



PHOENIX
TECHNOLOGY SERVICES

December 10, 2015

NM OIL CONSERVATION
ARTESIA DISTRICT

SEP 07 2016

RECEIVED

Apache Corporation
Attention: Regulatory Department
303 Veterans Airpark Lane, Suite 3000,
Midland, TX 79705

Re: Apache Corporation
Raven Federal Com #23H
Eddy County, NM
API #30-015-43362
Job No. 1514630

- Cedar Lake Federal CA 723H

Dear Regulatory Department;

Phoenix Technology Services, Inc. has filed the Survey Data Certification, Surveys, and Lease Plat for the above referenced well with the State of New Mexico Oil Conservation Division – District 2 via certified mail. A copy of the filing is attached for your records.

Name of Surveyor	Drain Hole Number	Surveyed Depths		Dates Performed		Type of Survey
		From	To	Start	End	
Bernard Caldwell	23H	4,349	8,701	11/22/15	11/25/15	MWD

Thank you for the opportunity to be of service. Please contact me if you have any questions or require additional information.

Best Regards,

Claudia Carreon

Claudia Carreon
Operations Administrator



**PHOENIX
TECHNOLOGY SERVICES**

December 10, 2015

Oil Conservation Division
State of New Mexico
811 S. First St.
Artesia, New Mexico 88210

NM OIL CONSERVATION
ARTESIA DISTRICT
SEP 07 2016

Dear District 2 - Artesia

RECEIVED

Attention: Regulatory Department

Re: Apache Corporation
Raven Federal Com #23H
Eddy County, NM
API #30-015-43362
Job No. 1514630

- Cedar Lake Federal CA 723H

Enclosed please find the Survey Data Certification, and the original Plat and one copy of the Survey Report performed on the above referenced Well by Phoenix Technology Services, Inc. (P-5 No. 664171). Other information required by your office is as follows:

Name & Title of Surveyor	Drain Hole Number	Surveyed Depths		Dates Performed		Type of Survey
		From	To	Start	End	
Bernard Caldwell	23H	4,349	8,701	11/22/15	11/25/15	MWD

A certified plat on which the bottom hole location is oriented both to the surface location and to the lease lines (or unit lines in case of pooling) is attached to the survey report. If any other information is required, please contact the undersigned at the letterhead address and phone number.

Best Regards,

Claudia Carreon

Claudia Carreon
Operations Administrator

Certified mail receipt number: 7015 0640 0000 9907 5210

**Phoenix Technology Services
SURVEY DATA CERTIFICATION**



PHOENIX JOB NUMBER

1514630

ENERGY COMPANY

Apache Corp

WELL NAME

Raven Federal Com #23H

COUNTY & STATE

Eddy County, NM

API WELL NUMBER

30-015-43362

PROPOSED DIRECTION

89.98°

TIE-IN DATA						
MEASURED DEPTH	VERTICAL DEPTH	INCLIN	AZIMUTH	N-S COORD	E-W COORD	DATA SOURCE
4,118 ft	4,117.87 ft	0.73°	16.48°	9.27 ft	45 ft	Gyro

FIRST SURVEY DATE	FIRST SURVEY DEPTH	INCLIN	AZIMUTH
22-Nov-15	4,349.00 ft	2.2°	84.5°

SURVEY INSTRUMENT TYPE
Phoenix MWD

LAST SURVEY DATE	LAST SURVEY DEPTH	INCLIN	AZIMUTH
25-Nov-15	8,701.00 ft	88.7°	90.9°

TO THE BEST OF MY KNOWLEDGE I
CERTIFY THIS SURVEY DATA TO BE
TRUE AND CORRECT.

PROJECTED TD SURVEY DATE	PROJECTED TD SURVEY DEPTH	INCLIN	AZIMUTH
25-Nov-15	8,765.00 ft	88.7°	90.9°

Bernard Caldwell

PRINT YOUR NAME ABOVE

Bernard Caldwell

SIGN YOUR NAME ABOVE

11/26/15

TODAY'S DATE

MAGNETIC DECLINATION OR TOTAL GRID

TOTAL CORRECTION USED	7.42
DECLINATION OR GRID	GRID

MWD SUPERVISOR 1

Bernard Caldwell

DIRECTIONAL DRILLER 1

David Eddins

MWD SUPERVISOR 2

Steve Poer

DIRECTIONAL DRILLER 2

Brad Jones

Phoenix Technology Services
 Design Report 26-Nov-2015 07:10:51

Apache Corporation

Raven Federal #23H
 Eddy County, NM (NAD27 NME)
 OH / Job #1514630
 Surveys (Capstar 114)

