



NM OIL CONSERVATION
ARTESIA DISTRICT

JUL 20 2017

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Apache Corporation

Eddy County, NM (NAD27 NME)

Cedar Lake Federal CA

#549H

30-015-43508

OH / Job #61008

Survey: Phoenix MWD Surveys

Standard Survey Report

13 April, 2017



Phoenix Technology Services LP

Survey Report



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: #549H
Wellbore: OH / Job #61008
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well #549H
TVD Reference: GL + KB @ 3811.60usft (Trinidad 436)
MD Reference: GL + KB @ 3811.60usft (Trinidad 436)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
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 Cedar Lake Federal CA

Site Position:
From: Map
Position Uncertainty: 0.00 usft
Northing: 670,624.80 usft
Easting: 633,024.10 usft
Slot Radius: 13-3/16 "
Latitude: 32° 50' 34.37962 N
Longitude: 103° 54' 0.75173 W
Grid Convergence: 0.23 °

Well #549H
Well Position +N/-S 0.00 usft
+E/-W 0.00 usft
Position Uncertainty 0.00 usft
Northing: 678,229.70 usft
Easting: 633,770.20 usft
Wellhead Elevation: usft
Latitude: 32° 51' 49.60046 N
Longitude: 103° 53' 51.63881 W
Ground Level: 3,795.00 usft

Wellbore OH / Job #61008

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	4/30/2017	7.47	60.78	48,401

Design Surveys (Trinidad 436)

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 (°)
	5,401.60	0.00	0.00	82.15

Survey Program Date 4/13/2017

From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
601.00	9,490.00	Phoenix MWD Surveys (OH / Job #61008)	MWD+HDGM	OWSG Rev.2 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)
480.00	0.86	183.34	479.98	-1.56	-1.21	-1.41	0.00	0.00	0.00
Tie In									
601.00	0.86	33.92	600.97	-1.71	-0.76	-0.98	1.37	0.00	-123.49
First Phoenix MWD Survey									
661.00	1.18	55.26	660.97	-0.99	0.00	-0.13	0.82	0.53	35.57
724.00	1.85	79.41	723.94	-0.43	1.54	1.46	1.45	1.06	38.33
786.00	2.89	88.30	785.89	-0.20	4.08	4.02	1.77	1.68	14.34
848.00	3.78	89.54	847.78	-0.14	7.69	7.60	1.44	1.44	2.00
911.00	3.95	89.00	910.64	-0.08	11.93	11.81	0.28	0.27	-0.86
974.00	4.00	89.63	973.49	-0.03	16.30	16.14	0.11	0.08	1.00

