

US State Plane 1927 (Exact solution)
NAD 1927 (NADCON CONUS)
Clarke 1866
New Mexico East 3001
Mean Sea Level

RKB Elevation: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))

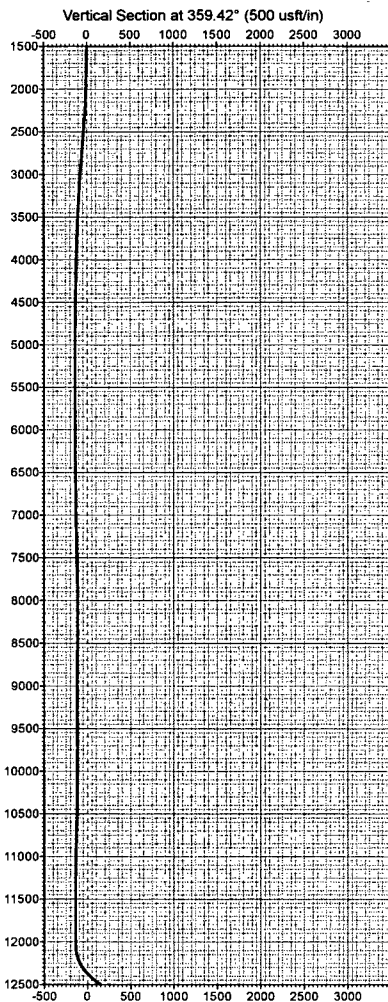
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.00	0.00	388806.12	790365.00	32° 3' 55.7169 N	103° 23' 45.6275 W	

SECTION DETAILS

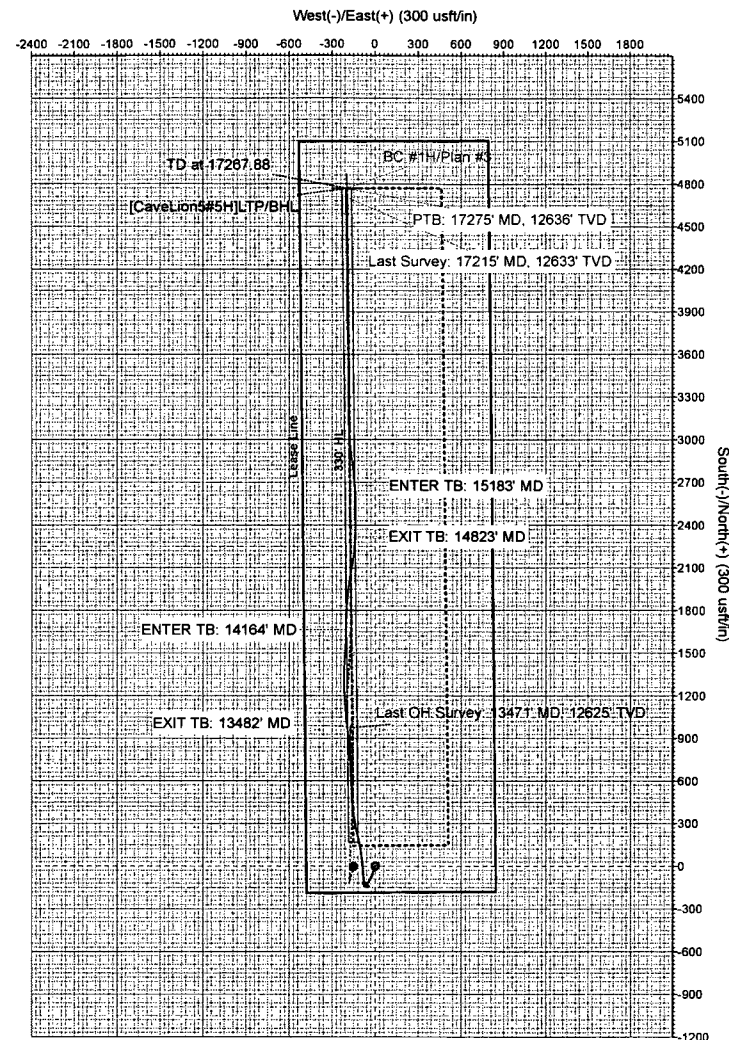
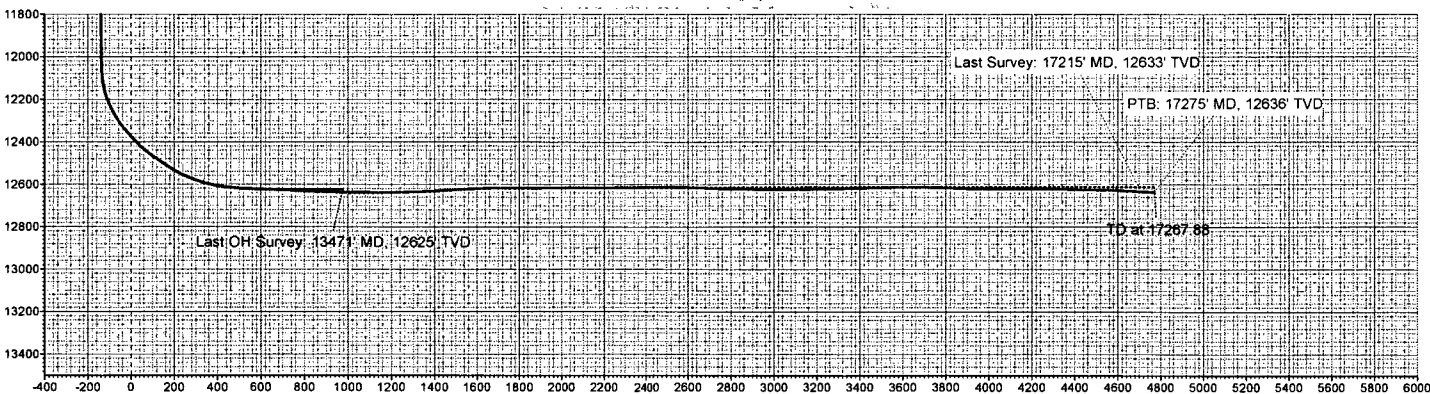
Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	VSect
1	13187.00	87.60	356.60	12626.01	690.20	-171.82	0.00	691.91
2	13303.00	86.80	355.60	12631.68	805.80	-179.70	1.10	807.57
3	13383.51	87.00	354.00	12636.03	885.85	-186.99	2.00	887.70
4	13778.30	93.00	4.21	12636.02	1279.90	-193.13	3.00	1281.79
5	14045.11	93.00	4.21	12622.04	1545.62	-173.55	0.00	1547.30
6	14231.88	90.10	359.42	12616.98	1732.15	-167.64	3.00	1733.76
7	17267.88	90.10	359.42	12611.68	4767.99	-198.37	0.00	4769.75

