PHOENIX
TECHNOLOGY SERVICES

March 14, 2014

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

RECEIVED
MAR 24 2014
NMOCD ARTESIA

Dear District 2 - Artesia

Attention: Regulatory Department

Re: Apache Corporation
Crow Federal #20H
Eddy Co., NM
API #30-015-41910
Job No. 1311215

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	Drainhole Number	Surveyed Depths		Dates Performed		Type of Survey
		From	To	Start	End	
Joe Bass	20H	727	10,232	03/02/14	03/12/14	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,

Kelly Jo Walter

Kelly Jo Walter
Operations Administrator

Certified mail receipt number: 7011 1570 0001 4364 8981

1805 Brittmoore Rd. Houston, TX 77043 • Phone (713) 337-0600 • Fax (713) 337-0599
www.phxtech.com

Phoenix Technology Services
SURVEY DATA CERTIFICATION

PHOENIX TECHNOLOGY SERVICES

PHOENIX JOB NUMBER	1311215	OPERATOR	Apache
WELL NAME	Crow Federal #20H	COUNTY & STATE	Eddy Co., NM
API WELL NUMBER	30-015-41910	PROPOSED DIRECTION	269.56

TIE-IN DATA						
MEASURED DEPTH	VERTICAL DEPTH	INCLIN	AZIMUTH	N-S COORD	E-W COORD	DATA SOURCE
600 ft	599.98 ft	.5 ft	246.6 ft	.27 ft	-5.14 ft	Gyrodata

FIRST SURVEY DATE	FIRST SURVEY DEPTH	INCLIN	AZIMUTH
2-Mar-14	727 ft	0.4	240.3

SURVEY INSTRUMENT TYPE
Phoenix MWD

LAST SURVEY DATE	LAST SURVEY DEPTH	INCLIN	AZIMUTH
12-Mar-14	10,232 ft	91.3	269.3

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
12-Mar-14	10,296 ft	91.3	269.3

Joe Bass

PRINT YOUR NAME ABOVE

SIGN YOUR NAME ABOVE

MAGNETIC DECLINATION OR TOTAL GRID

TOTAL CORRECTION USED	7.29
DECLINATION OR GRID	DECLINATION

12-MARCH-2014

TODAY'S DATE

MWD SUPERVISOR 1	Rick Reed	DIRECTIONAL DRILLER 1	Richard Thurman
MWD SUPERVISOR 2	Joe Bass	DIRECTIONAL DRILLER 2	Timothy Noland

1805 Brittmore Road Houston, Texas 77043 (713)3370609 (Voice), (713)337-0599 (Fax)

Project: Eddy County, NM (NAD27 NME)
Site: Crow Federal
Well: #20H
Wellbore: WB1/Job #1311215
Design: Plan #2 02-26-14
Rig: Capstar 114

Apache — Exploring What's Possible

PHOENIX TECHNOLOGY SERVICES

T G M

Azimuths to Grid North
True North: -0.26°
Magnetic North: 7.29°

Magnetic Field
Strength: 48665.8snT
Dip Angle: 60.64°
Date: 02/26/2014
Model: BGGM2013

WELL DETAILS

Ground Level: 3925.00

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude
0.00	0.00	672592.90	648559.00	32° 50' 53.18702 N	103° 50' 58.55835 W

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Target	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2	5458.75	0.00	0.00	5458.75	0.00	0.00	0.00	0.00	0.00		KOP Start Build 12.00
3	6221.88	91.58	269.56	5936.00	-3.77	-490.60	12.00	269.56	490.61		LP Start 1810.40 hold at 6221.88 MD
4	8032.28	91.58	269.56	5886.00	-17.67	-2300.26	0.00	0.00	2300.33	MP-Crow Fed #20H	Start DLS 2.00 TFO 178.34
5	8048.67	91.25	269.57	5885.59	-17.79	-2316.64	2.00	178.34	2316.71		Start 2264.50 hold at 8048.67 MD
6	10313.17	91.25	269.57	5836.00	-34.80	-4580.53	0.00	0.00	4580.65	PBHL-Crow Fed #20H	TD at 10313.17

