



Marathon Oil

NM OIL CONSERVATION
ARTESIA DISTRICT

DEC 04 2017

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Marathon Oil

Eddy County, NM

Cass 16 State

No. 2H

30-015-42733

OH

Design: Gyro/MWD 64' - 14015' PTB 14080'

Standard Survey Report

10 August, 2017



PRODIRECTIONAL

Company: Marathon Oil
Project: Eddy County, NM
Site: Cass 16 State
Well: No. 2H
Wellbore: OH
Design: Gyro/MWD 64' - 14015' PTB 14080'

Local Co-ordinate Reference: Well No. 2H
TVD Reference: Well @ 3189.00usft (GL: 3164' + KB: 25' (H&P498))
MD Reference: Well @ 3189.00usft (GL: 3164' + KB: 25' (H&P498))
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: WellPlanner1

Project	Eddy County, NM		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site	Cass 16 State		
Site Position:		Northing:	475,277.35 usft
From:	Map	Easting:	540,500.53 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32.306586°N
		Longitude:	104.202246°W
		Grid Convergence:	0.07 °

Well	No. 2H		
Well Position	+N/-S	0.00 usft	Northing: 475,607.36 usft
	+E/-W	0.00 usft	Easting: 539,928.05 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32.307495°N
		Longitude:	104.204098°W
		Ground Level:	3,164.00 usft

Wellbore	OH		
Magnetics	Model Name	Sample Date	Declination (°)
	HDGM	8/1/2017	7.42
		Dip Angle (°)	60.10
		Field Strength (nT)	48,088.50

Design	Gyro/MWD 64' - 14015' PTB 14080'		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.00	0.00	0.00
		Direction (°)	88.16

Survey Program	Date 8/10/2017		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
64.40	404.80	Gyro (OH)	GYRO-MWD
524.00	14,080.00	ProMWD (OH)	MWD+IFR1
			Description
			OWSG Gyro MWD
			OWSG MWD + IFR1

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)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
64.40	0.10	206.57	64.40	-0.05	-0.03	-0.03	0.16	0.16	0.00
94.50	0.03	274.75	94.50	-0.07	-0.04	-0.05	0.31	-0.23	226.51
189.50	0.91	334.85	189.50	0.61	-0.39	-0.37	0.94	0.93	63.26
282.00	2.64	352.20	281.95	3.39	-0.99	-0.88	1.94	1.87	18.76
373.90	3.87	355.20	373.70	8.58	-1.54	-1.26	1.35	1.34	3.26
404.80	3.55	358.63	404.53	10.57	-1.65	-1.31	1.26	-1.04	11.10
524.00	3.60	0.30	523.50	18.00	-1.72	-1.14	0.10	0.04	1.40

