



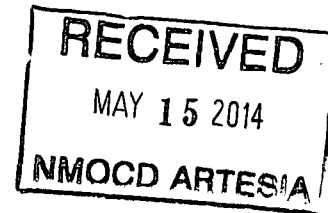
Apache Corporation

Eddy County, NM (NAD27 NME)

Crow Federal

#24H API # 30-015-41168

WB1/Job #1311334



Survey: Phoenix MWD Survey

Phoenix Final Survey Report

22 October, 2013



PHOENIX
TECHNOLOGY SERVICES



Phoenix Technology Services

Phoenix Final Survey Report



Company:	Apache Corporation	Local Co-ordinate Reference:	Well #24H
Project:	Eddy County, NM (NAD27 NME)	TVD Reference:	KB @ 3880.00usft (Capstar 114)
Site:	Crow Federal	MD Reference:	KB @ 3880.00usft (Capstar 114)
Well:	#24H	North Reference:	Grid
Wellbore:	WB1/Job #1311334	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:	Northings:	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:	#24H		
Well Position	+N-S 0.00 usft	Northings:	673,873.20 usft
	+E-W 0.00 usft	Easting:	638,369.90 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Ground Level:	3,869.00 usft

Wellbore:	WB1/Job #1311334				
Magnetics:	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (mT)
	IGRF2010_14	08/08/12	7.64	60.68	48,842

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	89.59	

Survey Program	Date	10/22/13			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	478.00	Gyrodata Survey (WB1/Job #1311334)	CB-GYRO-MS	Camera based gyro multishot	
614.00	10,858.00	Phoenix MWD Survey (WB1/Job #131133)	MWD	MWD - Standard	

Survey	MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	D Leg (°/100usft)
	478.00	0.73	18.41	477.98	4.37	-0.07	-0.04	0.00
Tie-on to Gyrodata	614.00	0.70	12.20	613.97	6.00	0.38	0.42	0.06
First Phoenix MWD Survey	660.00	0.70	322.50	659.96	6.50	0.26	0.31	1.28
	745.00	1.50	284.30	744.95	7.19	-1.13	-1.08	1.23
	831.00	2.80	263.30	830.89	7.22	-4.31	-4.26	1.74
	916.00	3.40	265.70	915.76	6.79	-8.88	-8.83	0.72
	1,002.00	3.60	268.80	1,001.60	6.54	-14.12	-14.08	0.32
	1,087.00	3.60	273.30	1,086.43	6.64	-19.46	-19.41	0.33
	1,172.00	3.50	277.00	1,171.27	7.11	-24.70	-24.64	0.29



