



Apache Corporation

Eddy County, NM (NAD27 NME)

NFE Federal COM

#47H

OH / Job #1610026

Survey: Phoenix MWD Surveys

Standard Survey Report

21 January, 2016

*Cedar Lake 2nd CA
547H
30-015-43507*





Phoenix Technology Services LP

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #47H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3805.00usft (Capstar 119)
Site:	NFE Federal COM	MD Reference:	KB @ 3805.00usft (Capstar 119)
Well:	#47H	North Reference:	Grid
Wellbore:	OH / Job #1610026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 119)	Database:	Compass 5000 GCR

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:	NFE Federal COM				
Site Position:		Northing:	673,264.70 usft	Latitude:	32° 51' 0.49036 N
From:	Map	Easting:	633,303.50 usft	Longitude:	103° 53' 57.34966 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.24 °

Well	#47H					
Well Position	+N/-S	0.00 usft	Northing:	678,204.70 usft	Latitude:	32° 51' 49.35308 N
	+E/-W	0.00 usft	Easting:	633,770.30 usft	Longitude:	103° 53' 51.63884 W
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	3,794.00 usft	

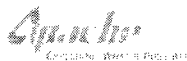
Wellbore:	OH / Job #1610026				
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Magnetic	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	12/31/2015	7.60	60.80	48,541

Design:	Surveys (Capstar 119)				
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	82.68	

Survey Program	Date	From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
	1/21/2016	100.00	4,356.00	Phoenix Gyro Surveys (OH / Job #161002	PHX_SPT_GTD	PHX Continuous north-seeking gyro
		4,396.00	9,068.00	Phoenix MWD Surveys (OH / Job #161002	PHX+MWD+HDGM	PHX+OWSG MWD + HDGM

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)
	4,356.00	1.47	329.17	4,355.42	28.31	-19.54	-15.77	0.00	0.00	0.00
Tie In to Phoenix Gyro Surveys	4,396.00	1.90	309.60	4,395.41	29.18	-20.31	-16.43	1.78	1.08	-48.93
First Phoenix MWD Survey	4,439.00	2.50	9.10	4,438.38	30.56	-20.71	-16.65	5.22	1.40	138.37
	4,482.00	6.00	40.80	4,481.26	33.19	-19.10	-14.71	9.51	8.14	73.72
	4,524.00	10.60	47.20	4,522.81	37.47	-14.82	-9.93	11.15	10.95	15.24
	4,567.00	15.40	49.50	4,564.70	43.87	-7.58	-1.92	11.23	11.16	5.35
	4,609.00	20.10	51.00	4,604.69	52.04	2.28	8.89	11.24	11.19	3.57



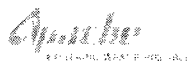
Phoenix Technology Services LP

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #47H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3805.00usft (Capstar 119)
Site:	NFE Federal COM	MD Reference:	KB @ 3805.00usft (Capstar 119)
Well:	#47H	North Reference:	Grid
Wellbore:	OH / Job #1610026	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 119)	Database:	Compass 5000 GCR