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617.00	3.40	0.30	616.33	23.68	-1.69	-0.93	0.22	-0.22	0.00
709.00	3.00	1.90	708.18	28.81	-1.59	-0.67	0.45	-0.43	1.74
802.00	2.60	1.10	801.07	33.36	-1.47	-0.40	0.43	-0.43	-0.86
897.00	2.20	7.60	895.99	37.32	-1.19	0.01	0.51	-0.42	6.84
991.00	1.70	10.30	989.94	40.48	-0.70	0.60	0.54	-0.53	2.87
1,086.00	1.40	0.70	1,084.90	43.02	-0.44	0.95	0.42	-0.32	-10.11
1,181.00	1.00	23.40	1,179.88	44.95	-0.09	1.35	0.65	-0.42	23.89
1,275.00	1.30	70.70	1,273.86	46.05	1.24	2.72	1.02	0.32	50.32
1,370.00	2.20	96.30	1,368.82	46.21	4.07	5.55	1.23	0.95	26.95
1,465.00	2.50	96.70	1,463.74	45.76	7.94	9.41	0.32	0.32	0.42
1,559.00	3.60	97.10	1,557.60	45.16	12.90	14.35	1.17	1.17	0.43
1,654.00	3.50	106.20	1,652.42	43.98	18.65	20.05	0.60	-0.11	9.58
1,749.00	3.60	112.20	1,747.24	42.05	24.20	25.53	0.40	0.11	6.32
1,843.00	2.30	120.00	1,841.11	39.99	28.56	29.83	1.44	-1.38	8.30
1,916.00	2.20	112.60	1,914.06	38.72	31.12	32.35	0.42	-0.14	-10.14
2,017.00	3.60	81.30	2,014.93	38.45	36.05	37.26	2.04	1.39	-30.99
2,112.00	3.40	33.40	2,109.78	41.26	40.55	41.85	3.00	-0.21	-50.42
2,206.00	3.80	353.50	2,203.60	46.68	41.73	43.21	2.64	0.43	-42.45
2,301.00	5.40	330.50	2,298.30	53.70	39.17	40.88	2.54	1.68	-24.21
2,396.00	5.50	326.20	2,392.87	61.37	34.44	36.39	0.44	0.11	-4.53
2,490.00	5.40	326.20	2,486.45	68.79	29.47	31.67	0.11	-0.11	0.00
2,585.00	5.10	325.80	2,581.05	76.00	24.61	27.04	0.32	-0.32	-0.42
2,679.00	5.80	344.00	2,674.63	84.02	20.95	23.64	1.97	0.74	19.36
2,774.00	6.00	359.40	2,769.13	93.60	19.58	22.57	1.67	0.21	16.21
2,869.00	6.20	15.40	2,863.60	103.51	20.89	24.20	1.80	0.21	16.84
2,963.00	6.00	8.00	2,957.07	113.27	22.92	26.55	0.86	-0.21	-7.87
3,058.00	5.80	8.10	3,051.57	122.94	24.29	28.22	0.21	-0.21	0.11
3,152.00	5.80	4.50	3,145.09	132.38	25.33	29.57	0.39	0.00	-3.83
3,247.00	5.50	4.30	3,239.63	141.70	26.05	30.58	0.32	-0.32	-0.21
3,341.00	5.30	0.70	3,333.21	150.53	26.44	31.26	0.42	-0.21	-3.83
3,436.00	5.40	11.20	3,427.80	159.31	27.36	32.46	1.03	0.11	11.05
3,531.00	5.50	12.40	3,522.37	168.14	29.21	34.59	0.16	0.11	1.26
3,625.00	6.20	0.10	3,615.88	177.61	30.18	35.87	1.52	0.74	-13.09
3,720.00	6.10	0.50	3,710.34	187.79	30.24	36.25	0.11	-0.11	0.42
3,814.00	6.30	359.00	3,803.79	197.94	30.19	36.53	0.27	0.21	-1.60
3,908.00	5.90	356.30	3,897.25	207.92	29.79	36.45	0.52	-0.43	-2.87
4,003.00	6.40	4.40	3,991.71	218.07	29.88	36.87	1.05	0.53	8.53
4,097.00	5.90	2.10	4,085.17	228.12	30.46	37.77	0.59	-0.53	-2.45
4,192.00	5.30	0.80	4,179.71	237.39	30.70	38.30	0.65	-0.63	-1.37
4,287.00	6.20	7.80	4,274.24	246.86	31.46	39.37	1.20	0.95	7.37
4,381.00	6.00	7.20	4,367.70	256.76	32.76	40.99	0.22	-0.21	-0.64
4,476.00	5.30	0.40	4,462.24	266.08	33.41	41.94	1.02	-0.74	-7.16