DESIGN TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Shape
PBHL-Crow Fed #20H	5836.00	-34.80	-4580.53	672558.10	643978.47	32° 50' 53.04704 N	103° 51' 52.25257 W	Point
- plan hits target center								
MP-Crow Fed #20H	5886.00	-17.67	-2300.26	672575.23	646258.74	32° 50' 53.11565 N	103° 51' 25.52261 W	Point
- plan hits target center								

PROJECT DETAILS: Eddy County, NM (NAD27 NME)

Geodetic System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1866
Zone: New Mexico East 3001

System Datum: Mean Sea Level

SITE DETAILS: Crow Federal

Site Centre Northing: 671130.90
Easting: 643906.80

Positional Uncertainty: 0.00
Convergence: 0.25
Local North: Grid

FORMATION TOP DETAILS

TVDPath	MDPath	Formation	DipAngle	DipDir
551.00	551.00	Rustler	-1.58	269.56
722.00	722.00	T/Salt	-1.58	269.56
1726.00	1726.00	B/Salt	-1.58	269.56
1893.00	1893.00	Yates	-1.58	269.56
2175.00	2175.00	Seven Rivers	-1.58	269.56
2802.00	2802.00	Queen	-1.58	269.56
3227.00	3227.00	Grayburg	-1.58	269.56
3562.00	3562.00	San Andres	-1.58	269.56
5042.00	5042.00	Glorieta	-1.58	269.56
5096.00	5096.00	(Yeso) Paddock	-1.58	269.56
5652.86	5658.65	(Yeso) Blinebry	-1.58	269.56

Map System: US State Plane 1927 (Exact solution)
Datum: NAD 1927 (NADCON CONUS)
Ellipsoid: Clarke 1866
Zone Name: New Mexico East 3001

Local Origin: Well #20H, Grid North

Latitude: 32° 50' 53.18702 N
Longitude: 103° 50' 58.55835 W

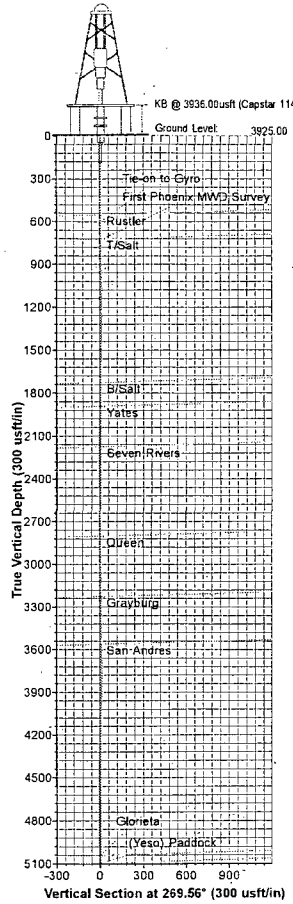
Grid East: 648559.00
Grid North: 672592.90
Scale Factor: 1.000

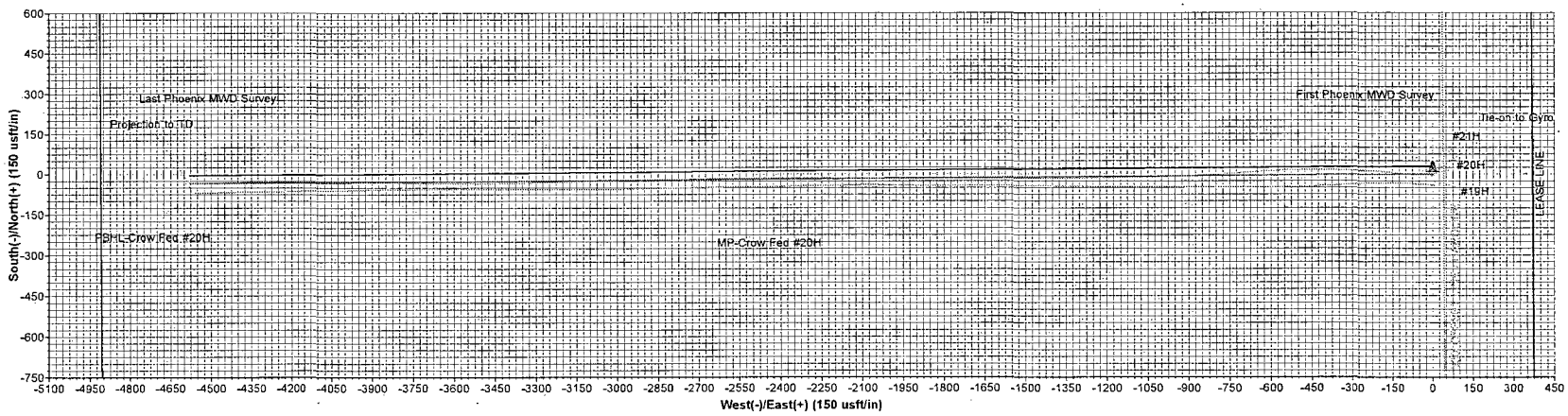
Geomagnetic Model: BGGM2013
Sample Date: 26-Feb-14
Magnetic Declination: 7.55°
Dip Angle from Horizontal: 60.64°
Magnetic Field Strength: 48666