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Site:	Crow Federal	MD Reference:	KB @ 3880.00usft (Capstar 114)
Well:	#24H	North Reference:	Grid
Wellbore:	WB1/Job #1311334	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)	D Leg (°/100usft)	
1,260.00	3.20	281.40	1,259.12	7.92	-29.77	-29.71	0.45	
1,348.00	2.90	277.60	1,347.00	8.70	-34.38	-34.32	0.41	
1,433.00	1.80	253.80	1,431.92	8.61	-37.80	-37.74	1.70	
1,519.00	1.40	228.70	1,517.89	7.54	-39.88	-39.83	0.93	
1,605.00	1.30	182.00	1,603.87	5.88	-40.71	-40.66	1.25	
1,690.00	1.60	177.60	1,688.84	3.73	-40.69	-40.66	0.38	
1,775.00	0.40	251.70	1,773.83	2.45	-40.92	-40.90	1.81	
1,860.00	0.40	283.60	1,858.83	2.42	-41.49	-41.48	0.26	
1,946.00	0.70	293.90	1,944.82	2.71	-42.27	-42.25	0.37	
2,032.00	0.60	272.80	2,030.82	2.94	-43.20	-43.17	0.30	
2,117.00	0.90	276.10	2,115.81	3.03	-44.30	-44.28	0.36	
2,203.00	0.90	284.10	2,201.80	3.27	-45.63	-45.61	0.15	
2,288.00	1.10	278.30	2,286.79	3.55	-47.09	-47.06	0.26	
2,374.00	1.00	289.40	2,372.77	3.92	-48.61	-48.58	0.26	
2,459.00	1.10	291.50	2,457.76	4.47	-50.07	-50.04	0.13	
2,545.00	1.20	295.10	2,543.74	5.15	-51.65	-51.61	0.14	
2,631.00	1.40	300.00	2,629.72	6.06	-53.38	-53.33	0.27	
2,716.00	1.40	304.40	2,714.69	7.16	-55.13	-55.08	0.13	
2,801.00	0.80	299.30	2,799.68	8.04	-56.51	-56.45	0.71	
2,887.00	0.90	293.00	2,885.67	8.60	-57.65	-57.59	0.16	
2,972.00	1.00	303.90	2,970.66	9.27	-58.88	-58.82	0.24	
3,058.00	1.00	301.00	3,056.64	10.08	-60.15	-60.08	0.06	
3,143.00	1.10	314.40	3,141.63	11.03	-61.37	-61.29	0.31	
3,229.00	1.30	313.70	3,227.61	12.28	-62.66	-62.57	0.23	
3,314.00	1.30	319.80	3,312.59	13.68	-63.98	-63.88	0.16	
3,400.00	1.40	323.70	3,398.57	15.28	-65.23	-65.12	0.16	
3,451.00	1.60	327.20	3,449.55	16.38	-65.99	-65.87	0.43	
3,564.00	1.60	325.10	3,562.50	19.00	-67.75	-67.61	0.05	
3,650.00	0.20	123.20	3,648.49	19.90	-68.31	-68.16	2.08	
3,735.00	0.30	108.90	3,733.49	19.75	-67.97	-67.83	0.14	
3,821.00	0.70	81.40	3,819.49	19.75	-67.24	-67.10	0.53	
3,909.00	1.20	106.90	3,907.48	19.56	-65.83	-65.69	0.73	
3,994.00	1.10	107.90	3,992.46	19.05	-64.20	-64.06	0.12	
4,080.00	1.10	103.80	4,078.45	18.60	-62.61	-62.48	0.09	
4,166.00	1.20	100.40	4,164.43	18.24	-60.92	-60.79	0.14	
4,251.00	0.60	115.40	4,249.42	17.89	-59.65	-59.52	0.75	
4,337.00	1.00	128.60	4,335.41	17.23	-58.65	-58.53	0.51	
4,422.00	1.10	139.20	4,420.39	16.15	-57.54	-57.42	0.26	
4,508.00	1.10	125.20	4,506.38	15.05	-56.33	-56.22	0.31	
4,593.00	0.90	132.00	4,591.37	14.13	-55.16	-55.06	0.27	
4,679.00	1.10	123.90	4,677.35	13.22	-53.98	-53.88	0.28	
4,764.00	1.20	119.10	4,762.34	12.33	-52.52	-52.43	0.16	
4,850.00	1.20	125.60	4,848.32	11.37	-51.00	-50.92	0.16	
4,935.00	1.10	110.90	4,933.30	10.56	-49.52	-49.44	0.37	