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1,036.00	3.87	84.05	1,035.34	0.20	20.54	20.38	0.65	-0.21	-9.00
1,099.00	3.66	84.01	1,098.21	0.63	24.66	24.51	0.33	-0.33	-0.06
1,162.00	3.01	76.08	1,161.10	1.24	28.26	28.17	1.26	-1.03	-12.59
1,287.00	2.10	61.68	1,285.98	3.11	33.47	33.58	0.89	-0.73	-11.52
1,349.00	1.79	53.17	1,347.94	4.23	35.24	35.49	0.68	-0.50	-13.73
1,412.00	1.58	54.47	1,410.91	5.33	36.74	37.12	0.34	-0.33	2.06
1,475.00	1.10	30.30	1,473.90	6.35	37.75	38.26	1.16	-0.76	-38.37
1,537.00	0.74	356.95	1,535.89	7.27	38.03	38.66	1.02	-0.58	-53.79
1,600.00	0.92	358.81	1,598.88	8.18	37.99	38.76	0.29	0.29	2.95
1,662.00	0.91	314.57	1,660.88	9.02	37.63	38.51	1.11	-0.02	-71.35
1,725.00	1.18	287.75	1,723.87	9.57	36.66	37.62	0.88	0.43	-42.57
1,787.00	1.07	291.17	1,785.85	9.98	35.51	36.54	0.21	-0.18	5.52
1,850.00	1.25	284.31	1,848.84	10.36	34.30	35.39	0.36	0.29	-10.89
1,911.00	0.50	233.32	1,909.83	10.36	33.44	34.54	1.66	-1.23	-83.59
1,974.00	0.76	176.92	1,972.83	9.78	33.24	34.27	1.01	0.41	-89.52
2,036.00	0.98	179.75	2,034.82	8.84	33.26	34.16	0.36	0.35	4.56
2,099.00	0.92	190.10	2,097.81	7.80	33.18	33.93	0.29	-0.10	16.43
2,161.00	1.07	182.65	2,159.80	6.74	33.06	33.67	0.32	0.24	-12.02
2,224.00	0.93	186.97	2,222.80	5.64	32.97	33.44	0.25	-0.22	6.86
2,285.00	0.94	175.31	2,283.79	4.65	32.96	33.28	0.31	0.02	-19.11
2,348.00	0.87	177.49	2,346.78	3.66	33.02	33.21	0.12	-0.11	3.46
2,410.00	1.02	184.61	2,408.77	2.64	33.00	33.05	0.31	0.24	11.48
2,473.00	0.95	188.20	2,471.76	1.56	32.88	32.78	0.15	-0.11	5.70
2,535.00	0.85	182.54	2,533.75	0.59	32.78	32.56	0.22	-0.16	-9.13
2,597.00	0.74	198.98	2,595.75	-0.24	32.63	32.29	0.41	-0.18	26.52
2,659.00	0.77	194.27	2,657.74	-1.03	32.40	31.95	0.11	0.05	-7.60
2,722.00	0.77	202.67	2,720.74	-1.83	32.13	31.58	0.18	0.00	13.33
2,784.00	0.57	198.90	2,782.73	-2.50	31.87	31.23	0.33	-0.32	-6.08
2,846.00	0.68	209.88	2,844.73	-3.11	31.59	30.87	0.26	0.18	17.71
2,909.00	0.69	233.97	2,907.72	-3.66	31.09	30.30	0.45	0.02	38.24
2,971.00	0.76	225.17	2,969.72	-4.17	30.50	29.64	0.21	0.11	-14.19
3,033.00	0.61	216.35	3,031.72	-4.73	30.01	29.09	0.30	-0.24	-14.23
3,096.00	0.61	217.08	3,094.71	-5.26	29.61	28.62	0.01	0.00	1.16
3,158.00	0.70	243.77	3,156.71	-5.69	29.07	28.02	0.51	0.15	43.05
3,221.00	0.79	228.94	3,219.70	-6.15	28.40	27.29	0.34	0.14	-23.54
3,282.00	0.74	227.39	3,280.70	-6.69	27.79	26.62	0.09	-0.08	-2.54
3,345.00	0.79	233.27	3,343.69	-7.23	27.15	25.90	0.15	0.08	9.33
3,407.00	0.83	234.74	3,405.69	-7.74	26.44	25.13	0.07	0.06	2.37
3,438.00	0.73	234.04	3,436.68	-7.99	26.09	24.76	0.32	-0.32	-2.26
3,521.00	0.96	226.81	3,519.67	-8.78	25.16	23.72	0.30	0.28	-8.71
3,583.00	1.10	233.04	3,581.66	-9.49	24.31	22.78	0.29	0.23	10.05
3,645.00	0.22	234.78	3,643.66	-9.91	23.73	22.15	1.42	-1.42	2.81
3,708.00	0.22	39.29	3,706.66	-9.89	23.71	22.14	0.69	0.00	261.13

