,579.6	-86.5	-3,279.6	3,280.4	3.00	3.00	0.00
5,687.0	92.20	270.50	2,578.5	-86.1	-3,311.6	3,312.4	2.00	1.25	-1.56
5,717.0	91.70	270.40	2,577.5	-85.9	-3,341.6	3,342.4	1.70	-1.67	-0.33
5,748.0	91.10	270.30	2,576.7	-85.7	-3,372.6	3,373.4	1.96	-1.94	-0.32
5,780.0	91.20	270.70	2,576.1	-85.4	-3,404.6	3,405.4	1.29	0.31	1.25
5,810.0	91.50	271.10	2,575.4	-84.9	-3,434.5	3,435.3	1.67	1.00	1.33
5,841.0	92.00	272.20	2,574.4	-84.0	-3,465.5	3,466.3	3.90	1.61	3.55
5,873.0	92.50	272.30	2,573.2	-82.8	-3,497.5	3,498.2	1.59	1.56	0.31
5,904.0	91.40	272.00	2,572.1	-81.6	-3,528.4	3,529.2	3.68	-3.55	-0.97
5,935.0	91.20	271.70	2,571.4	-80.6	-3,559.4	3,560.1	1.16	-0.65	-0.97
5,967.0	91.20	271.60	2,570.8	-79.7	-3,591.4	3,592.1	0.31	0.00	-0.31
5,997.0	91.10	272.00	2,570.2	-78.8	-3,621.4	3,622.1	1.37	-0.33	1.33
6,029.0	91.10	271.70	2,569.5	-77.7	-3,653.3	3,654.0	0.94	0.00	-0.94
6,061.0	91.40	271.70	2,568.8	-76.8	-3,685.3	3,686.0	0.94	0.94	0.00
6,092.0	91.70	271.50	2,568.0	-75.9	-3,716.3	3,717.0	1.16	0.97	-0.65
6,124.0	91.90	271.60	2,567.0	-75.0	-3,748.3	3,748.9	0.70	0.63	0.31
6,156.0	91.50	271.50	2,566.1	-74.2	-3,780.2	3,780.9	1.29	-1.25	-0.31
6,187.0	91.00	270.80	2,565.4	-73.6	-3,811.2	3,811.8	2.77	-1.61	-2.26
6,219.0	90.50	270.20	2,565.0	-73.3	-3,843.2	3,843.8	2.44	-1.56	-1.88
6,251.0	90.10	269.90	2,564.8	-73.3	-3,875.2	3,875.8	1.56	-1.25	-0.94
6,282.0	90.20	269.60	2,564.7	-73.4	-3,906.2	3,906.8	1.02	0.32	-0.97
6,314.0	90.30	269.40	2,564.6	-73.7	-3,938.2	3,938.8	0.70	0.31	-0.63
6,346.0	90.20	268.80	2,564.4	-74.2	-3,970.2	3,970.8	1.90	-0.31	-1.88
6,377.0	89.80	268.80	2,564.4	-74.8	-4,001.2	4,001.8	1.29	-1.29	0.00

DDC
Survey Report



Company:	Nadel & Gussman HEYCO, LLC	Local Co-ordinate Reference:	Well Iron Duke #2H
Project:	Eddy County, New Mexico (NAD83)	TVD Reference:	WELL @ 3349.0usft (Patriot #1)
Site:	Sec 9, T18S, R26E	MD Reference:	WELL @ 3349.0usft (Patriot #1)
Well:	Iron Duke #2H	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)
6,409.0	89.90	269.00	2,564.5	-75.4	-4,033.2	4,033.8	0.70	0.31	0.63
6,441.0	89.80	268.70	2,564.6	-76.1	-4,065.2	4,065.8	0.99	-0.31	-0.94
6,473.0	89.70	268.50	2,564.7	-76.9	-4,097.2	4,097.8	0.70	-0.31	-0.63
6,505.0	89.40	268.60	2,565.0	-77.7	-4,129.2	4,129.8	0.99	-0.94	0.31
6,537.0	90.20	268.30	2,565.1	-78.5	-4,161.2	4,161.8	2.67	2.50	-0.94
6,568.0	90.00	267.90	2,565.0	-79.6	-4,192.1	4,192.8	1.44	-0.65	-1.29
6,600.0	89.30	267.70	2,565.2	-80.8	-4,224.1	4,224.8	2.28	-2.19	-0.63
6,632.0	89.50	267.30	2,565.6	-82.2	-4,256.1	4,256.8	1.40	0.63	-1.25
6,664.0	89.80	267.40	2,565.8	-83.7	-4,288.1	4,288.8	0.99	0.94	0.31
6,696.0	89.50	267.70	2,566.0	-85.0	-4,320.0	4,320.7	1.33	-0.94	0.94
6,728.0	89.60	267.50	2,566.2	-86.4	-4,352.0	4,352.7	0.70	0.31	-0.63
6,759.0	89.20	267.20	2,566.5	-87.8	-4,383.0	4,383.7	1.61	-1.29	-0.97
6,791.0	89.10	266.90	2,567.0	-89.4	-4,414.9	4,415.7	0.99	-0.31	-0.94
6,823.0	89.10	267.10	2,567.5	-91.1	-4,446.9	4,447.7	0.62	0.00	0.63
6,855.0	88.80	267.00	2,568.1	-92.8	-4,478.8	4,479.6	0.99	-0.94	-0.31
6,887.0	88.70	266.80	2,568.8	-94.5	-4,510.8	4,511.6	0.70	-0.31	-0.63
6,919.0	88.70	266.50	2,569.5	-96.4	-4,542.7	4,543.5	0.94	0.00	-0.94
TD @ 6975' MD / 2571' TVD									
6,975.0	88.70	266.50	2,570.8	-99.8	-4,598.6	4,599.5	0.00	0.00	0.00

Survey Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
2,000.0	1,999.7	14.9	24.6	TIE IN @ 2000' MD / 2000' TVD
2,409.0	2,376.7	-1.0	-108.3	CROSSED HARD LINE @ 2409' MD / 2377' TVD
6,975.0	2,570.8	-99.8	-4,598.6	TD @ 6975' MD / 2571' TVD

Checked By: _____ Approved By: _____ Date: _____