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

Name	TVD	+N/-S	+E/-W	Northing	Easting
[CaveLion5#5H]LTP/BHL	12611.68	4767.99	-198.37	393574.11	790166.63



Target Line: 12620' TVD @ 0° VS, 90.1° INC



Azimuths to Grid North
True North: -0.50°
Magnetic North: 6.25°

Magnetic Field
Strength: 48009.0anT
Dip Angle: 59.82°
Date: 10/31/2017
Model: USER DEFINED

Azimuth Corrections

Total Magnetic Corr. (M to G): 6.25°

Declination (M to T): 6.75° East



Marathon Oil

Marathon Oil

Lea County, NM

Cave Lion 5 Federal

WC #5H

ST01

Design: MWD 13303'- 17215' PTB 17275'

Survey Report

05 December, 2017



Company:	Marathon Oil	Local Co-ordinate Reference:	Well WC #5H
Project:	Lea County, NM	TVD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Site:	Cave Lion 5 Federal	MD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Well:	WC #5H	North Reference:	Grid
Wellbore:	ST01	Survey Calculation Method:	Minimum Curvature
Design:	MWD 13303'- 17215' PTB 17275'	Database:	WellPlanner1

Project	Lea 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	Cave Lion 5 Federal		
Site Position:		Northing:	388,805.07 usft
From:	Map	Easting:	790,215.00 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 3' 55.7194 N
		Longitude:	103° 23' 47.3706 W
		Grid Convergence:	0.50 °

Well	WC #5H		
Well Position	+N/-S	0.00 usft	Northing: 388,806.12 usft
	+E/-W	0.00 usft	Easting: 790,365.00 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32° 3' 55.7169 N
		Longitude:	103° 23' 45.6275 W
		Ground Level:	3,270.00 usft

Wellbore	ST01				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	User Defined	10/31/2017	6.75	59.82	48,009.00

Design	MWD 13303'- 17215' PTB 17275'			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 13,187.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	359.42

Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference: Well WC #5H
TVD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
MD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: WellPlanner1

Survey Program		Date	12/5/2017		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
208.00	1,086.00	Survey #1 (OH)	GYRO-MWD	OWSG Gyro MWD	
1,146.00	13,187.00	Survey #2 (OH)	MWD+IFR1	OWSG MWD + IFR1	
13,303.00	17,275.00	Survey #1 (ST01)	MWD+IFR1	OWSG MWD + IFR1	