Surface Loc.:
 Northing: (Y) 672324.90
 Easting: (X) 628585.60
 KB Elev: 3733.00'
 GL Elev: 3722.00'

Survey Type Information:
 H 100.00 - 4118.00 PHOENIX GYRO SURVEYS : CB-GYRO-MS
 H 4349.00 - 8765.00 PHOENIX MWD SURVEYS : PHX+MWD+HDGM

Measured	Incl.	Azim.	Sub-Sea Depth (ft)	Vertical Depth (ft)	Local Coord (+N/-S) (ft)	Local Coord (+E/-W) (ft)	UTM Coord Northings (ft)	UTM Coord Eastings (ft)	Vertical Section (ft)	Dogleg Rate (%/100ft)	Annotation
0	0	0	-3733	0	0	0	672324.9	628585.6	0	0	
100	0.21	87.59	-3633	100	0.01	0.18	672324.9	628585.8	0.18	0.21	
200	0.31	172.68	-3533	200	-0.25	0.4	672324.7	628586	0.4	0.36	
300	0.48	243.81	-3433	300	-0.71	0.06	672324.2	628585.7	0.06	0.48	
400	0.69	238.18	-3333.01	399.99	-1.21	-0.83	672323.7	628584.8	-0.83	0.22	
500	0.63	235.98	-3233.01	499.99	-1.83	-1.8	672323.1	628583.8	-1.8	0.07	
600	0.63	230.38	-3133.02	599.98	-2.49	-2.67	672322.4	628582.9	-2.68	0.06	
700	0.51	312.88	-3033.02	699.98	-2.54	-3.42	672322.4	628582.2	-3.43	0.76	
800	0.48	321.12	-2933.03	799.97	-1.91	-4.01	672323	628581.6	-4.01	0.08	

900	0.28	334.41	-2833.03	899.97	-1.36	-4.38	672323.5	628581.2	-4.38	0.22
1000	0.39	5.69	-2733.03	999.97	-0.8	-4.45	672324.1	628581.2	-4.45	0.21
1100	0.78	44.53	-2633.04	1099.96	0.02	-3.94	672324.9	628581.7	-3.94	0.54
1200	0.88	51.99	-2533.05	1199.95	0.98	-2.86	672325.9	628582.7	-2.86	0.15
1300	0.95	62.68	-2433.06	1299.94	1.83	-1.52	672326.7	628584.1	-1.52	0.18
1400	0.85	82.57	-2333.07	1399.93	2.31	-0.05	672327.2	628585.6	-0.05	0.33
1500	0.72	91.26	-2233.08	1499.92	2.39	1.32	672327.3	628586.9	1.32	0.18
1600	0.57	15.99	-2133.09	1599.91	2.85	2.08	672327.8	628587.7	2.08	0.8
1700	0.55	331.29	-2033.09	1699.91	3.75	1.99	672328.7	628587.6	1.99	0.43
1800	0.48	0.54	-1933.09	1799.91	4.59	1.76	672329.5	628587.4	1.76	0.27
1900	0.25	165.92	-1833.1	1899.9	4.8	1.82	672329.7	628587.4	1.82	0.72
2000	0.16	123.68	-1733.1	1999.9	4.51	1.99	672329.4	628587.6	1.99	0.17
2100	0.26	349.73	-1633.1	2099.9	4.66	2.06	672329.6	628587.7	2.07	0.39
2200	0.27	262.58	-1533.1	2199.9	4.85	1.79	672329.8	628587.4	1.79	0.37
2300	0.15	170.6	-1433.1	2299.9	4.69	1.58	672329.6	628587.2	1.58	0.31
2400	0.14	39.6	-1333.1	2399.9	4.65	1.68	672329.6	628587.3	1.68	0.26
2500	0.04	57.34	-1233.1	2499.9	4.77	1.78	672329.7	628587.4	1.79	0.1
2600	0.07	51.45	-1133.1	2599.9	4.82	1.86	672329.7	628587.5	1.86	0.03
2700	0.08	72.01	-1033.1	2699.9	4.88	1.98	672329.8	628587.6	1.98	0.03
2800	0.31	198.32	-933.1	2799.9	4.65	1.96	672329.6	628587.6	1.96	0.36
2900	0.09	53.25	-833.1	2899.9	4.44	1.93	672329.3	628587.5	1.94	0.39
3000	0.1	258.11	-733.1	2999.9	4.47	1.91	672329.4	628587.5	1.91	0.19
3100	0.14	159.06	-633.1	3099.9	4.34	1.87	672329.2	628587.5	1.87	0.18
3200	0.13	286.8	-533.1	3199.9	4.25	1.81	672329.2	628587.4	1.81	0.24
3300	0.12	98.23	-433.1	3299.9	4.27	1.8	672329.2	628587.4	1.8	0.25
3400	0.13	348.4	-333.1	3399.9	4.37	1.88	672329.3	628587.5	1.88	0.2
3500	0.15	264.51	-233.1	3499.9	4.47	1.73	672329.4	628587.3	1.73	0.19
3600	0.24	332.56	-133.1	3599.9	4.64	1.5	672329.5	628587.1	1.5	0.23
3700	0.59	303.81	-33.1	3699.9	5.11	0.98	672330	628586.6	0.98	0.4
3800	0.51	306.19	66.89	3799.89	5.66	0.19	672330.6	628585.8	0.19	0.08
3900	0.81	24.23	166.89	3899.89	6.57	0.12	672331.5	628585.7	0.12	0.86
4000	0.71	352.72	266.88	3999.88	7.83	0.33	672332.7	628585.9	0.34	0.42
4118	0.73	16.48	384.87	4117.87	9.27	0.45	672334.2	628586.1	0.46	0.25
4349	2.2	84.5	615.8	4348.8	11.11	5.28	672336	628590.9	5.29	0.88

