

NM OIL CONSERVATION
ARTESIA DISTRICT

APR 17 2015

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Apache Corporation

Eddy County, NM (NAD27 NME)

Raven Federal

#19H API # 30-015-40916

SL: 485' FSL & 180' FEL WL: P 07-173-31E

WB1/Job #1411705

Survey: Phoenix MWD Survey

Standard Survey Report

27 October, 2014

Phoenix Survey Report

Company:	Apache Corporation	Local Co-ordinate Reference:	Well #19H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3724.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3724.00usft (Capstar 114)
Well:	#19H	North Reference:	Grid
Wellbore:	WB1/Job #1411705	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	Compass 5000 GCR epdm

Project	Eddy County, NM (NAD27 NME)		
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		Raven Federal			
Site Position:		Northing:	673,239.70 usft	Latitude:	32° 51' 0.24298 N
From:	Map	Easting:	633,303.50 usft	Longitude:	103° 53' 57.35087 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.24 °

Well	#19H					
Well Position	+N/-S	0.00 usft	Northing:	670,659.00 usft	Latitude:	32° 50' 34.72230 N
	+E/-W	0.00 usft	Easting:	632,918.80 usft	Longitude:	103° 54' 1.98434 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	3,713.00 usft

Wellbore	WB1/Job #1411705				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	BGGM2014	9/9/2014	7.56	60.62	48,584

Design		Surveys (Capstar 114)			
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	279.32	

Survey Program	Date 10/27/2014				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	405.00	Gyrodata Gyro Survey (WB1/Job #141170)	NS-GYRO-MS	North sensing gyrocompassing m/s	
479.00	9,315.00	Phoenix MWD Survey (WB1/Job #141170)	PHX+MWD+BGGM	PHX+MWD+BGGM v3:standard declination	

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)
405.00	0.61	223.57	404.99	-1.85	0.47	-0.77	0.00	0.00	0.00
Tie-on to Gyro									
497.00	0.80	216.10	496.99	-2.72	-0.24	-0.20	0.23	0.21	-8.12
First Phoenix MWD Survey									
628.00	0.70	238.00	627.98	-3.89	-1.46	0.81	0.23	-0.08	16.72
757.00	0.90	235.60	756.96	-4.88	-2.96	2.13	0.16	0.16	-1.86
885.00	1.30	243.50	884.94	-6.09	-5.09	4.04	0.33	0.31	6.17
1,013.00	0.50	63.00	1,012.93	-6.49	-5.89	4.77	1.41	-0.63	140.23
1,141.00	1.20	79.30	1,140.92	-5.98	-4.08	3.06	0.57	0.55	12.73

Phoenix

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Design:	Surveys (Capstar 114)	Database:	Compass 5000 GCR epdm