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)
4,652.00	25.20	52.60	4,644.36	62.26	15.30	23.11	11.95	11.86	3.72
4,694.00	30.80	54.00	4,681.43	74.02	31.12	40.29	13.42	13.33	3.33
4,737.00	36.00	57.30	4,717.31	87.33	50.67	61.39	12.81	12.09	7.67
4,780.00	40.70	60.50	4,751.03	101.07	73.52	85.80	11.86	10.93	7.44
4,822.00	45.60	63.30	4,781.67	114.56	98.86	112.66	12.52	11.67	6.67
4,865.00	50.60	64.50	4,810.37	128.63	127.60	142.95	11.81	11.63	2.79
4,907.00	55.80	63.90	4,835.52	143.26	157.87	174.84	12.43	12.38	-1.43
4,950.00	61.30	62.60	4,857.95	159.78	190.61	209.41	13.05	12.79	-3.02
4,992.00	67.10	62.50	4,876.22	177.20	224.15	244.90	13.81	13.81	-0.24
5,035.00	72.90	61.80	4,890.92	196.07	259.86	282.72	13.57	13.49	-1.63
5,077.00	76.30	61.30	4,902.08	215.36	295.45	320.49	8.18	8.10	-1.19
5,120.00	80.70	61.80	4,910.65	235.43	332.49	359.78	10.30	10.23	1.16
5,159.00	84.00	62.30	4,915.84	253.54	366.63	395.95	8.56	8.46	1.28
5,201.00	87.30	62.70	4,919.02	272.88	403.77	435.25	7.91	7.86	0.95
5,329.00	89.40	67.60	4,922.71	326.62	519.83	557.22	4.16	1.64	3.83
5,457.00	90.60	71.00	4,922.71	371.86	639.55	681.72	2.82	0.94	2.66
5,584.00	86.60	71.40	4,925.81	412.77	759.71	806.12	3.17	-3.15	0.31
5,712.00	87.50	73.60	4,932.40	451.21	881.62	931.93	1.85	0.70	1.72
5,840.00	86.50	78.30	4,939.10	482.23	1,005.58	1,058.84	3.75	-0.78	3.67
5,968.00	88.10	82.00	4,945.14	504.10	1,131.53	1,186.54	3.15	1.25	2.89
6,096.00	89.90	86.20	4,947.37	517.25	1,258.80	1,314.45	3.57	1.41	3.28
6,223.00	89.20	90.20	4,948.37	521.23	1,385.71	1,440.83	3.20	-0.55	3.15
6,351.00	89.70	90.60	4,949.60	520.34	1,513.70	1,567.66	0.50	0.39	0.31
6,479.00	89.10	90.20	4,950.94	519.45	1,641.69	1,694.49	0.56	-0.47	-0.31
6,606.00	88.30	89.40	4,953.82	519.89	1,768.65	1,820.48	0.89	-0.63	-0.63
6,734.00	87.90	87.40	4,958.06	523.46	1,896.52	1,947.77	1.59	-0.31	-1.56
6,862.00	88.80	87.80	4,961.75	528.82	2,024.36	2,075.24	0.77	0.70	0.31
6,990.00	89.10	87.90	4,964.09	533.62	2,152.24	2,202.70	0.25	0.23	0.08
7,117.00	91.40	88.80	4,963.54	537.28	2,279.18	2,329.06	1.94	1.81	0.71
7,245.00	90.90	89.60	4,960.97	539.06	2,407.14	2,456.21	0.74	-0.39	0.63
7,373.00	91.40	90.20	4,958.40	539.29	2,535.11	2,583.17	0.61	0.39	0.47
7,501.00	89.70	90.80	4,957.17	538.17	2,663.10	2,709.97	1.41	-1.33	0.47
7,628.00	91.00	91.30	4,956.40	535.84	2,790.07	2,835.61	1.10	1.02	0.39
7,756.00	89.70	91.00	4,955.62	533.27	2,918.04	2,962.21	1.04	-1.02	-0.23
7,884.00	89.00	89.10	4,957.07	533.16	3,046.03	3,089.13	1.58	-0.55	-1.48
8,012.00	90.00	88.60	4,958.19	535.73	3,173.99	3,216.38	0.87	0.78	-0.39
8,140.00	88.70	89.10	4,959.64	538.30	3,301.96	3,343.63	1.09	-1.02	0.39
8,268.00	89.50	90.30	4,961.65	538.97	3,429.93	3,470.65	1.13	0.63	0.94
8,398.00	87.80	89.80	4,964.71	538.86	3,559.89	3,599.54	1.36	-1.31	-0.38
8,525.00	89.00	90.80	4,968.26	538.19	3,686.84	3,725.36	1.23	0.94	0.79
8,653.00	89.30	88.00	4,970.16	539.53	3,814.80	3,852.46	2.20	0.23	-2.19
8,781.00	90.80	88.70	4,970.04	543.22	3,942.75	3,979.83	1.29	1.17	0.55
8,909.00	90.40	87.50	4,968.70	547.46	4,070.67	4,107.24	0.99	-0.31	-0.94



Phoenix Technology Services LP

Survey Report



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: NFE Federal COM
Well: #47H
Wellbore: OH / Job #1610026
Design: Surveys (Capstar 119)

Local Co-ordinate Reference: Well #47H
TVD Reference: KB @ 3805.00usft (Capstar 119)
MD Reference: KB @ 3805.00usft (Capstar 119)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: Compass 5000 GCR

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)
8,995.00	89.30	87.00	4,968.93	551.59	4,156.57	4,192.97	1.41	-1.28	-0.58
Final Phoenix MWD Survey									
9,068.00	89.30	87.00	4,969.82	555.41	4,229.46	4,265.76	0.00	0.00	0.00
Projection to TD									

Survey Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
4,356.00	4,355.42	28.31	-19.54	Tie In to Phoenix Gyro Surveys
4,396.00	4,395.41	29.18	-20.31	First Phoenix MWD Survey
8,995.00	4,968.93	551.59	4,156.57	Final Phoenix MWD Survey
9,068.00	4,969.82	555.41	4,229.46	Projection to TD

Checked By: _____ Approved By: _____ Date: _____