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4,571.00	4.90	356.70	4,556.87	274.52	33.21	42.01	0.54	-0.42	-3.89
4,665.00	5.80	6.30	4,650.46	283.25	33.50	42.58	1.35	0.96	10.21
4,760.00	5.40	7.60	4,745.00	292.45	34.62	43.99	0.44	-0.42	1.37
4,854.00	4.80	6.60	4,838.63	300.74	35.65	45.29	0.65	-0.64	-1.06
4,949.00	5.10	16.80	4,933.28	308.73	37.33	47.23	0.98	0.32	10.74
5,043.00	4.90	18.10	5,026.92	316.55	39.79	49.93	0.24	-0.21	1.38
5,138.00	4.90	6.20	5,121.58	324.44	41.49	51.88	1.07	0.00	-12.53
5,233.00	4.30	5.10	5,216.27	332.02	42.24	52.88	0.64	-0.63	-1.16
5,327.00	3.60	5.40	5,310.05	338.46	42.83	53.68	0.75	-0.74	0.32
5,422.00	3.00	3.50	5,404.89	343.92	43.26	54.28	0.64	-0.63	-2.00
5,517.00	4.20	9.20	5,499.70	349.83	43.97	55.18	1.32	1.26	6.00
5,611.00	5.70	1.90	5,593.35	357.89	44.68	56.15	1.73	1.60	-7.77
5,706.00	7.40	359.40	5,687.72	368.73	44.77	56.59	1.81	1.79	-2.63
5,800.00	7.50	0.70	5,780.93	380.92	44.78	56.99	0.21	0.11	1.38
5,895.00	7.20	11.50	5,875.15	392.95	46.04	58.64	1.49	-0.32	11.37
5,989.00	6.30	16.80	5,968.50	403.66	48.71	61.64	1.16	-0.96	5.64
6,084.00	5.90	9.30	6,062.97	413.47	51.00	64.25	0.94	-0.42	-7.89
6,179.00	5.60	12.30	6,157.49	422.82	52.78	66.33	0.45	-0.32	3.16
6,273.00	2.00	12.10	6,251.27	428.90	54.10	67.85	3.83	-3.83	-0.21
6,368.00	6.20	2.90	6,346.00	435.65	54.71	68.67	4.46	4.42	-9.68
6,462.00	5.90	1.80	6,439.48	445.55	55.12	69.40	0.34	-0.32	-1.17
6,557.00	5.50	3.00	6,534.01	454.98	55.51	70.09	0.44	-0.42	1.26
6,652.00	5.10	1.00	6,628.60	463.74	55.82	70.68	0.46	-0.42	-2.11
6,747.00	4.50	15.00	6,723.27	471.57	56.86	71.97	1.38	-0.63	14.74
6,841.00	4.30	6.00	6,817.00	478.63	58.18	73.52	0.76	-0.21	-9.57
6,936.00	5.90	3.10	6,911.62	487.05	58.82	74.43	1.71	1.68	-3.05
7,030.00	7.60	8.90	7,004.96	498.02	60.04	76.00	1.95	1.81	6.17
7,125.00	6.70	7.30	7,099.22	509.72	61.72	78.05	0.97	-0.95	-1.68
7,220.00	7.80	12.10	7,193.46	521.52	63.77	80.49	1.32	1.16	5.05
7,314.00	6.30	6.70	7,286.75	532.88	65.71	82.79	1.74	-1.60	-5.74
7,409.00	7.10	4.30	7,381.10	543.91	66.76	84.19	0.89	0.84	-2.53
7,503.00	5.40	350.40	7,474.54	554.07	66.46	84.22	2.41	-1.81	-14.79
7,598.00	6.80	346.00	7,569.01	563.93	64.35	82.43	1.55	1.47	-4.63
7,692.00	10.10	358.80	7,661.98	577.58	62.83	81.35	4.02	3.51	13.62
7,787.00	6.50	348.20	7,755.97	591.17	61.56	80.51	4.10	-3.79	-11.16
7,882.00	9.10	359.00	7,850.09	603.95	60.33	79.69	3.13	2.74	11.37
7,976.00	10.10	15.50	7,942.79	619.33	62.40	82.26	3.10	1.06	17.55
8,071.00	7.90	16.80	8,036.62	633.61	66.52	86.83	2.33	-2.32	1.37
8,166.00	5.60	25.00	8,130.95	644.06	70.36	91.01	2.62	-2.42	8.63
8,260.00	2.30	26.10	8,224.72	649.91	73.13	93.96	3.51	-3.51	1.17
8,355.00	1.80	31.20	8,319.66	652.90	74.74	95.67	0.56	-0.53	5.37
8,448.00	1.30	35.40	8,412.62	655.01	76.11	97.10	0.55	-0.54	4.52