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3,770.00	0.18	18.90	3,768.66	-9.71	23.82	22.27	0.13	-0.06	-32.89
3,832.00	0.23	8.36	3,830.66	-9.49	23.87	22.35	0.10	0.08	-17.00
3,894.00	0.29	355.57	3,892.66	-9.21	23.87	22.39	0.13	0.10	-20.63
3,957.00	0.31	345.26	3,955.66	-8.89	23.82	22.38	0.09	0.03	-16.37
4,020.00	0.34	342.95	4,018.66	-8.54	23.72	22.33	0.05	0.05	-3.67
4,082.00	0.42	336.44	4,080.65	-8.16	23.57	22.24	0.15	0.13	-10.50
4,144.00	0.34	332.43	4,142.65	-7.79	23.40	22.11	0.14	-0.13	-6.47
4,206.00	0.39	329.92	4,204.65	-7.44	23.21	21.97	0.08	0.08	-4.05
4,269.00	0.32	329.06	4,267.65	-7.11	23.01	21.82	0.11	-0.11	-1.37
4,332.00	0.30	324.60	4,330.65	-6.82	22.82	21.68	0.05	-0.03	-7.08
4,394.00	0.26	334.98	4,392.65	-6.56	22.67	21.56	0.10	-0.06	16.74
4,456.00	0.28	328.51	4,454.65	-6.31	22.53	21.46	0.06	0.03	-10.44
4,519.00	0.29	329.43	4,517.65	-6.04	22.37	21.33	0.02	0.02	1.46
4,580.00	0.30	329.76	4,578.65	-5.77	22.21	21.21	0.02	0.02	0.54
4,643.00	0.30	334.31	4,641.65	-5.47	22.06	21.10	0.04	0.00	7.22
4,705.00	0.36	322.71	4,703.64	-5.17	21.87	20.96	0.14	0.10	-18.71
4,768.00	0.40	299.52	4,766.64	-4.91	21.56	20.68	0.25	0.06	-36.81
4,785.00	0.39	302.71	4,783.64	-4.85	21.46	20.59	0.14	-0.06	18.76
4,833.00	0.54	16.92	4,831.64	-4.54	21.38	20.56	1.20	0.31	154.60
4,895.00	4.27	60.41	4,893.58	-3.12	23.48	22.83	6.28	6.02	70.15
4,958.00	9.46	61.58	4,956.10	0.50	30.07	29.86	8.24	8.24	1.86
5,020.00	14.98	57.86	5,016.68	7.19	41.35	41.95	8.99	8.90	-6.00
5,083.00	21.05	60.86	5,076.56	17.05	58.14	59.93	9.74	9.63	4.76
5,145.00	28.40	62.72	5,132.84	29.24	81.00	84.24	11.92	11.85	3.00
5,209.00	34.40	64.98	5,187.44	43.88	110.94	115.90	9.55	9.38	3.53
5,270.00	40.35	68.16	5,235.90	58.53	144.92	151.56	10.25	9.75	5.21
5,333.00	48.32	68.08	5,280.93	74.92	185.74	194.24	12.65	12.65	-0.13
5,396.00	56.90	68.16	5,319.15	93.56	232.15	242.76	13.62	13.62	0.13
5,458.00	65.24	67.46	5,349.11	114.05	282.34	295.28	13.49	13.45	-1.13
5,520.00	73.89	67.18	5,370.74	136.43	335.90	351.39	13.96	13.95	-0.45
5,571.00	81.09	66.44	5,381.78	156.03	381.63	399.37	14.19	14.12	-1.45
5,644.00	89.52	65.52	5,387.75	185.62	448.02	469.18	11.62	11.55	-1.26
5,706.00	90.42	65.53	5,387.78	211.30	504.45	528.59	1.45	1.45	0.02
5,769.00	91.82	65.55	5,386.55	237.38	561.79	588.95	2.22	2.22	0.03
5,831.00	92.55	65.69	5,384.19	262.96	618.22	648.35	1.20	1.18	0.23
5,894.00	91.46	66.28	5,381.98	288.58	675.73	708.82	1.97	-1.73	0.94
5,955.00	92.04	67.02	5,380.12	312.75	731.70	767.57	1.54	0.95	1.21
6,017.00	91.88	70.22	5,378.00	335.33	789.39	827.81	5.16	-0.26	5.16
6,080.00	90.61	72.33	5,376.63	355.55	849.04	889.66	3.91	-2.02	3.35
6,142.00	91.12	72.61	5,375.70	374.22	908.16	950.77	0.94	0.82	0.45
6,204.00	90.17	74.35	5,375.00	391.85	967.59	1,012.06	3.20	-1.53	2.81
6,267.00	90.59	74.56	5,374.58	408.73	1,028.28	1,074.49	0.75	0.67	0.33
6,330.00	91.54	74.67	5,373.41	425.45	1,089.01	1,136.93	1.52	1.51	0.17
6,392.00	92.27	75.01	5,371.35	441.65	1,148.82	1,198.40	1.30	1.18	0.55