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	388,806.12	790,365.00
208.00	0.30	11.00	208.00	0.53	0.53	0.10	0.54	11.00	388,806.65	790,365.10
299.00	0.10	64.00	299.00	0.80	0.80	0.22	0.83	15.37	388,806.92	790,365.22
390.00	0.20	358.00	390.00	0.99	1.00	0.29	1.04	16.04	388,807.12	790,365.29
481.00	0.00	102.00	481.00	1.15	1.16	0.28	1.19	13.67	388,807.28	790,365.28
574.00	0.10	315.00	574.00	1.21	1.21	0.22	1.23	10.45	388,807.33	790,365.22
758.40	0.40	302.00	758.40	1.67	1.67	-0.44	1.72	345.35	388,807.79	790,364.56
852.00	0.30	282.00	851.99	1.90	1.89	-0.95	2.12	333.27	388,808.01	790,364.05
946.91	0.20	280.00	946.90	1.99	1.97	-1.36	2.40	325.43	388,808.09	790,363.64
1,041.33	0.20	274.00	1,041.32	2.03	2.01	-1.69	2.63	320.05	388,808.13	790,363.31
1,086.00	0.40	304.00	1,085.99	2.12	2.10	-1.89	2.83	318.04	388,808.22	790,363.11
1,146.00	0.30	172.60	1,145.99	2.09	2.07	-2.05	2.91	315.28	388,808.19	790,362.95
1,240.00	0.40	116.70	1,239.99	1.69	1.67	-1.72	2.40	314.22	388,807.79	790,363.28
1,335.00	0.40	116.00	1,334.99	1.39	1.38	-1.13	1.78	320.77	388,807.50	790,363.87
1,429.00	0.50	143.10	1,428.99	0.91	0.91	-0.59	1.08	327.19	388,807.03	790,364.41
1,523.00	0.90	205.60	1,522.98	-0.08	-0.09	-0.66	0.66	262.64	388,806.03	790,364.34
1,617.00	1.50	211.10	1,616.96	-1.79	-1.80	-1.61	2.42	221.79	388,804.32	790,363.39
1,712.00	1.80	213.00	1,711.92	-4.09	-4.12	-3.07	5.14	216.67	388,802.00	790,361.93
1,806.00	1.40	209.90	1,805.88	-6.31	-6.35	-4.44	7.75	214.97	388,799.77	790,360.56
1,901.00	1.60	206.00	1,900.85	-8.49	-8.55	-5.60	10.22	213.24	388,797.57	790,359.40



Professional Directional Survey Report



Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference: Well WC #5H
TVD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
MD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: WellPlanner1

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)
1,995.00	1.80	195.20	1,994.81	-11.09	-11.16	-6.57	12.95	210.48	388,794.96	790,358.43
2,090.00	1.90	201.10	2,089.76	-13.99	-14.07	-7.52	15.95	208.15	388,792.05	790,357.48
2,184.00	2.70	201.60	2,183.68	-17.49	-17.58	-8.90	19.70	206.86	388,788.54	790,356.10
2,278.00	4.00	198.80	2,277.52	-22.63	-22.74	-10.77	25.16	205.35	388,783.38	790,354.23
2,372.00	4.80	196.50	2,371.24	-29.48	-29.61	-12.95	32.32	203.61	388,776.51	790,352.05
2,467.00	4.30	192.90	2,465.94	-36.75	-36.90	-14.87	39.78	201.95	388,769.22	790,350.13
2,561.00	3.90	188.60	2,559.70	-43.33	-43.49	-16.13	46.39	200.35	388,762.63	790,348.87
2,656.00	4.00	189.90	2,654.48	-49.78	-49.95	-17.19	52.83	198.99	388,756.17	790,347.81
2,750.00	4.70	194.70	2,748.20	-56.71	-56.91	-18.73	59.91	198.22	388,749.21	790,346.27
2,844.00	5.40	197.60	2,841.84	-64.63	-64.85	-21.04	68.18	197.98	388,741.27	790,343.96
2,939.00	5.20	208.20	2,936.44	-72.65	-72.90	-24.43	76.89	198.53	388,733.22	790,340.57
3,034.00	4.70	211.10	3,031.08	-79.74	-80.03	-28.47	84.94	199.59	388,726.09	790,336.53
3,128.00	4.00	207.90	3,124.81	-85.90	-86.23	-32.00	91.97	200.36	388,719.89	790,333.00
3,223.00	4.30	211.70	3,219.56	-91.82	-92.18	-35.42	98.75	201.02	388,713.94	790,329.58
3,318.00	4.30	214.80	3,314.29	-97.74	-98.14	-39.32	105.72	201.84	388,707.98	790,325.68
3,413.00	3.30	212.40	3,409.08	-102.93	-103.37	-42.82	111.89	202.50	388,702.75	790,322.18
3,508.00	3.10	210.30	3,503.94	-107.43	-107.90	-45.58	117.13	202.90	388,698.22	790,319.42
3,602.00	3.20	210.40	3,597.79	-111.86	-112.36	-48.19	122.25	203.22	388,693.76	790,316.81
3,697.00	2.70	206.90	3,692.67	-116.12	-116.64	-50.55	127.12	203.43	388,689.48	790,314.45
3,792.00	2.30	201.60	3,787.58	-119.87	-120.41	-52.26	131.26	203.46	388,685.71	790,312.74
3,886.00	2.00	232.20	3,881.51	-122.61	-123.16	-54.25	134.58	203.77	388,682.96	790,310.75
3,981.00	2.50	243.90	3,976.44	-124.50	-125.09	-57.42	137.64	204.66	388,681.03	790,307.58
4,075.00	2.50	238.80	4,070.35	-126.43	-127.06	-61.02	140.95	205.65	388,679.06	790,303.98
4,170.00	2.30	245.80	4,165.27	-128.25	-128.91	-64.53	144.16	206.59	388,677.21	790,300.47
4,264.00	1.90	237.10	4,259.21	-129.84	-130.53	-67.56	146.98	207.36	388,675.59	790,297.44
4,359.00	1.30	222.40	4,354.17	-131.47	-132.18	-69.61	149.39	207.77	388,673.94	790,295.39
4,453.00	1.00	207.20	4,448.15	-132.98	-133.70	-70.70	151.24	207.87	388,672.42	790,294.30

