



NM OIL CONSERVATION
ARTESIA DISTRICT
APR 27 2015

RECEIVED

Apache Corporation

Eddy County, NM (NAD27 NME)

Raven Federal

#20H API# 30-015-40917

SL: 420' FSL 4180' FEL UL: P 07-178-31E

WB1/Job #1410582

Survey: Phoenix MWD Survey

Standard Survey Report

20 August, 2014





Phoenix Technology Services

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #20H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3725.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3725.00usft (Capstar 114)
Well:	#20H	North Reference:	Grid
Wellbore:	WB1/Job #1410582	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR DB

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
From:	Map	Easting:	633,303.50 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 51' 0.24298 N
		Longitude:	103° 53' 57.35087 W
		Grid Convergence:	0.24 °

Well	#20H		
Well Position	+N/-S	0.00 usft	Northing:
	+E/-W	0.00 usft	Easting:
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32° 50' 34.07911 N
		Longitude:	103° 54' 1.98394 W
		Ground Level:	3,714.00 usft

Wellbore	WB1/Job #1410582				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010_14	08/04/14	7.40	60.62	48,636

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	269.62

Survey Program	Date 08/20/14				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	4,800.00	Gyrodatta Gyro Survey (WB1/Job #1410582)	NS-GYRO-MS	North sensing gyrocompassing m/s	
4,886.00	9,638.00	Phoenix MWD Survey (WB1/Job #1410582)	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)
4,800.00	0.27	285.61	4,799.70	-23.12	-12.08	12.23	0.00	0.00	0.00
Tie-on to Gyrodatta Gyro Survey									
4,886.00	1.00	285.30	4,885.70	-22.87	-13.00	13.15	0.85	0.85	-0.36
First Phoenix MWD Survey									
4,932.00	5.40	268.60	4,931.61	-22.81	-15.55	15.70	9.68	9.57	-36.30
4,974.00	11.00	268.90	4,973.17	-22.94	-21.54	21.69	13.33	13.33	0.71
5,017.00	16.90	270.30	5,014.88	-22.98	-31.90	32.05	13.74	13.72	3.26
5,060.00	22.60	273.00	5,055.34	-22.52	-46.41	46.56	13.42	13.26	6.28
5,103.00	28.20	274.70	5,094.16	-21.25	-64.80	64.94	13.13	13.02	3.95

Company:	Apache Corporation	Local Co-ordinate Reference:	Well #20H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3725.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3725.00usft (Capstar 114)
Well:	#20H	North Reference:	Grid
Wellbore:	WB1/Job #1410582	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR DB