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)
1,270.00	1.90	78.10	1,269.87	-5.29	-0.66	-0.21	0.54	0.54	-0.93
1,398.00	1.60	59.50	1,397.81	-3.95	2.96	-3.56	0.50	-0.23	-14.53
1,526.00	1.10	33.20	1,525.77	-2.01	5.17	-5.43	0.61	-0.39	-20.55
1,653.00	1.10	34.60	1,652.75	0.01	6.53	-6.44	0.02	0.00	1.10
1,781.00	1.30	5.30	1,780.72	2.47	7.36	-6.86	0.50	0.16	-22.89
1,910.00	1.10	347.60	1,909.70	5.13	7.23	-6.30	0.32	-0.16	-13.72
2,038.00	1.10	324.20	2,037.67	7.33	6.25	-4.98	0.35	0.00	-18.28
2,166.00	1.50	312.10	2,165.64	9.45	4.29	-2.70	0.38	0.31	-9.45
2,295.00	1.30	316.60	2,294.60	11.65	2.03	-0.11	0.18	-0.16	3.49
2,423.00	1.50	312.20	2,422.56	13.83	-0.21	2.45	0.18	0.16	-3.44
2,551.00	1.70	306.20	2,550.51	16.07	-2.98	5.55	0.20	0.16	-4.69
2,680.00	1.60	296.20	2,679.46	18.00	-6.14	8.98	0.24	-0.08	-7.75
2,811.00	1.00	270.50	2,810.43	18.82	-8.93	11.86	0.63	-0.46	-19.62
2,938.00	1.00	274.00	2,937.41	18.90	-11.14	14.06	0.05	0.00	2.76
3,072.00	1.10	273.80	3,071.39	19.07	-13.59	16.50	0.07	0.07	-0.15
3,200.00	1.10	262.00	3,199.36	18.98	-16.03	18.90	0.18	0.00	-9.22
3,328.00	1.10	252.50	3,327.34	18.44	-18.42	21.17	0.14	0.00	-7.42
3,401.00	1.00	260.70	3,400.33	18.13	-19.72	22.40	0.25	-0.14	11.23
3,490.00	1.40	249.70	3,489.31	17.62	-21.51	24.08	0.52	0.45	-12.36
3,618.00	1.80	201.40	3,617.26	15.21	-23.71	25.86	1.06	0.31	-37.73
3,747.00	1.00	168.10	3,746.22	12.22	-24.21	25.87	0.86	-0.62	-25.81
3,875.00	0.30	348.00	3,874.22	11.46	-24.05	25.59	1.02	-0.55	140.55
4,004.00	1.00	61.20	4,003.21	12.33	-23.14	24.83	0.74	0.54	56.74
4,132.00	1.20	62.10	4,131.19	13.49	-20.97	22.88	0.16	0.16	0.70
4,260.00	1.20	57.80	4,259.16	14.83	-18.65	20.81	0.07	0.00	-3.36
4,306.00	1.30	65.30	4,305.15	15.31	-17.77	20.02	0.42	0.22	16.30
4,320.00	1.30	67.70	4,319.14	15.44	-17.48	19.75	0.39	0.00	17.14
4,363.00	1.10	11.50	4,362.14	16.03	-16.95	19.32	2.66	-0.47	-130.70
4,405.00	4.90	318.60	4,404.08	17.77	-18.05	20.69	10.30	9.05	-125.95
4,448.00	11.10	313.20	4,446.64	21.98	-22.29	25.56	14.51	14.42	-12.56
4,491.00	18.20	313.00	4,488.21	29.40	-30.23	34.59	16.51	16.51	-0.47
4,534.00	25.50	313.30	4,528.10	40.35	-41.89	47.87	16.98	16.98	0.70
4,577.00	31.80	311.50	4,565.81	54.22	-57.13	65.16	14.79	14.65	-4.19
4,619.00	37.90	309.30	4,600.27	69.74	-75.42	85.72	14.83	14.52	-5.24
4,662.00	42.70	307.60	4,633.05	87.01	-97.20	110.01	11.45	11.16	-3.95
4,705.00	45.80	306.40	4,663.85	105.05	-121.17	136.58	7.47	7.21	-2.79
4,748.00	49.10	306.20	4,692.92	123.80	-146.70	164.81	7.68	7.67	-0.47
4,790.00	52.00	307.40	4,719.61	143.23	-172.66	193.57	7.25	6.90	2.86
4,833.00	54.10	309.90	4,745.46	164.70	-199.48	223.52	6.74	4.88	5.81
4,876.00	57.30	312.20	4,769.69	188.03	-226.26	253.72	8.65	7.44	5.35
4,919.00	63.20	312.80	4,791.02	213.25	-253.76	284.95	13.77	13.72	1.40
4,962.00	69.80	313.40	4,808.15	240.18	-282.54	317.70	15.40	15.35	1.40
5,004.00	76.50	314.00	4,820.32	267.94	-311.58	350.86	16.01	15.95	1.43

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Wellbore:	WB1/Job #1411705	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	Compass 5000 GCR epdm