0.25 Tie In to Phoenix Gyro Surveys
0.88 First Phoenix MWD Survey

4392	8.7	94.4	658.58	4391.58	10.94	9.35	672335.8	628595	9.36	15.22
4434	15.1	92	699.66	4432.66	10.51	18	672335.4	628603.6	18	15.28
4477	21.5	92	740.46	4473.46	10.03	31.48	672334.9	628617.1	31.49	14.88
4520	27	94.8	779.66	4512.66	8.94	49.1	672333.8	628634.7	49.1	13.06
4562	32.3	97.1	816.14	4549.14	6.76	69.75	672331.7	628655.4	69.75	12.9
4605	36.9	98.7	851.53	4584.53	3.38	93.92	672328.3	628679.5	93.93	10.9
4648	41.2	98.5	884.92	4617.92	-0.67	120.7	672324.2	628706.3	120.7	10
4690	45.3	99.3	915.5	4648.5	-5.13	149.13	672319.8	628734.7	149.13	9.85
4733	49.9	99.5	944.49	4677.49	-10.31	180.45	672314.6	628766.1	180.44	10.7
4776	54.1	98.7	970.96	4703.96	-15.66	213.9	672309.2	628799.5	213.89	9.88
4818	59	97.8	994.1	4727.1	-20.68	248.57	672304.2	628834.2	248.56	11.8
4861	64.3	97.5	1014.51	4747.51	-25.72	286.06	672299.2	628871.7	286.05	12.34
4904	66.8	97.6	1032.31	4765.31	-30.86	324.86	672294	628910.5	324.85	5.82
4946	70.6	98.8	1047.56	4780.56	-36.44	363.58	672288.5	628949.2	363.57	9.43
4989	74.3	99.7	1060.53	4793.53	-43.04	404.04	672281.9	628989.6	404.03	8.83
5032	80.3	99.7	1069.98	4802.98	-50.1	445.37	672274.8	629031	445.35	13.95
5080	85.4	98.5	1075.95	4808.95	-57.63	492.38	672267.3	629078	492.36	10.91
5123	87.3	96.6	1078.69	4811.69	-63.27	534.92	672261.6	629120.5	534.9	6.24
5251	87.4	94.3	1084.61	4817.61	-75.41	662.2	672249.5	629247.8	662.17	1.8
5379	87.6	92.1	1090.19	4823.19	-82.55	789.87	672242.4	629375.5	789.84	1.72
5507	87.8	88.4	1095.33	4828.33	-83.1	917.74	672241.8	629503.3	917.71	2.89
5635	88.8	87.8	1099.12	4832.12	-78.86	1045.61	672246	629631.2	1045.58	0.91
5763	87.8	87.5	1102.92	4835.92	-73.62	1173.44	672251.3	629759	1173.42	0.82
5891	87.7	87.1	1107.95	4840.95	-67.59	1301.2	672257.3	629886.8	1301.18	0.32
6019	89.8	89.3	1110.74	4843.74	-63.57	1429.1	672261.3	630014.7	1429.07	2.38
6147	90.3	91.1	1110.63	4843.63	-64.02	1557.09	672260.9	630142.7	1557.07	1.46
6275	88.4	90.1	1112.08	4845.08	-65.36	1685.07	672259.5	630270.7	1685.04	1.68
6399	86.3	88.7	1117.81	4850.81	-64.06	1808.92	672260.8	630394.5	1808.89	2.03
6526	87.5	87.3	1124.68	4857.68	-59.64	1935.65	672265.3	630521.3	1935.63	1.45
6655	88.6	87.2	1129.07	4862.07	-53.45	2064.42	672271.5	630650	2064.4	0.86
6782	89.1	86.5	1131.62	4864.62	-46.48	2191.2	672278.4	630776.8	2191.19	0.68
6910	87.8	87.2	1135.08	4868.08	-39.44	2318.96	672285.5	630904.6	2318.95	1.15
7038	88.6	88.9	1139.1	4872.1	-35.09	2446.82	672289.8	631032.4	2446.81	1.47
7167	89.3	89	1141.47	4874.47	-32.73	2575.77	672292.2	631161.4	2575.76	0.55