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Site:	Crow Federal	MD Reference:	KB @ 3880.00usft (Capstar 114)
Well:	#24H	North Reference:	Grid
Wellbore:	WB1/Job #1311334	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)	D Leg (%/100usft)	
5,021.00	1.50	133.30	5,019.28	9.50	-47.93	-47.86	0.74	
5,106.00	1.40	139.10	5,104.25	7.95	-46.44	-46.38	0.21	
5,195.00	0.40	126.90	5,193.24	6.94	-45.48	-45.43	1.14	
5,280.00	0.60	129.80	5,278.24	6.48	-44.90	-44.85	0.24	
5,366.00	0.50	139.90	5,364.23	5.90	-44.31	-44.27	0.16	
5,451.00	0.50	116.20	5,449.23	5.45	-43.74	-43.70	0.24	
5,537.00	0.50	112.20	5,535.23	5.15	-43.05	-43.02	0.04	
5,556.00	0.80	106.50	5,554.22	5.08	-42.85	-42.81	1.61	
5,585.00	0.60	82.80	5,583.22	5.04	-42.51	-42.47	1.20	
5,628.00	4.00	84.80	5,626.18	5.20	-40.79	-40.75	7.91	
5,670.00	8.30	86.40	5,667.93	5.53	-36.30	-36.26	10.25	
5,713.00	13.10	86.60	5,710.17	6.01	-28.34	-28.29	11.16	
5,756.00	17.80	88.00	5,751.60	6.53	-16.90	-16.85	10.96	
5,799.00	22.40	91.30	5,791.98	6.57	-2.13	-2.08	11.01	
5,843.00	27.60	92.10	5,831.84	6.01	16.45	16.49	11.84	
5,889.00	33.10	90.90	5,871.52	5.42	39.68	39.72	12.03	
5,932.00	39.60	90.30	5,906.13	5.16	65.15	65.18	15.14	
5,975.00	46.00	90.50	5,937.67	4.96	94.35	94.38	14.89	
6,018.00	51.20	90.20	5,966.10	4.76	126.59	126.62	12.10	
6,060.00	55.80	90.40	5,991.07	4.58	160.34	160.37	10.96	
6,103.00	60.20	90.50	6,013.85	4.30	196.80	196.83	10.23	
6,146.00	64.60	90.60	6,033.77	3.93	234.90	234.92	10.23	
6,188.00	69.50	90.70	6,050.14	3.49	273.56	273.58	11.67	
6,231.00	74.70	90.50	6,063.35	3.06	314.46	314.47	12.10	
6,274.00	79.70	90.90	6,072.88	2.55	356.37	356.38	11.66	
6,318.00	84.80	90.40	6,078.81	2.06	399.96	399.96	11.65	
6,403.00	87.20	89.80	6,084.74	1.91	484.74	484.74	2.91	
6,491.00	86.50	89.20	6,089.57	2.68	572.60	572.61	1.05	
6,579.00	88.70	89.70	6,093.26	3.52	660.52	660.53	2.56	
6,665.00	88.30	89.60	6,095.51	4.05	746.49	746.50	0.48	
6,750.00	88.90	89.10	6,097.59	5.01	831.45	831.47	0.92	
6,835.00	88.30	88.60	6,099.66	6.72	916.41	916.44	0.92	
6,921.00	87.60	88.10	6,102.74	9.19	1,002.32	1,002.36	1.00	
7,006.00	89.60	88.80	6,104.82	11.49	1,087.26	1,087.31	2.49	
7,092.00	89.10	88.40	6,105.79	13.59	1,173.23	1,173.29	0.74	
7,178.00	88.80	89.70	6,107.37	15.01	1,259.20	1,259.27	1.55	
7,263.00	88.00	89.10	6,109.74	15.90	1,344.16	1,344.24	1.18	
7,353.00	89.10	89.70	6,112.02	16.85	1,434.12	1,434.21	1.39	
7,439.00	88.70	89.40	6,113.67	17.52	1,520.11	1,520.19	0.58	
7,525.00	88.30	89.00	6,115.92	18.72	1,606.07	1,606.16	0.66	
7,612.00	87.70	88.60	6,118.96	20.54	1,692.99	1,693.10	0.83	
7,697.00	88.60	89.40	6,121.70	22.03	1,777.94	1,778.05	1.42	
7,783.00	88.00	89.70	6,124.25	22.70	1,863.89	1,864.01	0.78	
7,868.00	87.50	89.60	6,127.59	23.22	1,948.83	1,948.94	0.60	



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Well:	#24H	North Reference:	Grid
Wellbore:	WB1/Job #1311334	Survey Calculation Method:	Minimum Curvature
Design:	Survey (Capstar 114)	Database:	GCR DB