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)
5,047.00	82.80	312.70	4,828.04	296.96	-342.33	385.90	14.95	14.65	-3.02
5,090.00	86.10	311.60	4,832.20	325.67	-374.05	421.86	8.09	7.67	-2.56
5,205.00	90.30	306.40	4,835.82	397.96	-463.33	521.67	5.81	3.65	-4.52
5,333.00	90.40	300.60	4,835.03	468.58	-570.02	638.38	4.53	0.08	-4.53
5,461.00	90.70	296.00	4,833.80	529.24	-682.69	759.39	3.60	0.23	-3.59
5,590.00	91.30	291.70	4,831.55	581.38	-800.63	884.21	3.37	0.47	-3.33
5,718.00	90.80	287.60	4,829.20	624.41	-921.13	1,010.09	3.23	-0.39	-3.20
5,846.00	90.60	284.90	4,827.64	660.22	-1,043.99	1,137.13	2.11	-0.16	-2.11
5,975.00	90.40	281.90	4,826.51	690.11	-1,169.46	1,265.79	2.33	-0.16	-2.33
6,103.00	91.60	280.30	4,824.28	714.75	-1,295.04	1,393.70	1.56	0.94	-1.25
6,234.00	91.00	276.70	4,821.31	734.11	-1,424.55	1,524.63	2.79	-0.46	-2.75
6,363.00	90.50	273.10	4,819.62	745.12	-1,553.04	1,653.21	2.82	-0.39	-2.79
6,491.00	90.70	269.90	4,818.28	748.47	-1,680.97	1,780.00	2.50	0.16	-2.50
6,619.00	91.10	269.00	4,816.27	747.24	-1,808.95	1,906.09	0.77	0.31	-0.70
6,747.00	91.60	269.30	4,813.25	745.34	-1,936.90	2,032.04	0.46	0.39	0.23
6,876.00	90.60	270.90	4,810.77	745.57	-2,065.87	2,159.34	1.46	-0.78	1.24
7,004.00	90.90	270.60	4,809.10	747.25	-2,193.85	2,285.90	0.33	0.23	-0.23
7,132.00	91.00	269.30	4,806.98	747.13	-2,321.83	2,412.18	1.02	0.08	-1.02
7,261.00	91.50	270.10	4,804.16	746.46	-2,450.79	2,539.33	0.73	0.39	0.62
7,392.00	91.50	269.50	4,800.73	746.00	-2,581.75	2,668.48	0.46	0.00	-0.46
7,520.00	92.00	269.20	4,796.82	744.55	-2,709.68	2,794.49	0.46	0.39	-0.23
7,654.00	92.40	268.70	4,791.68	742.10	-2,843.56	2,926.20	0.48	0.30	-0.37
7,782.00	91.80	270.50	4,786.99	741.20	-2,971.46	3,052.27	1.48	-0.47	1.41
7,911.00	89.60	272.10	4,785.41	744.13	-3,100.41	3,179.99	2.11	-1.71	1.24
8,039.00	89.80	272.10	4,786.08	748.82	-3,228.32	3,306.97	0.16	0.16	0.00
8,167.00	90.50	270.20	4,785.75	751.39	-3,356.29	3,433.67	1.58	0.55	-1.48
8,299.00	90.70	269.90	4,784.37	751.50	-3,488.28	3,563.94	0.27	0.15	-0.23
8,427.00	91.00	269.10	4,782.47	750.39	-3,616.26	3,690.05	0.67	0.23	-0.63
8,556.00	90.80	269.90	4,780.44	749.26	-3,745.24	3,817.14	0.64	-0.16	0.62
8,684.00	91.00	269.60	4,778.43	748.70	-3,873.22	3,943.34	0.28	0.16	-0.23
8,815.00	90.80	269.50	4,776.37	747.68	-4,004.20	4,072.43	0.17	-0.15	-0.08
8,944.00	89.80	269.90	4,775.70	747.00	-4,133.19	4,199.61	0.83	-0.78	0.31
9,077.00	90.20	269.60	4,775.70	746.42	-4,266.19	4,330.76	0.38	0.30	-0.23
9,244.00	90.80	269.60	4,774.24	745.25	-4,433.18	4,495.35	0.36	0.36	0.00
Last Phoenix MWD Survey									
9,315.00	90.80	269.60	4,773.25	744.76	-4,504.17	4,565.33	0.00	0.00	0.00
Projection to Bit									

Phoenix

Survey Report

Company:	Apache Corporation	Local Co-ordinate Reference:	Well #19H
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Site:	Raven Federal	MD Reference:	KB @ 3724.00usft (Capstar 114)
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Wellbore:	WB1/Job #1411705	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	Compass 5000 GCR epdm

Survey Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
405.00	404.99	-1.85	0.47	Tie-on to Gyro
497.00	496.99	-2.72	-0.24	First Phoenix MWD Survey
9,244.00	4,774.24	745.25	-4,433.18	Last Phoenix MWD Survey
9,315.00	4,773.25	744.76	-4,504.17	Projection to Bit

Checked By: _____	Approved By: _____	Date: _____
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