7295	89.5	89	1142.81	4875.81	-30.49	2703.75	672294.4	631289.4	2703.74	0.16
7422	89.2	88.5	1144.25	4877.25	-27.72	2830.71	672297.2	631416.3	2830.7	0.46
7550	88.6	87.8	1146.71	4879.71	-23.59	2958.62	672301.3	631544.2	2958.61	0.72
7678	88.3	88.3	1150.17	4883.17	-19.24	3086.49	672305.7	631672.1	3086.49	0.46
7806	87.5	87.7	1154.86	4887.86	-14.77	3214.33	672310.1	631799.9	3214.32	0.78
7934	87	87.6	1161	4894	-9.53	3342.07	672315.4	631927.7	3342.07	0.4
8062	88	88.3	1166.58	4899.58	-4.96	3469.87	672319.9	632055.5	3469.87	0.95
8190	88.2	89.3	1170.83	4903.83	-2.28	3597.77	672322.6	632183.4	3597.77	0.8
8319	88.5	89.3	1174.54	4907.54	-0.7	3726.7	672324.2	632312.3	3726.7	0.23
8447	87.7	89.1	1178.78	4911.78	1.08	3854.62	672326	632440.2	3854.62	0.64
8574	90.5	92	1180.78	4913.78	-0.14	3981.57	672324.8	632567.2	3981.57	3.17
8701	88.7	90.9	1181.67	4914.67	-3.35	4108.52	672321.6	632694.1	4108.52	1.66
8765	88.7	90.9	1183.12	4916.12	-4.36	4172.5	672320.5	632758.1	4172.5	0

1.66 Final Phoenix MWD Survey
0 Projection to TD

All data are in feet unless otherwise stated. Directions and coordinates are relative to Grid North.
Vertical depths are relative to KB. Northings and Eastings are relative to Well.

The Dogleg Severity is in Degrees per 100 feet.
Vertical Section is from Slot and calculated along an Azimuth of 89.980° (Grid).

Coordinate System is NAD 1927 (NADCON CONUS) US State Plane 1927 (Exact solution), New Mexico East 3001.
Grid Convergence at Surface is 0.227°.

Based upon Minimum Curvature type calculations, at a Measured Depth of 8765.00ft.,
the Bottom Hole Displacement is 4172.50ft., in the Direction of 89.980° (Grid).



