



**Scientific  
Drilling**

## Directional Survey Certification

7327 West Barton Road  
Casper, WY 82604  
(307)-472-6621 Fax (307) 472-5439

<b>Operator</b>	<u>OXY USA RMAT</u>
<b>Well Name &amp; No.</b>	<u>Cascade Creek 697-15-19A</u>
<b>County &amp; State</b>	<u>Garfield County, CO</u>
<b>SDI Job No.</b>	<u>42DEF10101081</u>
<b>Rig</b>	<u>H&amp;P 353</u>

I, Rex Hall, having personal knowledge of all the facts, hereby  
certify that the attached directional survey run from a measured depth of 0 feet to a  
measured depth of 9270 feet is true and correct as determined from all available records.

  
\_\_\_\_\_  
Signature

14-Jan-11  
\_\_\_\_\_  
Date

**Rex Hall**  
Grand Junction Drilling Engineer  
Scientific Drilling - Rocky Mountain District

# **OXY USA RMAT**

**Garfield County, CO NAD27  
Cascade Creek 697-15-01 Pad  
CC 697-15-19A - Slot L**

**OH**

**Design: OH**

## **Standard Survey Report**

**11 January, 2011**

# Scientific Drilling International

## Survey Report

<b>Company:</b>	OXY USA RMAT	<b>Local Co-ordinate Reference:</b>	Well CC 697-15-19A - Slot L
<b>Project:</b>	Garfield County, CO NAD27	<b>TVD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Site:</b>	Cascade Creek 697-15-01 Pad	<b>MD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Well:</b>	CC 697-15-19A	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	OH	<b>Database:</b>	Rockies-R5000.1

<b>Project</b>	Garfield County, CO NAD27		
<b>Map System:</b>	US State Plane 1927 (Exact solution)	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	NAD 1927 (NADCON CONUS)		
<b>Map Zone:</b>	Colorado Central 502		

<b>Site</b>	Cascade Creek 697-15-01 Pad, Sec 15 T6S R97W		
<b>Site Position:</b>		<b>Northing:</b>	629,156.97 usft
<b>From:</b>	Map	<b>Easting:</b>	1,234,961.93 usft
<b>Position Uncertainty:</b>	0.00 ft	<b>Slot Radius:</b>	13.200 in
		<b>Latitude:</b>	39° 31' 46.180 N
		<b>Longitude:</b>	108° 12' 45.350 W
		<b>Grid Convergence:</b>	-1.71 °

<b>Well</b>	CC 697-15-19A - Slot L, 270' FNI 639' FWL		
<b>Well Position</b>	<b>+N/-S</b>	0.00 ft	<b>Northing:</b> 629,186.71 usft
	<b>+E/-W</b>	0.00 ft	<b>Easting:</b> 1,235,023.53 usft
<b>Position Uncertainty</b>	0.00 ft	<b>Wellhead Elevation:</b>	ft
		<b>Latitude:</b>	39° 31' 46.492 N
		<b>Longitude:</b>	108° 12' 44.575 W
		<b>Ground Level:</b>	8,348.00 ft

<b>Wellbore</b>	OH				
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	IGRF2005-10	2010/09/17	10.52	65.76	52,326

<b>Design</b>	OH				
<b>Audit Notes:</b>					
<b>Version:</b>	1.0	<b>Phase:</b>	ACTUAL	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Direction (°)</b>	
	0.00	0.00	0.00	138.14	

<b>Survey Program</b>	<b>Date</b>	2011/01/11			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
176.00	452.00	Survey #1 - Surface Gyro (OH)	Standard Keeper 103	Standard Wireline Keeper ver 1.0.3	
526.00	2,411.00	Survey #2 - Surface MWD (OH)	MWD-SDI	MWD - Standard ISCWSA	
2,504.00	9,270.00	Survey #3 - Production MWD (OH)	MWD-SDI	MWD - Standard ISCWSA	

<b>Survey</b>									
<b>Measured Depth (ft)</b>	<b>Inclination (°)</b>	<b>Azimuth (°)</b>	<b>Vertical Depth (ft)</b>	<b>+N/-S (ft)</b>	<b>+E/-W (ft)</b>	<b>Vertical Section (ft)</b>	<b>Dogleg Rate (°/100ft)</b>	<b>Build Rate (°/100ft)</b>	<b>Turn Rate (°/100ft)</b>
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
176.00	1.39	168.67	175.98	-2.09	0.42	1.84	0.79	0.79	0.00
<b>First Gyro Survey</b>									
268.00	3.88	152.94	267.88	-5.96	2.05	5.81	2.79	2.71	-17.10
360.00	6.05	150.32	359.53	-12.94	5.87	13.56	2.37	2.36	-2.85
452.00	8.19	151.83	450.81	-22.93	11.37	24.67	2.33	2.33	1.64
<b>Last Gyro Survey</b>									
526.00	9.06	145.42	523.98	-32.38	17.16	35.57	1.75	1.18	-8.66