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)
5,148.00	34.00	274.50	5,132.68	-19.39	-87.96	88.09	12.89	12.89	-0.44
5,191.00	39.60	272.20	5,167.10	-17.92	-113.66	113.78	13.41	13.02	-5.35
5,234.00	45.20	270.70	5,198.84	-17.21	-142.64	142.75	13.23	13.02	-3.49
5,277.00	51.50	269.60	5,227.40	-17.14	-174.75	174.86	14.77	14.65	-2.56
5,319.00	56.00	269.40	5,252.23	-17.44	-208.61	208.72	10.72	10.71	-0.48
5,365.00	59.60	269.60	5,276.74	-17.77	-247.53	247.64	7.83	7.83	0.43
5,408.00	62.70	269.70	5,297.49	-18.00	-285.19	285.30	7.21	7.21	0.23
5,451.00	65.90	270.00	5,316.13	-18.10	-323.93	324.04	7.47	7.44	0.70
5,495.00	68.90	270.70	5,333.04	-17.85	-364.54	364.65	6.97	6.82	1.59
5,538.00	74.30	271.50	5,346.61	-17.07	-405.32	405.43	12.68	12.56	1.86
5,580.00	80.20	272.50	5,355.87	-15.63	-446.24	446.34	14.24	14.05	2.38
5,640.00	87.60	273.50	5,362.24	-12.51	-505.78	505.85	12.44	12.33	1.67
5,726.00	87.60	273.10	5,365.85	-7.56	-591.56	591.60	0.46	0.00	-0.47
5,811.00	89.20	272.20	5,368.22	-3.64	-676.43	676.44	2.16	1.88	-1.06
5,897.00	91.70	271.20	5,367.54	-1.08	-762.38	762.37	3.13	2.91	-1.16
5,983.00	91.80	271.10	5,364.92	0.64	-848.33	848.30	0.16	0.12	-0.12
6,068.00	91.80	271.00	5,362.25	2.20	-933.27	933.24	0.12	0.00	-0.12
6,154.00	91.30	270.80	5,359.92	3.55	-1,019.23	1,019.18	0.63	-0.58	-0.23
6,239.00	91.30	268.00	5,357.99	2.66	-1,104.19	1,104.15	3.29	0.00	-3.29
6,368.00	90.50	267.80	5,355.97	-2.07	-1,233.09	1,233.08	0.64	-0.62	-0.16
6,496.00	91.60	267.40	5,353.62	-7.43	-1,360.95	1,360.97	0.91	0.86	-0.31
6,624.00	90.90	265.70	5,350.83	-15.13	-1,488.69	1,488.75	1.44	-0.55	-1.33
6,752.00	90.90	268.40	5,348.82	-21.71	-1,616.49	1,616.60	2.11	0.00	2.11
6,880.00	92.40	269.40	5,345.13	-24.17	-1,744.41	1,744.53	1.41	1.17	0.78
7,009.00	90.70	269.80	5,341.64	-25.07	-1,873.35	1,873.48	1.35	-1.32	0.31
7,137.00	90.40	270.60	5,340.41	-24.62	-2,001.34	2,001.46	0.67	-0.23	0.63
7,265.00	89.40	269.90	5,340.64	-24.06	-2,129.34	2,129.45	0.95	-0.78	-0.55
7,394.00	90.20	271.80	5,341.09	-22.15	-2,258.32	2,258.41	1.60	0.62	1.47
7,525.00	90.50	271.90	5,340.29	-17.92	-2,389.25	2,389.31	0.24	0.23	0.08
7,656.00	89.90	272.00	5,339.83	-13.46	-2,520.17	2,520.20	0.46	-0.46	0.08
7,784.00	90.30	269.70	5,339.61	-11.57	-2,648.15	2,648.16	1.82	0.31	-1.80
7,912.00	90.20	269.70	5,339.05	-12.24	-2,776.14	2,776.16	0.08	-0.08	0.00
8,041.00	90.50	271.00	5,338.26	-11.45	-2,905.14	2,905.15	1.03	0.23	1.01
8,169.00	91.10	270.40	5,336.47	-9.88	-3,033.11	3,033.11	0.66	0.47	-0.47
8,297.00	91.30	268.30	5,333.79	-11.34	-3,161.07	3,161.07	1.65	0.16	-1.64
8,425.00	90.40	267.10	5,331.89	-16.47	-3,288.95	3,288.98	1.17	-0.70	-0.94
8,553.00	89.90	267.10	5,331.56	-22.95	-3,416.78	3,416.86	0.39	-0.39	0.00
8,681.00	90.80	268.50	5,330.78	-27.86	-3,544.68	3,544.79	1.30	0.70	1.09
8,809.00	90.80	267.80	5,328.99	-31.99	-3,672.60	3,672.73	0.55	0.00	-0.55
8,937.00	90.60	268.70	5,327.42	-35.90	-3,800.53	3,800.69	0.72	-0.16	0.70
9,065.00	92.00	270.70	5,324.52	-36.57	-3,928.49	3,928.64	1.91	1.09	1.56
9,194.00	92.40	270.30	5,319.57	-35.45	-4,057.39	4,057.53	0.44	0.31	-0.31
9,322.00	92.30	269.90	5,314.32	-35.22	-4,185.28	4,185.42	0.32	-0.08	-0.31

Company:	Apache Corporation	Local Co-ordinate Reference:	Well #20H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3725.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3725.00usft (Capstar 114)
Well:	#20H	North Reference:	Grid
Wellbore:	WB1/Job #1410582	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	GCR DB

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)
9,451.00	89.90	268.90	5,311.84	-36.58	-4,314.24	4,314.38	2.02	-1.86	-0.78
9,569.00	90.20	268.70	5,311.74	-39.05	-4,432.21	4,432.37	0.31	0.25	-0.17
Last Phoenix MWD Survey									
9,638.00	90.20	268.70	5,311.50	-40.61	-4,501.19	4,501.36	0.00	0.00	0.00
Projection to TD									

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
4,800.00	4,799.70	-23.12	-12.08	Tie-on to Gyrodata Gyro Survey
4,886.00	4,885.70	-22.87	-13.00	First Phoenix MWD Survey
9,569.00	5,311.74	-39.05	-4,432.21	Last Phoenix MWD Survey
9,638.00	5,311.50	-40.61	-4,501.19	Projection to TD

Checked By: _____	Approved By: _____	Date: _____
-------------------	--------------------	-------------