NM OIL CONSERVATION
ARTESIA DISTRICT
SEP 07 2016

RECEIVED

Apache Corporation

Eddy County, NM (NAD27 NME)

Raven Federal

#23H

- Cedar Lake Federal CA 723H

OH / Job #1514630

*Gyro +
mwd*

Design: Surveys (Capstar 114)

Standard Survey Report

26 November, 2015



PHOENIX
TECHNOLOGY SERVICES



Phoenix Technology Services LP

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #23H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3733.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3733.00usft (Capstar 114)
Well:	#23H	North Reference:	Grid
Wellbore:	OH / Job #1514630	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	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:	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:	#23H					
Well Position	+N/-S	0.00 usft	Northing:	672,324.90 usft	Latitude:	32° 50' 51.37938 N
	+E/-W	0.00 usft	Easting:	628,585.60 usft	Longitude:	103° 54' 52.69762 W
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft	Ground Level:	3,722.00 usft	

Wellbore	OH / Job #1514630		
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Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	HDGM	10/29/2015	7.65	60.77	48,543

Design	Surveys (Capstar 114)		
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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	89.98

Survey Program	Date 11/26/2015		
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From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.00	4,118.00	Phoenix Gyro Surveys (OH / Job #151463)	CB-GYRO-MS	Camera based gyro multishot
4,349.00	8,765.00	Phoenix MWD Surveys (OH / Job #15146)	PHX+MWD+HDGM	PHX+OWSG MWD + HDGM

Survey									
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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)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.21	87.59	100.00	0.01	0.18	0.18	0.21	0.21	0.00
200.00	0.31	172.68	200.00	-0.25	0.40	0.40	0.36	0.10	85.09
300.00	0.48	243.81	300.00	-0.71	0.06	0.06	0.48	0.17	71.13
400.00	0.69	238.18	399.99	-1.21	-0.83	-0.83	0.22	0.21	-5.63
500.00	0.63	235.98	499.99	-1.83	-1.80	-1.80	0.07	-0.06	-2.20
600.00	0.63	230.38	599.98	-2.49	-2.67	-2.68	0.06	0.00	-5.60
700.00	0.51	312.88	699.98	-2.54	-3.42	-3.43	0.76	-0.12	82.50
800.00	0.48	321.12	799.97	-1.91	-4.01	-4.01	0.08	-0.03	8.24
900.00	0.28	334.41	899.97	-1.36	-4.38	-4.38	0.22	-0.20	13.29