# Scientific Drilling International

## Survey Report

<b>Company:</b>	OXY USA RMAT	<b>Local Co-ordinate Reference:</b>	Well CC 697-15-19A - Slot L
<b>Project:</b>	Garfield County, CO NAD27	<b>TVD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Site:</b>	Cascade Creek 697-15-01 Pad	<b>MD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Well:</b>	CC 697-15-19A	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	OH	<b>Database:</b>	Rockies-R5000.1

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
<b>First SDI Surface MWD Survey</b>									
618.00	10.56	140.45	614.63	-44.84	26.64	51.18	1.87	1.63	-5.40
712.00	11.74	136.97	706.86	-58.48	38.65	69.35	1.44	1.26	-3.70
804.00	13.70	137.98	796.59	-73.41	52.33	89.60	2.14	2.13	1.10
899.00	15.56	137.26	888.51	-91.13	68.51	113.59	1.97	1.96	-0.76
993.00	17.06	137.44	978.73	-110.55	86.40	139.99	1.60	1.60	0.19
1,088.00	17.94	137.53	1,069.33	-131.60	105.70	168.55	0.93	0.93	0.09
1,182.00	18.91	137.97	1,158.51	-153.60	125.67	198.26	1.04	1.03	0.47
1,277.00	20.14	138.84	1,248.04	-177.35	146.75	230.01	1.33	1.29	0.92
1,372.00	20.58	135.50	1,337.11	-201.57	169.21	263.04	1.31	0.46	-3.52
1,466.00	20.93	138.40	1,425.01	-225.91	191.94	296.34	1.15	0.37	3.09
1,561.00	21.54	139.11	1,513.56	-251.78	214.62	330.74	0.70	0.64	0.75
1,655.00	21.37	138.23	1,601.05	-277.60	237.33	365.12	0.39	-0.18	-0.94
1,750.00	20.49	138.76	1,689.78	-303.01	259.82	399.06	0.95	-0.93	0.56
1,844.00	19.87	138.40	1,778.01	-327.33	281.27	431.49	0.67	-0.66	-0.38
1,939.00	19.43	138.05	1,867.48	-351.16	302.55	463.43	0.48	-0.46	-0.37
2,033.00	19.43	138.49	1,956.12	-374.49	323.37	494.70	0.16	0.00	0.47
2,128.00	19.52	138.14	2,045.69	-398.15	344.43	526.37	0.16	0.09	-0.37
2,222.00	18.99	136.56	2,134.43	-420.95	365.43	557.37	0.79	-0.56	-1.68
2,317.00	18.91	138.14	2,224.28	-443.63	386.33	588.21	0.55	-0.08	1.66
2,411.00	19.08	141.08	2,313.17	-466.93	406.14	618.79	1.03	0.18	3.13
<b>Last SDI Surface MWD Survey</b>									
2,504.00	20.22	139.70	2,400.75	-491.02	426.09	650.03	1.32	1.23	-1.48
<b>First SDI Production MWD Survey</b>									
2,599.00	20.84	139.53	2,489.71	-516.39	447.68	683.34	0.66	0.65	-0.18
2,694.00	22.60	135.66	2,577.97	-542.31	471.41	718.47	2.39	1.85	-4.07
2,788.00	23.04	135.66	2,664.61	-568.38	496.89	754.90	0.47	0.47	0.00
2,883.00	22.25	136.01	2,752.29	-594.62	522.37	791.44	0.84	-0.83	0.37
2,977.00	21.19	134.08	2,839.61	-619.24	546.94	826.18	1.36	-1.13	-2.05
3,072.00	21.72	131.79	2,928.03	-642.90	572.38	860.77	1.04	0.56	-2.41
3,166.00	21.02	131.97	3,015.57	-665.77	597.88	894.82	0.75	-0.74	0.19
3,261.00	21.37	133.37	3,104.14	-689.05	623.13	929.01	0.65	0.37	1.47
3,355.00	20.66	133.29	3,191.89	-712.18	647.65	962.60	0.76	-0.76	-0.09
3,450.00	19.61	134.78	3,281.08	-734.90	671.17	995.21	1.23	-1.11	1.57
3,544.00	20.22	131.44	3,369.47	-756.76	694.54	1,027.09	1.37	0.65	-3.55
3,639.00	18.64	132.41	3,459.05	-777.87	718.06	1,058.51	1.70	-1.66	1.02
3,733.00	18.73	134.08	3,548.10	-798.50	739.99	1,088.51	0.58	0.10	1.78
3,828.00	20.40	136.89	3,637.61	-821.20	762.27	1,120.28	2.02	1.76	2.96
3,922.00	19.79	139.17	3,725.89	-845.20	783.87	1,152.57	1.06	-0.65	2.43
4,017.00	19.52	139.26	3,815.36	-869.40	804.74	1,184.52	0.29	-0.28	0.09
4,111.00	21.90	141.11	3,903.28	-894.94	826.00	1,217.73	2.63	2.53	1.97
4,206.00	21.37	141.37	3,991.58	-922.25	847.93	1,252.71	0.57	-0.56	0.27
4,300.00	20.66	141.46	4,079.33	-948.60	868.95	1,286.36	0.76	-0.76	0.10
4,395.00	21.10	139.17	4,168.09	-974.65	890.57	1,320.19	0.98	0.46	-2.41