Company:	Marathon Oil	Local Co-ordinate Reference:	Well WC #5H
Project:	Lea County, NM	TVD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Site:	Cave Lion 5 Federal	MD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Well:	WC #5H	North Reference:	Grid
Wellbore:	ST01	Survey Calculation Method:	Minimum Curvature
Design:	MWD 13303'- 17215' PTB 17275'	Database:	WellPlanner1

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)	
4,548.00	0.70	168.70	4,543.14	-134.28	-135.01	-70.96	152.52	207.73	388,671.11	790,294.04	
4,642.00	1.10	132.30	4,637.13	-135.46	-136.18	-70.18	153.20	207.27	388,669.94	790,294.82	
4,737.00	1.70	126.20	4,732.10	-136.92	-137.62	-68.37	153.67	206.42	388,668.50	790,296.63	
4,831.00	1.70	115.90	4,826.06	-138.38	-139.05	-65.99	153.92	205.39	388,667.07	790,299.01	
4,926.00	2.30	119.90	4,921.00	-139.97	-140.62	-63.07	154.12	204.16	388,665.50	790,301.93	
5,020.00	1.80	112.50	5,014.94	-141.51	-142.13	-60.07	154.30	202.91	388,663.99	790,304.93	
5,115.00	1.70	99.30	5,109.90	-142.34	-142.92	-57.31	153.98	201.85	388,663.20	790,307.69	
5,209.00	1.00	92.60	5,203.87	-142.62	-143.19	-55.11	153.43	201.05	388,662.93	790,309.89	
5,303.00	0.80	71.90	5,297.86	-142.47	-143.02	-53.67	152.76	200.57	388,663.10	790,311.33	
5,384.00	1.00	83.90	5,378.85	-142.23	-142.77	-52.43	152.09	200.16	388,663.35	790,312.57	
5,486.00	0.70	74.00	5,480.84	-141.98	-142.50	-50.94	151.33	199.67	388,663.62	790,314.06	
5,580.00	0.70	77.40	5,574.83	-141.71	-142.22	-49.83	150.70	199.31	388,663.90	790,315.17	
5,674.00	0.70	83.70	5,668.82	-141.53	-142.03	-48.70	150.15	198.93	388,664.09	790,316.30	
5,768.00	0.70	86.90	5,762.82	-141.45	-141.94	-47.55	149.69	198.52	388,664.18	790,317.45	
5,863.00	0.80	79.50	5,857.81	-141.31	-141.78	-46.32	149.16	198.09	388,664.34	790,318.68	
5,957.00	0.60	73.40	5,951.80	-141.06	-141.52	-45.21	148.57	197.71	388,664.60	790,319.79	
6,051.00	0.50	70.60	6,045.80	-140.79	-141.25	-44.35	148.05	197.43	388,664.87	790,320.65	
6,144.00	0.80	74.00	6,138.79	-140.49	-140.93	-43.34	147.45	197.09	388,665.19	790,321.66	
6,239.00	0.70	85.10	6,233.78	-140.27	-140.70	-42.13	146.87	196.67	388,665.42	790,322.87	
6,333.00	1.40	307.50	6,327.77	-139.52	-139.95	-42.46	146.25	196.88	388,666.17	790,322.54	
6,427.00	1.80	304.40	6,421.74	-137.96	-138.42	-44.59	145.43	197.86	388,667.70	790,320.41	
6,521.00	1.70	300.50	6,515.69	-136.40	-136.88	-47.01	144.73	198.96	388,669.24	790,317.99	
6,615.00	1.60	295.90	6,609.65	-135.09	-135.60	-49.39	144.31	200.02	388,670.52	790,315.61	
6,709.00	1.70	297.30	6,703.62	-133.85	-134.38	-51.81	144.03	201.08	388,671.74	790,313.19	
6,803.00	1.60	293.20	6,797.58	-132.67	-133.23	-54.26	143.85	202.16	388,672.89	790,310.74	
6,897.00	1.80	291.50	6,891.53	-131.59	-132.17	-56.84	143.87	203.27	388,673.95	790,308.16	
6,991.00	1.80	293.70	6,985.49	-130.43	-131.04	-59.56	143.94	204.44	388,675.08	790,305.44	