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8,495.00	4.90	46.50	8,459.55	656.83	77.88	98.92	7.73	7.66	23.62
8,542.00	10.70	54.50	8,506.09	660.75	82.89	104.06	12.53	12.34	17.02
8,589.00	15.70	64.40	8,551.84	666.03	92.18	113.52	11.64	10.64	21.06
8,637.00	20.70	75.30	8,597.44	671.00	106.26	127.75	12.56	10.42	22.71
8,684.00	24.20	85.80	8,640.89	673.81	123.91	145.48	11.30	7.45	22.34
8,732.00	28.30	92.30	8,683.94	674.08	145.11	166.68	10.42	8.54	13.54
8,779.00	32.50	96.40	8,724.47	672.22	168.80	190.30	9.96	8.94	8.72
8,826.00	37.00	92.30	8,763.09	670.24	195.50	216.92	10.78	9.57	-8.72
8,873.00	42.60	89.30	8,799.18	669.87	225.56	246.95	12.59	11.91	-6.38
8,921.00	46.90	89.60	8,833.26	670.19	259.34	280.73	8.97	8.96	0.63
8,968.00	51.00	90.40	8,864.12	670.18	294.78	316.15	8.82	8.72	1.70
9,016.00	55.70	91.60	8,892.77	669.50	333.27	354.60	9.99	9.79	2.50
9,061.00	61.30	92.30	8,916.27	668.19	371.60	392.86	12.51	12.44	1.56
9,085.00	64.00	92.40	8,927.30	667.31	392.90	414.12	11.26	11.25	0.42
9,170.00	73.40	92.30	8,958.14	664.07	471.94	493.02	11.06	11.06	-0.12
9,221.00	78.20	92.60	8,970.65	661.96	521.32	542.31	9.43	9.41	0.59
9,265.00	76.80	90.50	8,980.17	660.79	564.26	585.18	5.64	-3.18	-4.77
9,312.00	76.20	90.10	8,991.14	660.55	609.96	630.85	1.52	-1.28	-0.85
9,359.00	75.00	89.30	9,002.83	660.79	655.48	676.36	3.04	-2.55	-1.70
9,405.00	73.50	86.70	9,015.32	662.33	699.72	720.63	6.34	-3.26	-5.65
9,454.00	74.00	85.70	9,029.03	665.45	746.66	767.64	2.21	1.02	-2.04
9,501.00	80.80	83.00	9,039.28	669.98	792.27	813.37	15.51	14.47	-5.74
9,548.00	89.20	81.60	9,043.37	676.25	838.63	859.91	18.12	17.87	-2.98
9,643.00	93.80	83.60	9,040.89	688.48	932.77	954.40	5.28	4.84	2.11
9,738.00	91.90	86.70	9,036.16	696.50	1,027.30	1,049.13	3.82	-2.00	3.26
9,832.00	90.10	89.80	9,034.52	699.37	1,121.23	1,143.10	3.81	-1.91	3.30
9,927.00	90.80	96.20	9,033.77	694.40	1,216.04	1,237.71	6.78	0.74	6.74
10,021.00	85.20	96.60	9,037.05	683.93	1,309.36	1,330.65	5.97	-5.96	0.43
10,115.00	83.90	93.70	9,045.98	675.53	1,402.55	1,423.51	3.37	-1.38	-3.09
10,210.00	84.30	89.30	9,055.75	673.06	1,496.99	1,517.83	4.63	0.42	-4.63
10,305.00	85.90	86.60	9,063.87	676.45	1,591.57	1,612.47	3.29	1.68	-2.84
10,400.00	87.90	84.40	9,069.01	683.89	1,686.13	1,707.22	3.13	2.11	-2.32
10,494.00	90.70	84.80	9,070.15	692.73	1,779.69	1,801.02	3.01	2.98	0.43
10,589.00	83.90	87.90	9,074.63	698.78	1,874.33	1,895.80	7.86	-7.16	3.26
10,683.00	83.60	86.00	9,084.86	703.75	1,967.63	1,989.21	2.03	-0.32	-2.02
10,708.00	84.30	85.70	9,087.50	705.55	1,992.43	2,014.05	3.04	2.80	-1.20
10,802.00	89.30	83.40	9,092.74	714.46	2,085.82	2,107.68	5.85	5.32	-2.45
10,897.00	89.90	84.50	9,093.41	724.47	2,180.29	2,202.42	1.32	0.63	1.16
10,992.00	90.50	87.40	9,093.07	731.18	2,275.04	2,297.34	3.12	0.63	3.05
11,086.00	88.80	87.70	9,093.65	735.20	2,368.95	2,391.33	1.84	-1.81	0.32
11,181.00	88.10	88.60	9,096.22	738.27	2,463.86	2,486.30	1.20	-0.74	0.95
11,275.00	90.70	88.90	9,097.20	740.32	2,557.83	2,580.28	2.78	2.77	0.32