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## Survey Report

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<b>Project:</b>	Garfield County, CO NAD27	<b>TVD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Site:</b>	Cascade Creek 697-15-01 Pad	<b>MD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Well:</b>	CC 697-15-19A	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	OH	<b>Database:</b>	Rockies-R5000.1

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
4,489.00	19.70	142.60	4,256.20	-1,000.04	911.26	1,352.90	1.96	-1.49	3.65
4,584.00	18.99	137.77	4,345.84	-1,024.21	931.38	1,384.33	1.84	-0.75	-5.08
4,679.00	18.20	141.11	4,435.88	-1,047.20	951.08	1,414.60	1.40	-0.83	3.52
4,773.00	18.11	136.63	4,525.21	-1,069.25	970.33	1,443.87	1.49	-0.10	-4.77
4,868.00	17.76	139.53	4,615.59	-1,091.01	989.87	1,473.11	1.01	-0.37	3.05
4,962.00	16.27	138.03	4,705.48	-1,111.70	1,007.99	1,500.61	1.65	-1.59	-1.60
5,057.00	16.09	132.85	4,796.72	-1,130.55	1,026.54	1,527.03	1.53	-0.19	-5.45
5,149.00	14.25	132.41	4,885.51	-1,146.86	1,044.25	1,550.99	2.00	-2.00	-0.48
5,244.00	14.33	137.15	4,977.57	-1,163.37	1,060.87	1,574.38	1.23	0.08	4.99
5,338.00	14.77	138.38	5,068.56	-1,180.85	1,076.74	1,598.00	0.57	0.47	1.31
5,433.00	14.51	137.86	5,160.47	-1,198.73	1,092.77	1,622.01	0.31	-0.27	-0.55
5,527.00	14.07	139.09	5,251.57	-1,216.10	1,108.16	1,645.21	0.57	-0.47	1.31
5,622.00	13.10	140.49	5,343.91	-1,233.13	1,122.57	1,667.51	1.08	-1.02	1.47
5,716.00	11.87	137.68	5,435.68	-1,248.50	1,135.86	1,687.82	1.46	-1.31	-2.99
5,810.00	11.87	141.11	5,527.67	-1,263.17	1,148.43	1,707.14	0.75	0.00	3.65
5,905.00	10.64	139.61	5,620.85	-1,277.46	1,160.25	1,725.67	1.33	-1.29	-1.58
5,999.00	8.62	133.37	5,713.52	-1,288.90	1,171.00	1,741.37	2.42	-2.15	-6.64
6,094.00	8.00	137.33	5,807.52	-1,298.65	1,180.65	1,755.07	0.89	-0.65	4.17
6,189.00	7.12	139.35	5,901.69	-1,307.98	1,188.97	1,767.57	0.97	-0.93	2.13
6,283.00	6.86	141.90	5,995.00	-1,316.82	1,196.23	1,778.99	0.43	-0.28	2.71
6,378.00	6.51	145.33	6,089.35	-1,325.71	1,202.79	1,790.00	0.56	-0.37	3.61
6,472.00	5.72	152.45	6,182.82	-1,334.25	1,207.99	1,799.83	1.16	-0.84	7.57
6,567.00	4.75	158.42	6,277.42	-1,342.10	1,211.63	1,808.10	1.17	-1.02	6.28
6,662.00	4.31	146.73	6,372.12	-1,348.75	1,215.03	1,815.32	1.07	-0.46	-12.31
6,756.00	3.96	139.61	6,465.88	-1,354.17	1,219.07	1,822.06	0.66	-0.37	-7.57
6,851.00	3.87	143.83	6,560.66	-1,359.26	1,223.09	1,828.53	0.32	-0.09	4.44
6,945.00	3.08	141.99	6,654.49	-1,363.81	1,226.52	1,834.21	0.85	-0.84	-1.96
7,040.00	2.64	144.80	6,749.37	-1,367.61	1,229.35	1,838.93	0.49	-0.46	2.96
7,134.00	2.73	162.46	6,843.27	-1,371.51	1,231.27	1,843.12	0.88	0.10	18.79
7,229.00	3.69	151.21	6,938.12	-1,376.35	1,233.43	1,848.16	1.20	1.01	-11.84
7,323.00	3.34	136.19	7,031.94	-1,380.98	1,236.78	1,853.84	1.04	-0.37	-15.98
7,418.00	3.61	130.12	7,126.77	-1,384.90	1,240.98	1,859.57	0.48	0.28	-6.39
7,513.00	2.90	127.75	7,221.61	-1,388.30	1,245.17	1,864.89	0.76	-0.75	-2.49
7,607.00	1.85	127.57	7,315.53	-1,390.68	1,248.25	1,868.72	1.12	-1.12	-0.19
7,702.00	1.49	124.76	7,410.49	-1,392.32	1,250.48	1,871.43	0.39	-0.38	-2.96
7,796.00	1.06	133.72	7,504.47	-1,393.62	1,252.12	1,873.49	0.50	-0.46	9.53
7,891.00	0.62	135.92	7,599.46	-1,394.59	1,253.11	1,874.88	0.46	-0.46	2.32
7,985.00	1.23	111.58	7,693.44	-1,395.33	1,254.40	1,876.29	0.76	0.65	-25.89
8,080.00	0.70	141.11	7,788.43	-1,396.16	1,255.71	1,877.78	0.75	-0.56	31.08
8,174.00	1.67	155.17	7,882.41	-1,397.85	1,256.65	1,879.66	1.07	1.03	14.96
8,269.00	2.11	168.27	7,977.36	-1,400.82	1,257.59	1,882.50	0.65	0.46	13.79
8,363.00	2.20	205.62	8,071.30	-1,404.14	1,257.16	1,884.69	1.47	0.10	39.73
8,458.00	2.46	218.10	8,166.22	-1,407.38	1,255.11	1,885.74	0.60	0.27	13.14