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6,455.00	91.68	76.77	5,369.18	457.00	1,209.88	1,260.98	2.94	-0.94	2.79
6,518.00	92.04	76.84	5,367.13	471.37	1,271.19	1,323.67	0.58	0.57	0.11
6,580.00	91.34	79.49	5,365.30	484.08	1,331.84	1,385.49	4.42	-1.13	4.27
6,642.00	90.70	81.27	5,364.20	494.44	1,392.95	1,447.45	3.05	-1.03	2.87
6,704.00	89.94	83.42	5,363.85	502.70	1,454.40	1,509.44	3.68	-1.23	3.47
6,767.00	88.96	84.74	5,364.46	509.20	1,517.06	1,572.40	2.61	-1.56	2.10
6,829.00	88.91	87.18	5,365.61	513.56	1,578.89	1,634.25	3.94	-0.08	3.94
6,891.00	88.85	88.62	5,366.82	515.83	1,640.83	1,695.93	2.32	-0.10	2.32
6,954.00	89.66	88.56	5,367.64	517.38	1,703.81	1,758.52	1.29	1.29	-0.10
7,016.00	90.09	88.87	5,367.78	518.77	1,765.79	1,820.11	0.85	0.69	0.50
7,079.00	88.69	89.95	5,368.45	519.42	1,828.78	1,882.60	2.81	-2.22	1.71
7,141.00	89.21	89.63	5,369.58	519.65	1,890.77	1,944.04	0.98	0.84	-0.52
7,204.00	87.73	88.93	5,371.26	520.44	1,953.74	2,006.53	2.60	-2.35	-1.11
7,266.00	88.60	89.05	5,373.25	521.53	2,015.70	2,068.06	1.42	1.40	0.19
7,328.00	89.27	89.02	5,374.40	522.58	2,077.68	2,129.60	1.08	1.08	-0.05
7,391.00	89.52	88.92	5,375.07	523.71	2,140.66	2,192.15	0.43	0.40	-0.16
7,453.00	87.90	88.89	5,376.46	524.89	2,202.63	2,253.70	2.61	-2.61	-0.05
7,515.00	88.43	88.62	5,378.45	526.24	2,264.59	2,315.25	0.96	0.85	-0.44
7,578.00	89.24	89.07	5,379.73	527.51	2,327.56	2,377.81	1.47	1.29	0.71
7,640.00	90.03	89.32	5,380.12	528.38	2,389.55	2,439.34	1.34	1.27	0.40
7,702.00	90.50	89.05	5,379.84	529.26	2,451.55	2,500.87	0.87	0.76	-0.44
7,765.00	89.02	89.01	5,380.10	530.33	2,514.54	2,563.42	2.35	-2.35	-0.06
7,827.00	89.52	89.04	5,380.89	531.39	2,576.52	2,624.96	0.81	0.81	0.05
7,890.00	89.69	88.85	5,381.33	532.55	2,639.51	2,687.52	0.40	0.27	-0.30
7,952.00	87.93	89.29	5,382.61	533.55	2,701.48	2,749.05	2.93	-2.84	0.71
8,015.00	88.49	88.91	5,384.58	534.54	2,764.45	2,811.56	1.07	0.89	-0.60
8,077.00	89.27	89.53	5,385.79	535.38	2,826.43	2,873.07	1.61	1.26	1.00
8,139.00	90.10	89.89	5,386.13	535.70	2,888.42	2,934.53	1.46	1.34	0.58
8,202.00	90.34	89.60	5,385.89	535.98	2,951.42	2,996.98	0.60	0.38	-0.46
8,264.00	88.91	89.21	5,386.30	536.62	3,013.42	3,058.48	2.39	-2.31	-0.63
8,326.00	89.58	88.94	5,387.12	537.62	3,075.40	3,120.02	1.17	1.08	-0.44
8,388.00	88.41	88.56	5,388.20	538.98	3,137.38	3,181.60	1.98	-1.89	-0.61
8,450.00	86.69	88.27	5,390.85	540.69	3,199.30	3,243.17	2.81	-2.77	-0.47
8,513.00	87.20	87.97	5,394.21	542.75	3,262.17	3,305.74	0.94	0.81	-0.48
8,575.00	87.81	88.05	5,396.91	544.90	3,324.08	3,367.35	0.99	0.98	0.13
8,638.00	88.57	88.26	5,398.90	546.93	3,387.01	3,429.98	1.25	1.21	0.33
8,700.00	89.16	88.23	5,400.13	548.83	3,448.97	3,491.61	0.95	0.95	-0.05
8,762.00	89.80	88.28	5,400.69	550.72	3,510.94	3,553.26	1.04	1.03	0.08
8,824.00	90.14	88.04	5,400.72	552.71	3,572.91	3,614.92	0.67	0.55	-0.39
8,887.00	89.16	87.65	5,401.11	555.08	3,635.86	3,677.60	1.67	-1.56	-0.62
8,949.00	89.52	87.38	5,401.82	557.76	3,697.80	3,739.33	0.73	0.58	-0.44
9,011.00	89.72	87.11	5,402.23	560.74	3,759.72	3,801.08	0.54	0.32	-0.44
9,074.00	90.22	86.96	5,402.27	564.00	3,822.64	3,863.85	0.83	0.79	-0.24