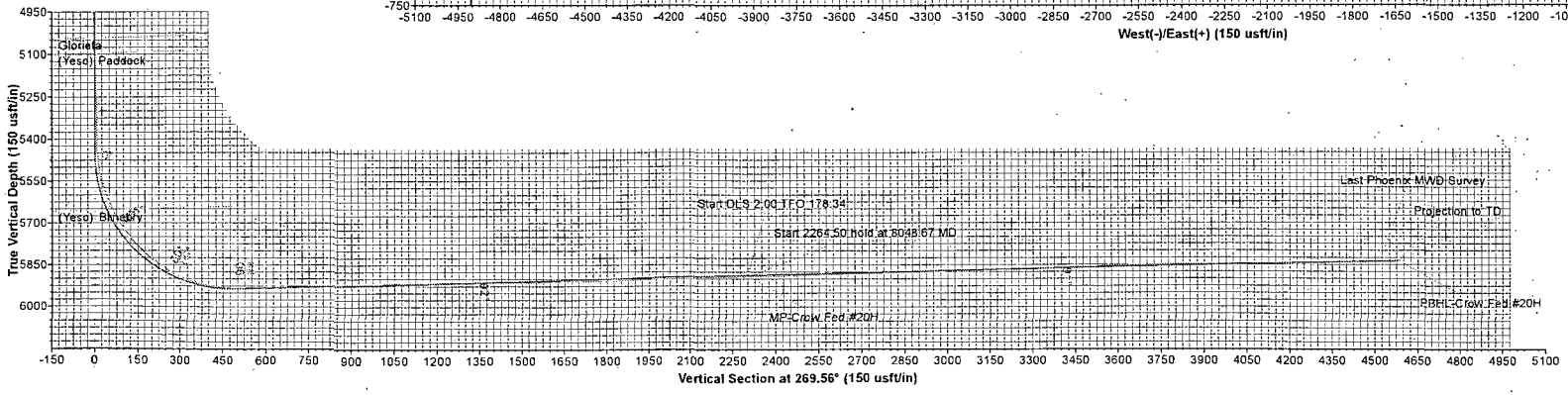
To convert a Magnetic Direction to a Grid Direction, Add 7.29°
To convert a Magnetic Direction to a True Direction, Add 7.55° East
To convert a True Direction to a Grid Direction, Subtract 0.26°

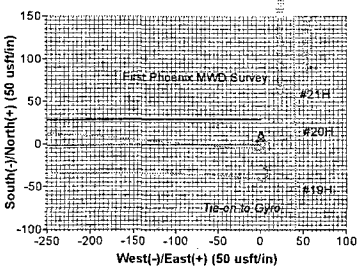
LEGEND

- #19H, WB1/Job #1311214, Surveys (Capstar 114) V0
- #20H, WB1/Job #1311215, Survey (Capstar 114) V0
- #21H, WB1/Job #1311216, Plan #2 09-23-13 V0
- Plan #2 02-26-14









Created By: Julio Piña Date: 10:03, March 12 2014

EXPLORING WHAT'S POSSIBLE

Apache Corporation

Eddy County, NM (NAD27 NME)
Crow Federal
#20H
WB1/Job #1311215

Design: Survey (Capstar 114)

Phoenix Final Survey Report

12 March, 2014

PHOENIX
TECHNOLOGY SERVICES

Phoenix Technology Services

Phoenix Final Survey Report

Company:	Apache Corporation	**Local Co-ordinate Reference:**	Well #20H
Project:	Eddy County, NM (NAD27 NME)	**TVD Reference:**	KB @ 3936.00usft (Capstar 114)
Site:	Crow Federal	**MD Reference:**	KB @ 3936.00usft (Capstar 114)
Well:	#20H	**North Reference:**	Grid
Wellbore:	WB1/Job #1311215	**Survey Calculation Method:**	Minimum Curvature
Design:	Survey (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 Crow Federal