Survey								
MD (usft)	Inc (°)	Azi ² (azimuth) (°)	TVD (usft)	N/S (usft)	E/W (usft)	V. Sec (usft)	D Leg (°/100usft)	
7,954.00	89.10	89.10	6,130.14	24.19	2,034.78	2,034.90	1.95	
8,039.00	88.50	89.10	6,131.92	25.53	2,119.75	2,119.88	0.71	
8,125.00	88.90	91.00	6,133.87	25.45	2,205.73	2,205.85	2.26	
8,210.00	88.40	90.90	6,135.87	24.05	2,290.69	2,290.80	0.60	
8,296.00	88.20	90.70	6,138.42	22.85	2,376.64	2,376.75	0.33	
8,381.00	87.50	90.70	6,141.61	21.81	2,461.58	2,461.67	0.82	
8,467.00	89.10	90.50	6,144.16	20.91	2,547.53	2,547.62	1.87	
8,556.00	88.80	90.50	6,145.80	20.13	2,636.51	2,636.59	0.34	
8,641.00	88.60	90.30	6,147.72	19.54	2,721.49	2,721.56	0.33	
8,727.00	88.40	90.40	6,149.98	19.01	2,807.46	2,807.52	0.26	
8,812.00	89.60	90.10	6,151.46	18.64	2,892.44	2,892.50	1.46	
8,898.00	88.70	89.40	6,152.73	19.02	2,978.43	2,978.49	1.33	
8,983.00	90.00	89.50	6,153.70	19.83	3,063.42	3,063.48	1.53	
9,069.00	89.30	89.20	6,154.22	20.81	3,149.41	3,149.48	0.89	
9,154.00	88.70	88.80	6,155.71	22.29	3,234.38	3,234.46	0.85	
9,240.00	90.00	88.60	6,156.68	24.24	3,320.36	3,320.44	1.53	
9,326.00	89.60	88.10	6,156.98	26.72	3,406.32	3,406.42	0.74	
9,411.00	90.90	89.40	6,156.61	28.57	3,491.29	3,491.41	2.16	
9,497.00	90.50	88.40	6,155.56	30.22	3,577.27	3,577.40	1.25	
9,582.00	90.20	89.00	6,155.04	32.15	3,662.25	3,662.38	0.79	
9,668.00	89.80	88.50	6,155.04	34.03	3,748.23	3,748.37	0.74	
9,753.00	89.80	88.50	6,155.34	36.25	3,833.20	3,833.36	0.00	
9,839.00	90.10	90.60	6,155.41	36.93	3,919.19	3,919.35	2.47	
9,925.00	89.80	90.50	6,155.49	36.10	4,005.18	4,005.34	0.37	
10,010.00	89.70	90.10	6,155.86	35.66	4,090.18	4,090.33	0.49	
10,095.00	89.40	90.20	6,156.53	35.44	4,175.18	4,175.33	0.37	
10,180.00	89.10	89.80	6,157.64	35.44	4,260.17	4,260.32	0.59	
10,266.00	88.50	89.10	6,159.44	36.26	4,346.15	4,346.30	1.07	
10,351.00	88.20	89.00	6,161.89	37.67	4,431.10	4,431.26	0.37	
10,437.00	87.90	89.30	6,164.82	38.94	4,517.04	4,517.20	0.49	
10,524.00	87.30	89.00	6,168.46	40.23	4,603.95	4,604.13	0.77	
10,612.00	86.80	89.20	6,172.99	41.61	4,691.83	4,692.00	0.61	
10,697.00	86.20	88.50	6,178.18	43.32	4,776.65	4,776.84	1.08	
10,783.00	85.80	88.60	6,184.18	45.49	4,862.41	4,862.61	0.48	
10,805.00	85.60	88.80	6,185.83	45.99	4,884.35	4,884.55	1.28	
Last Phoenix MWD Survey								
10,858.00	85.60	88.80	6,189.89	47.09	4,937.18	4,937.39	0.00	
Projection to TD								



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Design:	Survey (Capstar 114)	Database:	GCR DB

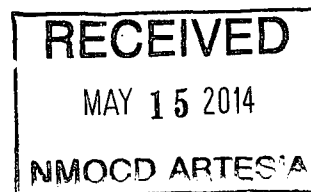
Survey Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
478.00	477.98	4.37	-0.07	Tie-on to Gyrodata
614.00	613.97	6.00	0.38	First Phoenix MWD Survey
10,805.00	6,185.83	45.99	4,884.35	Last Phoenix MWD Survey
10,858.00	6,189.89	47.09	4,937.18	Projection to TD

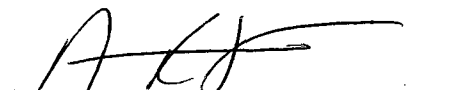
Checked By: _____ Approved By: _____ Date: _____

Apache Corporation
303 Veterans Airpark Lane, #3000
Midland, TX 79705

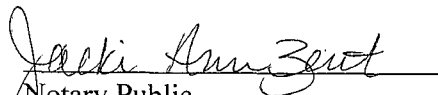
Crow Federal #24H API# 30-015-41168
Eddy County, New Mexico 1620' FNL & 10' FWR UL: E 09-178-31E

236	2.36	0.25	0.44	1.03	1.03
510	5.10	0.50	0.88	4.46	4.46




Archie Brown - General Manager

The attached instrument was acknowledged before me on the 31st day of October, 2013 by
Archie Brown - General Manager, CapStar Drilling, Inc.


Notary Public