Phoenix Technology Services LP

Survey Report



Company: Apache Corporation
Project: Eddy County, NM (NAD27 NME)
Site: Cedar Lake Federal CA
Well: #549H
Wellbore: OH / Job #61008
Design: Surveys (Trinidad 436)

Local Co-ordinate Reference: Well #549H
TVD Reference: GL + KB @ 3811.60usft (Trinidad 436)
MD Reference: GL + KB @ 3811.60usft (Trinidad 436)
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)
9,136.00	91.01	87.16	5,401.60	567.18	3,884.55	3,925.62	1.31	1.27	0.32
9,199.00	89.75	87.94	5,401.18	569.88	3,947.49	3,988.34	2.35	-2.00	1.24
9,261.00	90.06	87.73	5,401.29	572.22	4,009.45	4,050.03	0.60	0.50	-0.34
9,323.00	90.53	87.42	5,400.97	574.84	4,071.39	4,111.75	0.91	0.76	-0.50
9,385.00	89.30	87.68	5,401.06	577.49	4,133.33	4,173.47	2.03	-1.98	0.42
9,422.00	89.69	87.90	5,401.38	578.92	4,170.30	4,210.29	1.21	1.05	0.59
Final Phoenix MWD Survey									
9,490.00	90.41	88.30	5,401.32	581.17	4,238.27	4,277.93	1.21	1.06	0.59
Projection to TD									

Survey Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
480.00	479.98	-1.56	-1.21	Tie In
601.00	600.97	-1.71	-0.76	First Phoenix MWD Survey
9,422.00	5,401.38	578.92	4,170.30	Final Phoenix MWD Survey
9,490.00	5,401.32	581.17	4,238.27	Projection to TD