Phoenix Technology Services LP

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #23H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3733.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3733.00usft (Capstar 114)
Well:	#23H	North Reference:	Grid
Wellbore:	OH / Job #1514630	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	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)
1,000.00	0.39	5.69	999.97	-0.80	-4.45	-4.45	0.21	0.11	31.28
1,100.00	0.78	44.53	1,099.96	0.02	-3.94	-3.94	0.54	0.39	38.84
1,200.00	0.88	51.99	1,199.95	0.98	-2.86	-2.86	0.15	0.10	7.46
1,300.00	0.95	62.68	1,299.94	1.83	-1.52	-1.52	0.18	0.07	10.69
1,400.00	0.85	82.57	1,399.93	2.31	-0.05	-0.05	0.33	-0.10	19.89
1,500.00	0.72	91.26	1,499.92	2.39	1.32	1.32	0.18	-0.13	8.69
1,600.00	0.57	15.99	1,599.91	2.85	2.08	2.08	0.80	-0.15	-75.27
1,700.00	0.55	331.29	1,699.91	3.75	1.99	1.99	0.43	-0.02	-44.70
1,800.00	0.48	0.54	1,799.91	4.59	1.76	1.76	0.27	-0.07	29.25
1,900.00	0.25	165.92	1,899.90	4.80	1.82	1.82	0.72	-0.23	165.38
2,000.00	0.16	123.68	1,999.90	4.51	1.99	1.99	0.17	-0.09	-42.24
2,100.00	0.26	349.73	2,099.90	4.66	2.06	2.07	0.39	0.10	-133.95
2,200.00	0.27	262.58	2,199.90	4.85	1.79	1.79	0.37	0.01	-87.15
2,300.00	0.15	170.60	2,299.90	4.69	1.58	1.58	0.31	-0.12	-91.98
2,400.00	0.14	39.60	2,399.90	4.65	1.68	1.68	0.26	-0.01	-131.00
2,500.00	0.04	57.34	2,499.90	4.77	1.78	1.79	0.10	-0.10	17.74
2,600.00	0.07	51.45	2,599.90	4.82	1.86	1.86	0.03	0.03	-5.89
2,700.00	0.08	72.01	2,699.90	4.88	1.98	1.98	0.03	0.01	20.56
2,800.00	0.31	198.32	2,799.90	4.65	1.96	1.96	0.36	0.23	126.31
2,900.00	0.09	53.25	2,899.90	4.44	1.93	1.94	0.39	-0.22	-145.07
3,000.00	0.10	258.11	2,999.90	4.47	1.91	1.91	0.19	0.01	-155.14
3,100.00	0.14	159.06	3,099.90	4.34	1.87	1.87	0.18	0.04	-99.05
3,200.00	0.13	286.80	3,199.90	4.25	1.81	1.81	0.24	-0.01	127.74
3,300.00	0.12	98.23	3,299.90	4.27	1.80	1.80	0.25	-0.01	171.43
3,400.00	0.13	348.40	3,399.90	4.37	1.88	1.88	0.20	0.01	-109.83
3,500.00	0.15	264.51	3,499.90	4.47	1.73	1.73	0.19	0.02	-83.89
3,600.00	0.24	332.56	3,599.90	4.64	1.50	1.50	0.23	0.09	68.05
3,700.00	0.59	303.81	3,699.90	5.11	0.98	0.98	0.40	0.35	-28.75
3,800.00	0.51	306.19	3,799.89	5.66	0.19	0.19	0.08	-0.08	2.38
3,900.00	0.81	24.23	3,899.89	6.57	0.12	0.12	0.86	0.30	78.04
4,000.00	0.71	352.72	3,999.88	7.83	0.33	0.34	0.42	-0.10	-31.51
4,118.00	0.73	16.48	4,117.87	9.27	0.45	0.46	0.25	0.02	20.14
Tie In to Phoenix Gyro Surveys									
4,349.00	2.20	84.50	4,348.80	11.11	5.28	5.29	0.88	0.64	29.45
First Phoenix MWD Survey									
4,392.00	8.70	94.40	4,391.58	10.94	9.35	9.36	15.22	15.12	23.02
4,434.00	15.10	92.00	4,432.66	10.51	18.00	18.00	15.28	15.24	-5.71
4,477.00	21.50	92.00	4,473.46	10.03	31.48	31.49	14.88	14.88	0.00
4,520.00	27.00	94.80	4,512.66	8.94	49.10	49.10	13.06	12.79	6.51
4,562.00	32.30	97.10	4,549.14	6.76	69.75	69.75	12.90	12.62	5.48
4,605.00	36.90	98.70	4,584.53	3.38	93.92	93.93	10.90	10.70	3.72
4,648.00	41.20	98.50	4,617.92	-0.67	120.70	120.70	10.00	10.00	-0.47
4,690.00	45.30	99.30	4,648.50	-5.13	149.13	149.13	9.85	9.76	1.90