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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)
11,369.00	90.80	90.70	9,095.97	740.65	2,651.81	2,674.23	1.92	0.11	1.91
11,464.00	88.90	91.00	9,096.22	739.24	2,746.80	2,769.12	2.02	-2.00	0.32
11,558.00	91.80	91.90	9,095.65	736.86	2,840.75	2,862.95	3.23	3.09	0.96
11,653.00	88.80	90.70	9,095.15	734.70	2,935.72	2,957.79	3.40	-3.16	-1.26
11,748.00	86.90	90.30	9,098.71	733.87	3,030.64	3,052.64	2.04	-2.00	-0.42
11,843.00	88.20	88.30	9,102.77	735.04	3,125.54	3,147.53	2.51	1.37	-2.11
11,937.00	88.90	88.10	9,105.15	737.99	3,219.46	3,241.50	0.77	0.74	-0.21
12,032.00	94.90	85.40	9,102.00	743.36	3,314.21	3,336.37	6.92	6.32	-2.84
12,126.00	93.70	86.00	9,094.96	750.39	3,407.68	3,430.01	1.43	-1.28	0.64
12,221.00	88.10	87.90	9,093.46	755.44	3,502.49	3,524.94	6.22	-5.89	2.00
12,316.00	91.70	88.70	9,093.63	758.26	3,597.43	3,619.92	3.88	3.79	0.84
12,410.00	90.00	88.90	9,092.24	760.23	3,691.39	3,713.90	1.82	-1.81	0.21
12,505.00	89.90	89.10	9,092.32	761.89	3,786.38	3,808.89	0.24	-0.11	0.21
12,599.00	89.90	89.00	9,092.48	763.44	3,880.37	3,902.88	0.11	0.00	-0.11
12,694.00	89.80	89.20	9,092.73	764.94	3,975.36	3,997.87	0.24	-0.11	0.21
12,788.00	88.20	87.80	9,094.37	767.40	4,069.30	4,091.84	2.26	-1.70	-1.49
12,883.00	91.30	88.10	9,094.79	770.79	4,164.23	4,186.83	3.28	3.26	0.32
12,977.00	88.20	86.80	9,095.20	774.97	4,258.12	4,280.81	3.58	-3.30	-1.38
13,072.00	88.40	86.00	9,098.02	780.94	4,352.89	4,375.72	0.87	0.21	-0.84
13,166.00	90.60	86.30	9,098.84	787.25	4,446.67	4,469.66	2.36	2.34	0.32
13,261.00	89.70	85.50	9,098.59	794.04	4,541.43	4,564.58	1.27	-0.95	-0.84
13,355.00	89.10	85.90	9,099.57	801.09	4,635.16	4,658.49	0.77	-0.64	0.43
13,450.00	89.30	85.60	9,100.90	808.13	4,729.88	4,753.39	0.38	0.21	-0.32
13,545.00	88.70	86.40	9,102.56	814.75	4,824.64	4,848.31	1.05	-0.63	0.84
13,639.00	87.60	85.80	9,105.59	821.14	4,918.37	4,942.20	1.33	-1.17	-0.64
13,733.00	86.90	85.60	9,110.10	828.18	5,012.00	5,036.00	0.77	-0.74	-0.21
13,828.00	87.50	86.70	9,114.74	834.55	5,106.67	5,130.83	1.32	0.63	1.16
13,922.00	88.70	87.90	9,117.86	838.98	5,200.51	5,224.76	1.80	1.28	1.28
14,015.00	90.30	86.40	9,118.67	843.60	5,293.38	5,317.74	2.36	1.72	-1.61
Last Survey: 14015' MD, 9119' TVD									
14,080.00	90.30	86.40	9,118.33	847.68	5,358.25	5,382.71	0.00	0.00	0.00
PTB: 14080' MD, 9118' TVD									

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
14,015.00	9,118.67	843.60	5,293.38	Last Survey: 14015' MD, 9119' TVD
14,080.00	9,118.33	847.68	5,358.25	PTB: 14080' MD, 9118' TVD



Marathon Oil Corporation

Marathon Oil
Eddy County, NM
Cass 16 State
No. 2H
Plan #2 - FINAL PVA
GL: 3164' + KB: 25' (H&P498)

US State Plane 1983 (Exact solution)
NAD 1983 Zone 10N (CONUS)
Clarke 1866
New Mexico East 3001
Mean Sea Level

RKB Elevation: Well @ 3189.00usft (GL: 3164' + KB: 25' (H&P498))

	+N-S	+E-W	North	East	Longitude	Latitude	Slot
	0.00	0.00	475607.36	539928.05	104.204098°W	32.307495°N	