Site Position:		**Northing:**	671,130.90 usft	**Latitude:**	32° 50' 38.92796 N
From:	Map	**Easting:**	643,906.80 usft	**Longitude:**	103° 51' 53.16689 W
Position Uncertainty:	0.00 usft	**Slot Radius:**	13-3/16"	**Grid Convergence:**	0.25 °

Well #20H

Well Position	**+N/-S**	0.00 usft	**Northing:**	672,592.90 usft	**Latitude:**	32° 50' 53.18702 N
	+E/-W	0.00 usft	**Easting:**	648,559.00 usft	**Longitude:**	103° 50' 58.55835 W
Position Uncertainty		0.00 usft	**Wellhead Elevation:**	usft	**Ground Level:**	3,925.00 usft

Wellbore WB1/Job #1311215

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	BGGM2013	02/26/14	7.55	60.64	48,666

Design Survey (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	269.56

Survey Program **Date** 03/12/14

From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.00	600.00	Gyro Survey (WB1/Job #1311215)	CB-GYRO-MS	Camera based gyro multishot
727.00	10,296.00	Phoenix MWD Survey (WB1/Job #131121	MWD	MWD - Standard

Survey

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.51	283.91	100.00	0.11	-0.43	0.43	0.51
200.00	0.64	288.94	199.99	0.40	-1.39	1.39	0.14
300.00	0.57	278.13	299.99	0.65	-2.41	2.41	0.13
400.00	0.55	265.96	399.98	0.68	-3.38	3.38	0.12
500.00	0.52	257.18	499.98	0.55	-4.31	4.30	0.09
600.00	0.50	246.61	599.98	0.27	-5.15	5.15	0.10
Tie-on to Gyro							
727.00	0.40	240.30	726.97	-0.16	-6.04	6.04	0.09
First Phoenix MWD Survey							
904.00	0.70	247.30	903.96	-0.89	-7.58	7.58	0.17

Company:	Apache Corporation	**Local Co-ordinate Reference:**	Well #20H
Project:	Eddy County, NM (NAD27 NME)	**TVD Reference:**	KB @ 3936.00usft (Capstar 114)
Site:	Crow Federal	**MD Reference:**	KB @ 3936.00usft (Capstar 114)
Well:	#20H	**North Reference:**	Grid
Wellbore:	WB1/Job #1311215	**Survey Calculation Method:**	Minimum Curvature
Design:	Survey (Capstar 114)	**Database:**	GCR DB