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Project: Lea County, NM
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Wellbore: ST01
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Survey											
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7,086.00	1.80	292.80	7,080.44	-129.22	-129.86	-62.31	144.03	205.63	388,676.26	790,302.69	
7,180.00	1.20	353.30	7,174.41	-127.66	-128.31	-63.78	143.29	206.43	388,677.81	790,301.22	
7,274.00	1.20	358.30	7,268.39	-125.69	-126.35	-63.93	141.60	206.84	388,679.77	790,301.07	
7,368.00	1.20	352.60	7,362.37	-123.73	-124.39	-64.08	139.92	207.26	388,681.73	790,300.92	
7,462.00	1.00	348.80	7,456.36	-121.95	-122.61	-64.37	138.48	207.70	388,683.51	790,300.63	
7,556.00	0.90	9.70	7,550.34	-120.42	-121.07	-64.40	137.14	208.01	388,685.05	790,300.60	
7,650.00	1.00	8.80	7,644.33	-118.88	-119.54	-64.15	135.66	208.22	388,686.58	790,300.85	
7,745.00	1.00	20.00	7,739.32	-117.29	-117.94	-63.74	134.06	208.39	388,688.18	790,301.26	
7,839.00	0.80	21.50	7,833.30	-115.91	-116.56	-63.22	132.60	208.48	388,689.56	790,301.78	
7,934.00	0.50	15.50	7,928.30	-114.90	-115.54	-62.87	131.54	208.55	388,690.58	790,302.13	
8,029.00	0.60	322.00	8,023.29	-114.10	-114.75	-63.06	130.94	208.79	388,691.37	790,301.94	
8,123.00	0.70	286.00	8,117.29	-113.55	-114.20	-63.92	130.87	209.24	388,691.92	790,301.08	
8,217.00	1.20	275.50	8,211.28	-113.28	-113.95	-65.45	131.41	209.87	388,692.17	790,299.55	
8,312.00	2.80	264.90	8,306.21	-113.36	-114.06	-68.75	133.18	211.08	388,692.06	790,296.25	
8,407.00	3.10	258.60	8,401.09	-114.02	-114.77	-73.58	136.34	212.66	388,691.35	790,291.42	
8,502.00	1.50	228.80	8,496.01	-115.32	-116.10	-77.03	139.33	213.56	388,690.02	790,287.97	
8,596.00	1.30	227.60	8,589.98	-116.83	-117.63	-78.75	141.56	213.80	388,688.49	790,286.25	
8,691.00	1.30	236.50	8,684.96	-118.13	-118.95	-80.44	143.60	214.07	388,687.17	790,284.56	
8,786.00	0.50	245.90	8,779.95	-118.88	-119.72	-81.72	144.95	214.32	388,686.40	790,283.28	
8,880.00	0.50	255.60	8,873.94	-119.14	-119.99	-82.49	145.61	214.51	388,686.13	790,282.51	
8,975.00	0.50	244.40	8,968.94	-119.42	-120.27	-83.27	146.28	214.70	388,685.85	790,281.73	
9,070.00	0.80	252.90	9,063.93	-119.78	-120.64	-84.27	147.16	214.94	388,685.48	790,280.73	
9,165.00	0.70	233.80	9,158.93	-120.31	-121.18	-85.38	148.23	215.17	388,684.94	790,279.62	
9,260.00	0.40	273.30	9,253.92	-120.62	-121.50	-86.18	148.96	215.35	388,684.62	790,278.82	
9,355.00	0.70	279.50	9,348.92	-120.50	-121.39	-87.08	149.39	215.65	388,684.73	790,277.92	
9,450.00	1.00	25.20	9,443.91	-119.65	-120.54	-87.30	148.83	215.91	388,685.58	790,277.70	
9,545.00	0.90	351.80	9,538.90	-118.17	-119.05	-87.05	147.49	216.17	388,687.07	790,277.95	

Company:	Marathon Oil	Local Co-ordinate Reference:	Well WC #5H
Project:	Lea County, NM	TVD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Site:	Cave Lion 5 Federal	MD Reference:	Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Well:	WC #5H	North Reference:	Grid
Wellbore:	ST01	Survey Calculation Method:	Minimum Curvature
Design:	MWD 13303'- 17215' PTB 17275'	Database:	WellPlanner1