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<b>Project:</b>	Garfield County, CO NAD27	<b>TVD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Site:</b>	Cascade Creek 697-15-01 Pad	<b>MD Reference:</b>	GL 8348' & RKB 30' @ 8378.00ft
<b>Well:</b>	CC 697-15-19A	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	OH	<b>Database:</b>	Rockies-R5000.1

Survey									
Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
8,552.00	2.11	222.05	8,260.14	-1,410.26	1,252.71	1,886.28	0.41	-0.37	4.20
8,647.00	2.11	240.07	8,355.08	-1,412.43	1,250.02	1,886.10	0.70	0.00	18.97
8,742.00	2.20	235.85	8,450.01	-1,414.32	1,246.99	1,885.49	0.19	0.09	-4.44
8,836.00	2.20	229.61	8,543.94	-1,416.51	1,244.13	1,885.21	0.25	0.00	-6.64
8,931.00	1.93	230.14	8,638.88	-1,418.71	1,241.51	1,885.10	0.28	-0.28	0.56
9,025.00	2.55	228.65	8,732.81	-1,421.11	1,238.73	1,885.03	0.66	0.66	-1.59
9,120.00	2.64	237.79	8,827.71	-1,423.67	1,235.29	1,884.65	0.45	0.09	9.62
9,211.00	2.99	229.35	8,918.60	-1,426.34	1,231.71	1,884.24	0.60	0.38	-9.27
Last SDI Production MWD Survey									
9,270.00	2.99	229.35	8,977.52	-1,428.34	1,229.38	1,884.18	0.00	0.00	0.00
Projection To TD - BHL = 627722.31, 1236209.72									

Design Annotations				
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
176.00	175.98	-2.09	0.42	First Gyro Survey
452.00	450.81	-22.93	11.37	Last Gyro Survey
526.00	523.98	-32.38	17.16	First SDI Surface MWD Survey
2,411.00	2,313.17	-466.93	406.14	Last SDI Surface MWD Survey
2,504.00	2,400.75	-491.02	426.09	First SDI Production MWD Survey
9,211.00	8,918.60	-1,426.34	1,231.71	Last SDI Production MWD Survey
9,270.00	8,977.52	-1,428.34	1,229.38	Projection To TD
9,270.00	8,977.52	-1,428.34	1,229.38	BHL = 627722.31, 1236209.72

Checked By: \_\_\_\_\_ Approved By: \_\_\_\_\_ Date: \_\_\_\_\_