Survey

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)
1,032.00	0.70	256.50	1,031.95	-1.37	-9.06	9.07	0.09
1,163.00	0.20	17.90	1,162.95	-1.34	-9.77	9.78	0.63
1,291.00	0.40	61.00	1,290.95	-0.91	-9.31	9.31	0.23
1,423.00	0.70	83.70	1,422.94	-0.60	-8.10	8.11	0.28
1,554.00	0.80	92.50	1,553.93	-0.55	-6.39	6.40	0.12
1,682.00	1.00	103.20	1,681.92	-0.85	-4.41	4.42	0.20
1,810.00	1.00	99.10	1,809.90	-1.28	-2.22	2.23	0.06
1,939.00	1.10	104.00	1,938.87	-1.76	0.09	-0.08	0.10
2,067.00	1.00	110.00	2,066.85	-2.44	2.33	-2.31	0.12
2,195.00	0.90	138.60	2,194.84	-3.57	4.05	-4.02	0.37
2,324.00	0.50	171.60	2,323.83	-4.89	4.80	-4.76	0.43
2,452.00	0.90	257.40	2,451.82	-5.66	3.90	-3.86	0.78
2,580.00	1.00	256.50	2,579.80	-6.14	1.83	-1.79	0.08
2,709.00	1.10	261.00	2,708.78	-6.60	-0.48	0.54	0.10
2,837.00	1.20	262.10	2,836.75	-6.97	-3.03	3.08	0.08
2,965.00	0.50	288.30	2,964.74	-6.98	-4.88	4.94	0.61
3,094.00	0.70	319.50	3,093.73	-6.21	-5.93	5.98	0.29
3,222.00	0.70	321.20	3,221.72	-5.00	-6.93	6.97	0.02
3,350.00	0.80	337.90	3,349.71	-3.56	-7.75	7.78	0.19
3,453.00	0.80	331.70	3,452.70	-2.27	-8.37	8.38	0.08
3,559.00	0.70	323.20	3,558.69	-1.10	-9.10	9.11	0.14
3,688.00	0.80	228.60	3,687.69	-1.06	-10.25	10.26	0.86
3,816.00	0.90	95.40	3,815.68	-1.75	-9.92	9.93	1.22
3,944.00	1.30	83.10	3,943.66	-1.67	-7.48	7.49	0.36
4,073.00	1.30	83.10	4,072.62	-1.31	-4.57	4.58	0.00
4,201.00	1.50	84.70	4,200.59	-0.98	-1.46	1.47	0.16
4,329.00	2.00	36.20	4,328.53	0.97	1.52	-1.53	1.18
4,458.00	0.80	86.60	4,457.49	2.84	3.75	-3.77	1.25
4,586.00	0.90	76.40	4,585.48	3.13	5.62	-5.65	0.14
4,714.00	1.50	202.70	4,713.47	1.82	5.95	-5.97	1.69
4,843.00	1.50	191.10	4,842.42	-1.39	4.98	-4.96	0.23
4,971.00	1.50	242.10	4,970.38	-3.82	3.17	-3.14	1.01
5,102.00	1.10	241.10	5,101.35	-5.23	0.56	-0.52	0.31
5,231.00	2.20	278.30	5,230.30	-5.47	-2.98	3.02	1.15
5,359.00	0.70	294.50	5,358.25	-4.79	-6.12	6.16	1.20
5,409.00	0.60	307.40	5,408.25	-4.51	-6.61	6.64	0.35
5,493.00	6.90	267.90	5,492.03	-4.42	-12.00	12.04	7.68
5,536.00	13.40	270.60	5,534.34	-4.47	-19.58	19.61	15.15
5,578.00	19.20	273.50	5,574.63	-3.99	-31.35	31.38	13.94
5,621.00	22.30	274.10	5,614.84	-2.98	-46.54	46.57	7.23
5,664.00	25.10	275.00	5,654.21	-1.60	-63.77	63.78	6.57
5,706.00	29.80	274.70	5,691.47	0.03	-83.06	83.05	11.20
5,749.00	35.70	274.60	5,727.62	1.92	-106.23	106.21	13.72
5,792.00	40.10	274.50	5,761.54	4.01	-132.56	132.52	10.23

Company:	Apache Corporation	**Local Co-ordinate Reference:**	Well #20H
Project:	Eddy County, NM (NAD27 NME)	**TVD Reference:**	KB @ 3936.00usft (Capstar 114)
Site:	Crow Federal	**MD Reference:**	KB @ 3936.00usft (Capstar 114)
Well:	#20H	**North Reference:**	Grid
Wellbore:	WB1/Job #1311215	**Survey Calculation Method:**	Minimum Curvature
Design:	Survey (Capstar 114)	**Database:**	GCR DB