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)	
9,640.00	0.90	316.40	9,633.89	-116.88	-117.77	-87.67	146.82	216.66	388,688.35	790,277.33	
9,735.00	0.90	263.80	9,728.88	-116.41	-117.32	-88.93	147.21	217.16	388,688.80	790,276.07	
9,829.00	1.00	136.60	9,822.87	-117.08	-117.99	-89.10	147.85	217.06	388,688.13	790,275.90	
9,925.00	1.10	150.90	9,918.86	-118.51	-119.40	-88.08	148.37	216.41	388,686.72	790,276.92	
10,019.00	1.50	145.10	10,012.83	-120.32	-121.20	-86.93	149.16	215.65	388,684.92	790,278.07	
10,114.00	1.50	61.20	10,107.81	-120.76	-121.62	-85.13	148.46	214.99	388,684.50	790,279.87	
10,209.00	1.50	76.10	10,202.78	-119.88	-120.73	-82.84	146.41	214.46	388,685.39	790,282.16	
10,303.00	1.50	97.80	10,296.74	-119.78	-120.60	-80.42	144.95	213.70	388,685.52	790,284.58	
10,399.00	0.30	160.40	10,392.73	-120.20	-121.00	-79.09	144.56	213.17	388,685.12	790,285.91	
10,493.00	0.80	208.90	10,486.73	-121.00	-121.81	-79.33	145.36	213.07	388,684.31	790,285.67	
10,588.00	1.50	176.80	10,581.71	-122.82	-123.63	-79.58	147.03	212.77	388,682.49	790,285.42	
10,683.00	2.20	174.80	10,676.66	-125.88	-126.69	-79.34	149.49	212.06	388,679.43	790,285.66	
10,778.00	1.80	171.50	10,771.60	-129.18	-129.98	-78.96	152.08	211.28	388,676.14	790,286.04	
10,873.00	2.20	121.70	10,866.55	-131.63	-132.42	-77.19	153.27	210.24	388,673.70	790,287.81	
10,968.00	2.20	100.00	10,961.48	-132.94	-133.69	-73.84	152.73	208.91	388,672.43	790,291.16	
11,063.00	2.60	102.50	11,056.40	-133.76	-134.47	-69.94	151.57	207.48	388,671.65	790,295.06	
11,158.00	1.70	170.70	11,151.34	-135.64	-136.33	-67.61	152.17	206.38	388,669.79	790,297.39	
11,253.00	1.20	174.10	11,246.31	-138.02	-138.71	-67.28	154.17	205.87	388,667.41	790,297.72	
11,347.00	0.80	79.50	11,340.30	-138.89	-139.57	-66.53	154.62	205.49	388,666.55	790,298.47	
11,442.00	0.90	71.40	11,435.29	-138.54	-139.21	-65.17	153.71	205.09	388,666.91	790,299.83	
11,537.00	0.30	207.50	11,530.29	-138.53	-139.19	-64.58	153.45	204.89	388,666.93	790,300.42	
11,632.00	1.00	230.40	11,625.28	-139.27	-139.94	-65.33	154.44	205.03	388,666.18	790,299.67	
11,727.00	1.30	270.10	11,720.26	-139.78	-140.47	-67.05	155.65	205.52	388,665.65	790,297.95	
11,779.00	1.30	285.80	11,772.25	-139.61	-140.31	-68.21	156.01	205.93	388,665.81	790,296.79	
11,896.00	1.60	290.70	11,889.21	-138.64	-139.37	-71.01	156.42	207.00	388,666.75	790,293.99	
11,991.00	1.90	277.90	11,984.17	-137.93	-138.68	-73.81	157.10	208.02	388,667.44	790,291.19	
12,084.00	3.10	332.90	12,077.09	-135.45	-136.23	-76.49	156.24	209.31	388,669.89	790,288.51	

Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference:
TVD Reference: Well WC #5H
MD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
North Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Survey Calculation Method: Grid
Database: Minimum Curvature
 WellPlanner1

Survey

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)
12,116.00	7.90	349.10	12,108.94	-132.51	-133.30	-77.30	154.09	210.11	388,672.82	790,287.70
12,148.00	10.50	354.40	12,140.52	-127.44	-128.24	-78.00	150.10	211.31	388,677.88	790,287.00
12,180.00	16.00	355.50	12,171.66	-120.13	-120.94	-78.63	144.25	213.03	388,685.18	790,286.37
12,212.00	20.80	358.50	12,202.01	-110.05	-110.85	-79.12	136.19	215.52	388,695.27	790,285.88
12,244.00	24.60	1.50	12,231.53	-97.70	-98.51	-79.10	126.34	218.76	388,707.61	790,285.90
12,276.00	26.80	354.70	12,260.37	-83.85	-84.66	-79.59	116.20	223.23	388,721.46	790,285.41
12,307.00	32.00	352.80	12,287.37	-68.72	-69.55	-81.27	106.96	229.44	388,736.57	790,283.73
12,338.00	36.30	355.10	12,313.02	-51.40	-52.24	-83.08	98.14	237.84	388,753.88	790,281.92
12,370.00	40.40	355.40	12,338.11	-31.60	-32.46	-84.72	90.73	249.03	388,773.66	790,280.28
12,401.00	40.80	354.80	12,361.65	-11.49	-12.36	-86.44	87.32	261.86	388,793.76	790,278.56
12,433.00	42.80	354.10	12,385.50	9.76	8.87	-88.51	88.95	275.72	388,814.99	790,276.49
12,464.00	45.20	354.50	12,407.80	31.21	30.29	-90.65	95.57	288.48	388,836.41	790,274.35
12,496.00	48.60	354.40	12,429.66	54.48	53.54	-92.91	107.23	299.96	388,859.66	790,272.09
12,527.00	52.30	351.70	12,449.40	78.23	77.26	-95.81	123.08	308.88	388,883.38	790,269.19
12,574.00	55.10	349.40	12,477.22	115.64	114.62	-102.04	153.46	318.32	388,920.74	790,262.96
12,621.00	56.20	349.90	12,503.74	153.88	152.79	-109.01	187.69	324.49	388,958.91	790,255.99
12,652.00	57.30	348.20	12,520.74	179.38	178.24	-113.94	211.55	327.41	388,984.36	790,251.06
12,684.00	60.50	346.60	12,537.27	206.18	204.97	-119.92	237.48	329.67	389,011.09	790,245.08
12,715.00	64.30	347.10	12,551.63	232.99	231.72	-126.17	263.84	331.43	389,037.84	790,238.83
12,747.00	66.20	347.40	12,565.02	261.39	260.06	-132.58	291.91	332.99	389,066.18	790,232.42
12,778.00	69.40	349.40	12,576.74	289.56	288.17	-138.35	319.66	334.36	389,094.29	790,226.65
12,810.00	72.50	351.00	12,587.18	319.41	317.98	-143.49	348.85	335.71	389,124.10	790,221.51
12,841.00	75.40	351.00	12,595.75	348.88	347.40	-148.15	377.67	336.90	389,153.52	790,216.85
12,872.00	78.20	350.80	12,602.83	378.72	377.20	-152.92	407.02	337.93	389,183.32	790,212.08
12,904.00	80.70	354.10	12,608.69	409.94	408.38	-157.05	437.53	338.96	389,214.50	790,207.95
12,935.00	82.70	356.20	12,613.16	440.53	438.94	-159.65	467.07	340.01	389,245.06	790,205.35
12,967.00	84.50	356.90	12,616.73	472.29	470.68	-161.56	497.63	341.06	389,276.80	790,203.44

Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference:
TVD Reference: Well WC #5H
MD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
North Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
Survey Calculation Method: Grid
Database: Minimum Curvature
 WellPlanner1

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)
12,998.00	86.50	357.40	12,619.16	503.17	501.54	-163.10	527.40	341.99	389,307.66	790,201.90
13,093.00	88.80	357.70	12,623.06	598.03	596.37	-167.15	619.35	344.34	389,402.49	790,197.85
13,187.00	87.60	356.60	12,626.01	691.91	690.20	-171.82	711.27	346.02	389,496.32	790,193.18
Tie into OH at 13187' MD										
13,303.00	86.80	355.60	12,631.68	807.57	805.80	-179.70	825.59	347.43	389,611.92	790,185.30
13,397.00	88.60	354.70	12,635.45	901.23	899.38	-187.64	918.75	348.22	389,705.50	790,177.36
13,482.00	89.41	354.79	12,636.93	985.94	984.01	-195.43	1,003.23	348.77	389,790.13	790,169.57
EXIT TB: 13482' MD										
13,492.00	89.50	354.80	12,637.02	995.90	993.97	-196.34	1,013.17	348.83	389,800.09	790,168.66
13,587.00	89.20	354.60	12,638.10	1,090.57	1,088.55	-205.11	1,107.71	349.33	389,894.67	790,159.89
13,681.00	90.40	355.80	12,638.43	1,184.32	1,182.22	-212.98	1,201.25	349.79	389,988.34	790,152.02
13,775.00	92.50	358.50	12,636.05	1,278.20	1,276.06	-217.65	1,294.49	350.32	390,082.18	790,147.35
13,869.00	92.40	1.60	12,632.03	1,372.09	1,369.96	-217.57	1,387.13	350.98	390,176.08	790,147.43
13,963.00	93.10	4.00	12,627.52	1,465.82	1,463.73	-212.98	1,479.15	351.72	390,269.85	790,152.02
14,057.00	94.10	3.50	12,621.62	1,559.36	1,557.35	-206.84	1,571.02	352.43	390,363.47	790,158.16
14,151.00	90.80	359.80	12,617.60	1,653.17	1,651.19	-204.15	1,663.76	352.95	390,457.31	790,160.85
14,164.00	90.69	0.25	12,617.43	1,666.17	1,664.19	-204.14	1,676.67	353.01	390,470.31	790,160.86
ENTER TB: 14164' MD										
14,246.00	90.00	3.10	12,616.94	1,748.10	1,746.15	-201.74	1,757.76	353.41	390,552.27	790,163.26
14,340.00	90.40	2.50	12,616.61	1,841.93	1,840.03	-197.15	1,850.56	353.88	390,646.15	790,167.85
14,434.00	90.50	5.90	12,615.87	1,935.59	1,933.76	-190.27	1,943.10	354.38	390,739.88	790,174.73
14,529.00	90.70	10.10	12,614.87	2,029.50	2,027.81	-177.05	2,035.53	355.01	390,833.93	790,187.95
14,623.00	89.60	10.60	12,614.63	2,121.79	2,120.28	-160.16	2,126.32	355.68	390,926.40	790,204.84
14,717.00	90.70	5.40	12,614.38	2,214.71	2,213.33	-147.08	2,218.21	356.20	391,019.45	790,217.92
14,811.00	89.90	3.30	12,613.89	2,308.35	2,307.05	-139.95	2,311.30	356.53	391,113.17	790,225.05
14,823.00	90.00	2.73	12,613.90	2,320.33	2,319.04	-139.32	2,323.22	356.56	391,125.16	790,225.68
EXIT TB: 14823' MD										
14,906.00	90.70	358.80	12,613.39	2,403.29	2,402.01	-138.21	2,405.99	356.71	391,208.13	790,226.79

Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference: Well WC #5H
TVD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
MD Reference: Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: WellPlanner1