Phoenix Technology Services LP

Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #23H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3733.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3733.00usft (Capstar 114)
Well:	#23H	North Reference:	Grid
Wellbore:	OH / Job #1514630	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	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)	
4,733.00	49.90	99.50	4,677.49	-10.31	180.45	180.44	10.70	10.70	0.47	
4,776.00	54.10	98.70	4,703.96	-15.66	213.90	213.89	9.88	9.77	-1.86	
4,818.00	59.00	97.80	4,727.10	-20.68	248.57	248.56	11.80	11.67	-2.14	
4,861.00	64.30	97.50	4,747.51	-25.72	286.06	286.05	12.34	12.33	-0.70	
4,904.00	66.80	97.60	4,765.31	-30.86	324.86	324.85	5.82	5.81	0.23	
4,946.00	70.60	98.80	4,780.56	-36.44	363.58	363.57	9.43	9.05	2.86	
4,989.00	74.30	99.70	4,793.53	-43.04	404.04	404.03	8.83	8.60	2.09	
5,032.00	80.30	99.70	4,802.98	-50.10	445.37	445.35	13.95	13.95	0.00	
5,080.00	85.40	98.50	4,808.95	-57.63	492.38	492.36	10.91	10.63	-2.50	
5,123.00	87.30	96.60	4,811.89	-63.27	534.92	534.90	6.24	4.42	-4.42	
5,251.00	87.40	94.30	4,817.61	-75.41	662.20	662.17	1.80	0.08	-1.80	
5,379.00	87.60	92.10	4,823.19	-82.55	789.87	789.84	1.72	0.16	-1.72	
5,507.00	87.80	88.40	4,828.33	-83.10	917.74	917.71	2.89	0.16	-2.89	
5,635.00	88.80	87.80	4,832.13	-78.86	1,045.61	1,045.58	0.91	0.78	-0.47	
5,763.00	87.80	87.50	4,835.92	-73.62	1,173.45	1,173.42	0.82	-0.78	-0.23	
5,891.00	87.70	87.10	4,840.95	-67.59	1,301.20	1,301.18	0.32	-0.08	-0.31	
6,019.00	89.80	89.30	4,843.74	-63.57	1,429.10	1,429.07	2.38	1.64	1.72	
6,147.00	90.30	91.10	4,843.63	-64.02	1,557.09	1,557.07	1.46	0.39	1.41	
6,275.00	88.40	90.10	4,845.08	-65.36	1,685.07	1,685.04	1.68	-1.48	-0.78	
6,399.00	86.30	88.70	4,850.81	-64.06	1,808.92	1,808.89	2.03	-1.69	-1.13	
6,526.00	87.50	87.30	4,857.68	-59.64	1,935.65	1,935.63	1.45	0.94	-1.10	
6,655.00	88.60	87.20	4,862.07	-53.45	2,064.42	2,064.40	0.86	0.85	-0.08	
6,782.00	89.10	86.50	4,864.62	-46.48	2,191.20	2,191.19	0.68	0.39	-0.55	
6,910.00	87.80	87.20	4,868.08	-39.44	2,318.96	2,318.95	1.15	-1.02	0.55	
7,038.00	88.60	88.90	4,872.10	-35.09	2,446.82	2,446.81	1.47	0.63	1.33	
7,167.00	89.30	89.00	4,874.47	-32.73	2,575.77	2,575.76	0.55	0.54	0.08	
7,295.00	89.50	89.00	4,875.81	-30.49	2,703.75	2,703.74	0.16	0.16	0.00	
7,422.00	89.20	88.50	4,877.25	-27.72	2,830.71	2,830.70	0.46	-0.24	-0.39	
7,550.00	88.60	87.80	4,879.71	-23.59	2,958.62	2,958.61	0.72	-0.47	-0.55	
7,678.00	88.30	88.30	4,883.17	-19.24	3,086.49	3,086.49	0.46	-0.23	0.39	
7,806.00	87.50	87.70	4,887.86	-14.77	3,214.33	3,214.32	0.78	-0.63	-0.47	
7,934.00	87.00	87.60	4,894.00	-9.53	3,342.07	3,342.07	0.40	-0.39	-0.08	
8,062.00	88.00	88.30	4,899.58	-4.96	3,469.87	3,469.87	0.95	0.78	0.55	
8,190.00	88.20	89.30	4,903.83	-2.28	3,597.77	3,597.77	0.80	0.16	0.78	
8,319.00	88.50	89.30	4,907.54	-0.70	3,726.70	3,726.70	0.23	0.23	0.00	
8,447.00	87.70	89.10	4,911.78	1.08	3,854.62	3,854.62	0.64	-0.63	-0.16	
8,574.00	90.50	92.00	4,913.78	-0.14	3,981.57	3,981.57	3.17	2.20	2.28	
8,701.00	88.70	90.90	4,914.67	-3.35	4,108.52	4,108.52	1.66	-1.42	-0.87	
Final Phoenix MWD Survey										
8,765.00	88.70	90.90	4,916.12	-4.36	4,172.50	4,172.50	0.00	0.00	0.00	
Projection to TD										



Phoenix Technology Services LP

Survey Report



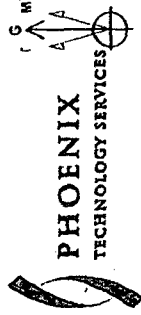
Company:	Apache Corporation	Local Co-ordinate Reference:	Well #23H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3733.00usft (Capstar 114)
Site:	Raven Federal	MD Reference:	KB @ 3733.00usft (Capstar 114)
Well:	#23H	North Reference:	Grid
Wellbore:	OH / Job #1514630	Survey/Calculation Method:	Minimum Curvature
Design:	Surveys (Capstar 114)	Database:	Compass 5000 GCR