SECTION DETAILS

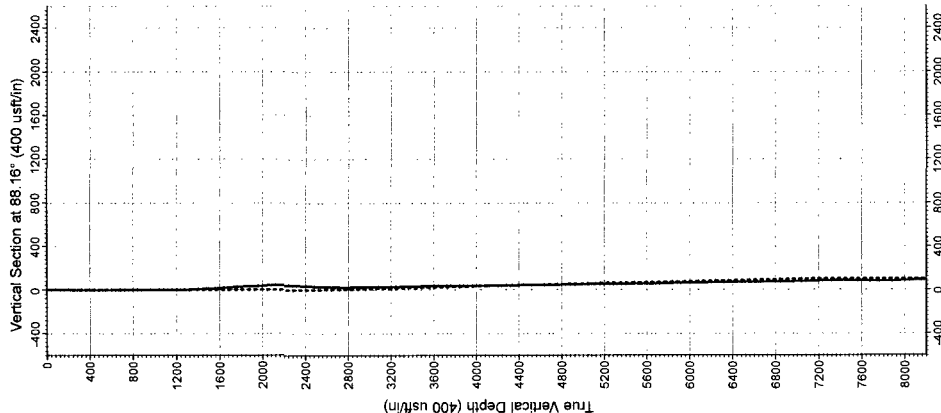
Sec	MD	Inc	Azi	TVD	+N-S	+E-W	Diag	Vsect
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2000.00	0.00	0.00	2000.00	0.00	0.00	0.00	0.00
3	3065.67	8.00	7.07	2963.20	73.15	9.15	0.75	11.52
4	3883.50	8.00	7.07	2881.50	73.15	9.15	0.75	11.52
5	7431.13	0.00	0.00	7431.13	80.50	8.50	2.00	91.30
6	8528.84	0.00	0.00	7387.79	80.50	8.50	2.00	101.30
7	9421.87	89.30	88.16	8485.50	80.50	8.50	10.00	667.29
8	14137.83	89.30	88.16	9058.42	667.21	646.20	10.00	5382.89

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

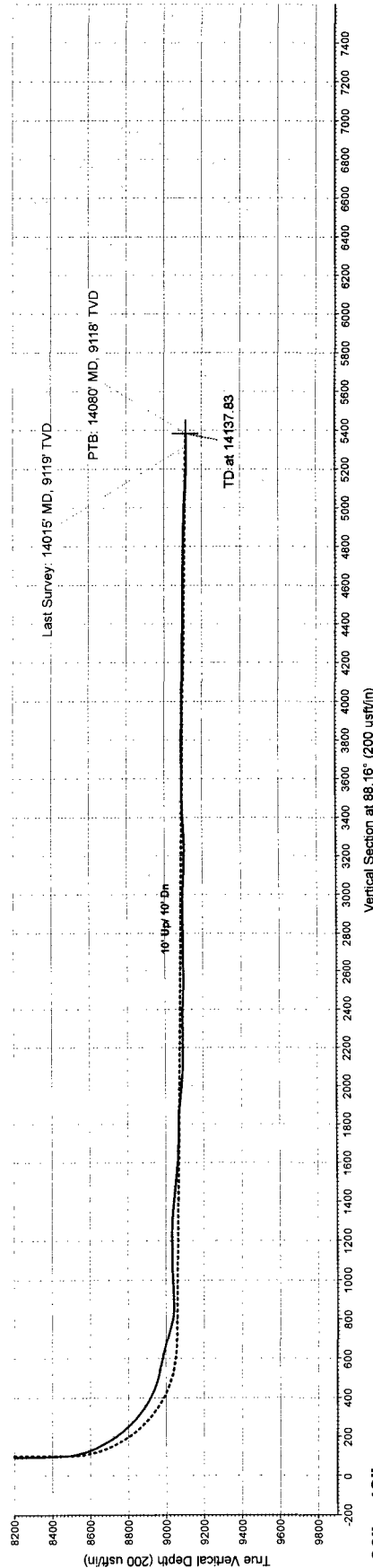
Name	TVD	+N-S	+E-W	North	East
[Cass16ST#2H]FTP: 665' VS	0.00	667.13	643.45	476274.49	540571.50
[Cass16ST#2H]KOP: 5283' VS	0.00	652.50	179.20	476259.86	540107.25
[Cass16ST#2H]HLP: 5383' VS	0.00	816.03	5268.37	476423.36	545197.42
[Cass16ST#2H]HL: 5383' VS	9115.77	818.93	5359.36	476423.29	545267.41



PRO DIRECTIONAL

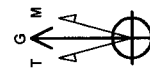


Target Line: 9050' TVD @ 0° VS, 89.3° INC



West(-)/East(+) (400 usf/in)

South(-)/North(+) (400 usf/in)



Azimuth to Grid North
True North: 0.00°
Magnetic North: 7.35°
Magnetic Field
Strength: 48089.8nT
Declination: 7.35°
Date: 8/12/2017
Model: HDGM

Azimuth Corrections

Total Magnetic Corr. (M to G): 7.35°
Declination (M to T): 7.42° East

36" x 48"