Survey											
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)	
15,001.00	91.00	1.90	12,611.98	2,498.25	2,496.99	-137.63	2,500.78	356.85	391,303.11	790,227.37	
15,096.00	88.40	357.00	12,612.48	2,593.22	2,591.95	-138.54	2,595.65	356.94	391,398.07	790,226.46	
15,183.00	86.64	355.43	12,616.24	2,679.99	2,678.67	-144.28	2,682.55	356.92	391,484.79	790,220.72	
ENTER TB: 15183' MD											
15,190.00	86.50	355.30	12,616.66	2,686.96	2,685.63	-144.85	2,689.54	356.91	391,491.75	790,220.15	
15,284.00	89.60	355.00	12,619.86	2,780.63	2,779.23	-152.79	2,783.43	356.85	391,585.35	790,212.21	
15,379.00	87.40	349.80	12,622.35	2,874.85	2,873.33	-165.34	2,878.08	356.71	391,679.45	790,199.66	
15,473.00	89.30	355.10	12,625.06	2,968.08	2,966.44	-177.68	2,971.75	356.57	391,772.56	790,187.32	
15,567.00	89.90	358.00	12,625.71	3,061.95	3,060.25	-183.34	3,065.74	356.57	391,866.37	790,181.66	
15,661.00	91.30	359.90	12,624.73	3,155.94	3,154.22	-185.06	3,159.65	356.64	391,960.34	790,179.94	
15,756.00	91.60	359.70	12,622.33	3,250.90	3,249.19	-185.39	3,254.48	356.73	392,055.31	790,179.61	
15,850.00	91.50	359.80	12,619.78	3,344.87	3,343.16	-185.80	3,348.32	356.82	392,149.28	790,179.20	
15,944.00	91.30	0.20	12,617.49	3,438.83	3,437.13	-185.80	3,442.15	356.91	392,243.25	790,179.20	
16,038.00	92.20	359.90	12,614.62	3,532.78	3,531.08	-185.72	3,535.97	356.99	392,337.20	790,179.28	
16,205.00	88.40	357.00	12,613.74	3,699.71	3,697.97	-190.24	3,702.86	357.06	392,504.09	790,174.76	
16,300.00	88.40	358.30	12,616.39	3,794.62	3,792.85	-194.13	3,797.82	357.07	392,598.97	790,170.87	
16,396.00	88.30	359.30	12,619.16	3,890.58	3,888.79	-196.14	3,893.74	357.11	392,694.91	790,168.86	
16,490.00	89.80	0.00	12,620.72	3,984.56	3,982.77	-196.71	3,987.63	357.17	392,788.89	790,168.29	
16,585.00	90.30	0.50	12,620.63	4,079.55	4,077.77	-196.30	4,082.49	357.24	392,883.89	790,168.70	
16,679.00	89.80	359.80	12,620.55	4,173.54	4,171.77	-196.05	4,176.38	357.31	392,977.89	790,168.95	
16,773.00	89.80	359.80	12,620.88	4,267.54	4,265.77	-196.38	4,270.29	357.36	393,071.89	790,168.62	
16,868.00	88.80	359.50	12,622.04	4,362.53	4,360.76	-196.96	4,365.21	357.41	393,166.88	790,168.04	
16,963.00	88.50	359.30	12,624.28	4,457.50	4,455.73	-197.96	4,460.12	357.46	393,261.85	790,167.04	
17,058.00	89.40	359.20	12,626.02	4,552.49	4,550.70	-199.20	4,555.06	357.49	393,356.82	790,165.80	
17,152.00	86.50	358.40	12,629.38	4,646.41	4,644.61	-201.17	4,648.97	357.52	393,450.73	790,163.83	
17,215.00	86.40	359.00	12,633.28	4,709.28	4,707.47	-202.59	4,711.83	357.54	393,513.59	790,162.41	
Last Survey: 17215' MD, 12633' TVD											

Company: Marathon Oil
Project: Lea County, NM
Site: Cave Lion 5 Federal
Well: WC #5H
Wellbore: ST01
Design: MWD 13303'- 17215' PTB 17275'

Local Co-ordinate Reference:
TVD Reference:
MD Reference:
North Reference:
Survey Calculation Method:
Database:

Well WC #5H
 Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
 Well @ 3295.00usft (GL: 3270' + KB: 25' (H&P423))
 Grid
 Minimum Curvature
 WellPlanner1

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	Closure Distance (usft)	Closure Azimuth (°)	Northing (usft)	Easting (usft)
17,275.00	88.40	359.00	12,636.00	4,769.22	4,767.40	-203.64	4,771.75	357.55	393,573.52	790,161.36
PTB: 17275' MD, 12636' TVD										

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
13,187.00	12,626.01	690.20	-171.82	Tie into OH at 13187' MD
13,482.00	12,636.93	984.01	-195.43	EXIT TB: 13482' MD
14,164.00	12,617.43	1,664.19	-204.14	ENTER TB: 14164' MD
14,823.00	12,613.90	2,319.04	-139.32	EXIT TB: 14823' MD
15,183.00	12,616.24	2,678.67	-144.28	ENTER TB: 15183' MD
17,215.00	12,633.28	4,707.47	-202.59	Last Survey: 17215' MD, 12633' TVD
17,275.00	12,636.00	4,767.40	-203.64	PTB: 17275' MD, 12636' TVD