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
4,118.00	4,117.87	9.27	0.45	Tie In to Phoenix Gyro Surveys
4,349.00	4,348.80	11.11	5.28	First Phoenix MWD Survey
8,701.00	4,914.67	-3.35	4,108.52	Final Phoenix MWD Survey
8,765.00	4,916.12	-4.36	4,172.50	Projection to TD

Checked By: _____	Approved By: _____	Date: _____
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Project: Eddy County, NM (NAD27 NME)
 Site: Raven Federal
 Well: #23H
 Wellbore: OH / Job #1514630
 Design: Plan #4 11-21-15
 Rig: Capstar 114



Alignments to Grid North
 True North: 0.23°
 Magnetic North: 7.42°
 Magnetic Field
 Strength: 48543.191T
 Dip Angle: 60.77°
 Date: 10/29/2015
 Model: HDGM

Map System: US State Plane 1927 (East solution)
 Datum: NAD83 (NAD83 CONUS)
 Epoch: 1988
 Zone Name: New Mexico East 3001
 Local Origin: Well #23H, One North
 Latitude: 32° 52' 51.31838 N
 Longitude: 107° 54' 52.63781 W
 Grid North: 67332.90
 Grid East: 626585.60
 Scale Factor: 1.000
 Geomagnetic Model: HDGM
 Sample Date: 29-Oct-15
 Magnetic Declination: 7.65°
 Dip Angle from Horizontal: 60.77°
 Magnetic Field Strength: 48543

To convert a Magnetic Direction to a Grid Direction, Add 7.42°
 To convert a Magnetic Direction to a True Direction, Add 7.65° East
 To convert a True Direction to a Grid Direction, Subtract 0.23°

FORMATION TOP DETAILS

True Vert	Formation	Dip Angle	Depth
217.00	Blaker		
217.00	Blaker		
466.00	421.61 1752K		
1334.00	1324.00 5752K		
1466.00	1462.00 5756K		
1742.00	1742.00 5756K		
1742.00	1742.00 5756K		
3074.00	3074.00 San Anitros		
3748.00	3748.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		

LEGEND

- #23H, OH / Job #1514630, Surveys (Capstar 114) V0
- #1, CH, Actual Surveys V0
- #14H, W81, Plan #2, 04-30-14 V0
- #15H, W81, Plan #2, 04-30-14 V0
- #17H, CH / Job #1310326, Surveys (Basec 44) V0
- #23H, CH, Plan #3 10-23-15 V0
- #19H, W81/Job #111705, Surveys (Capstar 114) V0
- #23H, CH / Job #1514630, Surveys (Capstar 114) V0
- #15H, W81, Plan #2, 04-30-14 V0
- #10H, CH / Job #1211217, Surveys (Basec 44) V0
- Plan #4 11-21-15

WELL DETAILS

True Vert	Formation	Dip Angle	Depth
217.00	Blaker		
217.00	Blaker		
466.00	421.61 1752K		
1334.00	1324.00 5752K		
1466.00	1462.00 5756K		
1742.00	1742.00 5756K		
1742.00	1742.00 5756K		
3074.00	3074.00 San Anitros		
3748.00	3748.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		
4559.00	4559.00 5756K		

SECTION DETAILS

Spec	MD	VC	AS	TVD	SLW	Deg	TSPN	VSPC	Temp	Annulation
1	4115.00	0.73	16.48	4117.97	0.27	0.45	0.00	0.00	0.46	Tie in to Phoenix Gyro Surveys
2	4347.50	0.73	16.48	4347.97	12.08	1.25	0.00	0.00	1.29	KOP: 12,007/100' Build
3	5086.00	0.73	16.48	5086.97	493.84	49.08	0.00	0.00	493.85	LP: Hold 88.77' Inc. 3,007/100' Turn
4	5411.00	0.73	16.48	5411.97	801.25	74.21	175.31	3.00	752.33	Hold 88.77' Azim
5	5798.00	0.73	16.48	5798.97	801.25	74.21	175.31	3.00	752.33	Hold 88.77' Azim

DESIGN TARGET DETAILS

Name	True Vert	MD	VC	AS	TVD	SLW	Deg	TSPN	VSPC	Temp
OH - Raven Fed #23H V2	4300.00	1.70	17.00	4300.00	1.70	17.00	0.00	0.00	1.70	Plan
OH - Raven Fed #23H V2	4300.00	1.70	17.00	4300.00	1.70	17.00	0.00	0.00	1.70	Plan