Survey

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)
5,835.00	44.60	274.70	5,793.31	6.33	-161.42	161.37	10.47
5,878.00	50.30	275.00	5,822.38	9.02	-192.97	192.90	13.27
5,920.00	54.30	273.50	5,848.06	11.47	-226.11	226.01	9.93
5,963.00	58.70	271.60	5,871.78	13.05	-261.92	261.81	10.88
6,006.00	64.00	270.90	5,892.39	13.86	-299.63	299.52	12.41
6,049.00	70.00	271.00	5,909.19	14.52	-339.19	339.07	13.96
6,092.00	76.30	271.00	5,921.65	15.24	-380.32	380.19	14.65
6,135.00	82.80	270.80	5,929.44	15.90	-422.57	422.44	15.12
6,178.00	87.50	271.10	5,933.08	16.61	-465.40	465.26	10.95
6,221.00	89.90	269.20	5,934.05	16.72	-508.39	508.24	7.12
6,263.00	90.90	266.70	5,933.76	15.22	-550.35	550.22	6.41
6,391.00	92.00	265.80	5,930.52	6.85	-678.04	677.96	1.11
6,519.00	92.30	266.60	5,925.72	-1.62	-805.66	805.65	0.67
6,646.00	92.20	268.10	5,920.73	-7.49	-932.43	932.46	1.18
6,775.00	91.10	268.90	5,917.02	-10.87	-1,061.33	1,061.38	1.05
6,903.00	90.40	269.00	5,915.34	-13.21	-1,189.29	1,189.36	0.55
7,032.00	90.90	268.90	5,913.88	-15.58	-1,318.26	1,318.34	0.40
7,160.00	90.60	270.30	5,912.20	-16.47	-1,446.24	1,446.33	1.12
7,288.00	90.70	269.60	5,910.75	-16.58	-1,574.24	1,574.32	0.55
7,416.00	91.30	269.70	5,908.52	-17.36	-1,702.21	1,702.30	0.48
7,545.00	91.30	270.40	5,905.59	-17.25	-1,831.18	1,831.26	0.54
7,673.00	91.70	270.80	5,902.24	-15.91	-1,959.13	1,959.19	0.44
7,801.00	92.10	270.20	5,897.99	-14.79	-2,087.05	2,087.10	0.56
7,930.00	91.70	270.40	5,893.72	-14.12	-2,215.98	2,216.02	0.35
8,061.00	91.40	270.10	5,890.17	-13.55	-2,346.93	2,346.96	0.32
8,189.00	91.00	269.10	5,887.49	-14.44	-2,474.90	2,474.93	0.84
8,317.00	92.40	269.10	5,883.70	-16.45	-2,602.82	2,602.87	1.09
8,449.00	91.70	269.00	5,878.97	-18.64	-2,734.72	2,734.78	0.54
8,577.00	91.30	269.00	5,875.62	-20.87	-2,862.65	2,862.73	0.31
8,705.00	91.60	268.60	5,872.38	-23.55	-2,990.58	2,990.68	0.39
8,834.00	91.30	268.50	5,869.12	-26.81	-3,119.50	3,119.62	0.25
8,962.00	90.70	268.70	5,866.89	-29.94	-3,247.44	3,247.58	0.49
9,093.00	92.80	268.90	5,862.89	-32.68	-3,378.35	3,378.50	1.61
9,222.00	92.30	269.70	5,857.15	-34.26	-3,507.21	3,507.37	0.73
9,350.00	91.60	270.70	5,852.79	-33.81	-3,635.13	3,635.28	0.95
9,478.00	90.80	271.00	5,850.11	-31.91	-3,763.09	3,763.22	0.67
9,607.00	90.20	271.00	5,848.98	-29.66	-3,892.06	3,892.17	0.47
9,735.00	90.90	270.10	5,847.76	-28.43	-4,020.05	4,020.15	0.89
9,863.00	90.80	270.10	5,845.86	-28.21	-4,148.03	4,148.13	0.08
9,991.00	91.30	269.00	5,843.51	-29.21	-4,276.01	4,276.10	0.94
10,119.00	91.50	269.00	5,840.38	-31.45	-4,403.95	4,404.06	0.16
10,232.00	91.30	269.30	5,837.62	-33.12	-4,516.90	4,517.02	0.32

Last Phoenix MWD Survey

Phoenix Technology Services

Phoenix Final Survey Report

Company:	Apache Corporation	**Local Co-ordinate Reference:**	Well #20H
Project:	Eddy County, NM (NAD27 NME)	**TVD Reference:**	KB @ 3936.00usft (Capstar 114)
Site:	Crow Federal	**MD Reference:**	KB @ 3936.00usft (Capstar 114)
Well:	#20H	**North Reference:**	Grid
Wellbore:	WB1/Job #1311215	**Survey Calculation Method:**	Minimum Curvature
Design:	Survey (Capstar 114)	**Database:**	GCR DB

Survey

MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	DLeg (°/100usft)
10,296.00	91.30	269.30	5,836.17	-33.90	-4,580.88	4,581.01	0.00
Projection to TD							

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
600.00	599.98	0.27	-5.15	Tie-on to Gyro
727.00	726.97	-0.16	-6.04	First Phoenix MWD Survey
10,232.00	5,837.62	-33.12	-4,516.90	Last Phoenix MWD Survey
10,296.00	5,836.17	-33.90	-4,580.88	Projection to TD

Checked By: _____ Approved By: _____ Date: _____