



**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 697-16-42B</u>
<b>County &amp; State</b>	<u>Garfield County, CO</u>
<b>SDI Job No.</b>	<u>42DEFK1004252</u>
<b>Rig</b>	<u>H&amp;P 330</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 8686 feet is true and correct as determined from all available records.

  
\_\_\_\_\_  
Signature

20-Apr-10  
\_\_\_\_\_  
Date

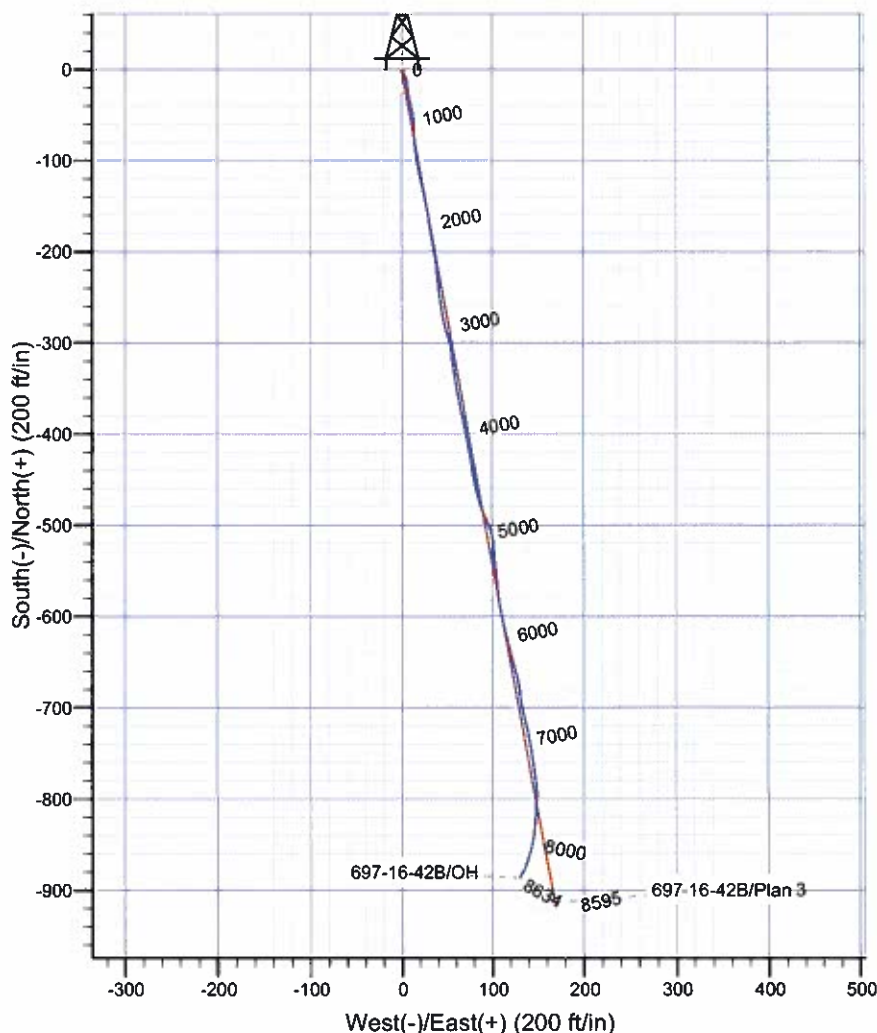
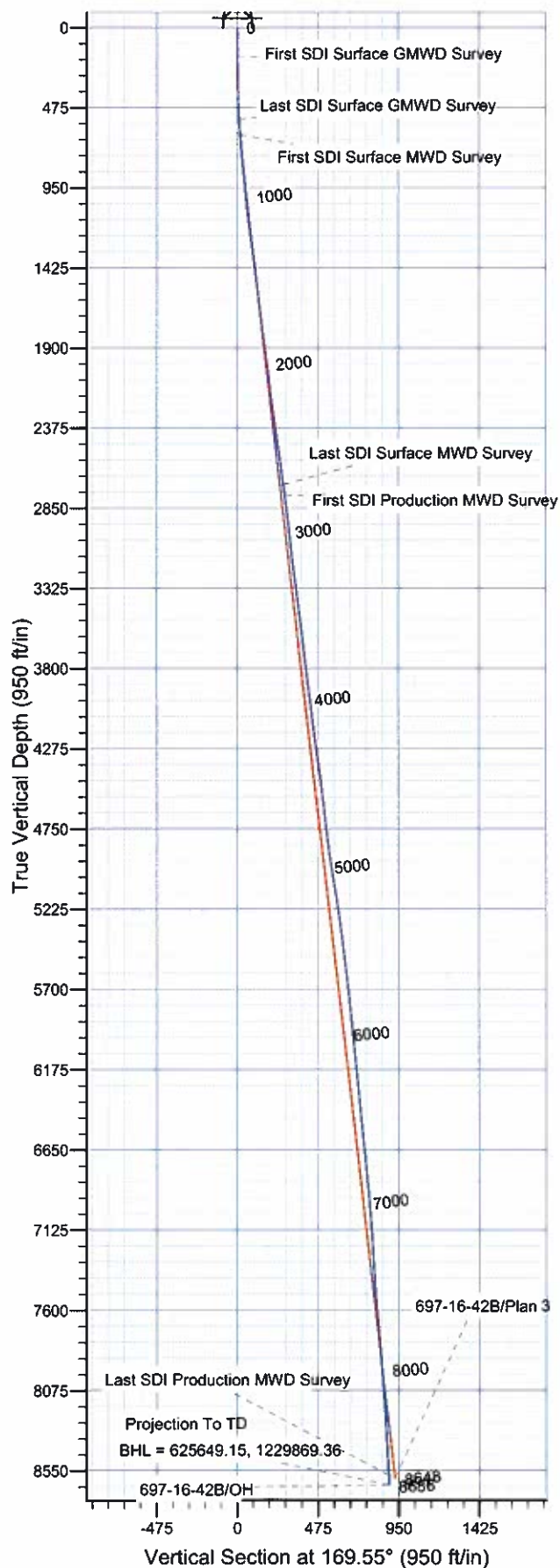
**Rex Hall**  
Grand Junction Drilling Engineer  
Scientific Drilling - Rocky Mountain District



**Scientific Drilling**  
Rocky Mountain Operations

Project: Garfield County, CO NAD27  
Site: Cascade Creek 697-16A II Pad  
Well: 697-16-42B  
Wellbore: OH  
Design: OH

**OXY USA RMAT**



**WELL DETAILS: 697-16-42B**

Ground Level: GL 8312' & RKB 30' @ 8342.00ft  
+N/-S +E/-W  
0.00 0.00  
North 626539.18 Easting 1229765.94  
Latitude 39° 31' 18.780 N Longitude 108° 13' 50.630 W

**REFERENCE INFORMATION**

Co-ordinate (N/E) Reference: Well 697-16-42B, True North  
Vertical (TVD) Reference: GL 8312' & RKB 30' @ 8342.00ft  
Section (VS) Reference: Slot - (0.00N, 0.00E)  
Measured Depth Reference: GL 8312' & RKB 30' @ 8342.00ft  
Calculation Method: Minimum Curvature  
Local North: True  
Location: Sec 16 T6S R97W

**PROJECT DETAILS: Garfield County, CO NAD27**

Geodetic System: US State Plane 1927 (Exact solution)  
Datum: NAD 1927 (NADCON CONUS)  
Ellipsoid: Clarke 1866  
Zone: Colorado Central 502

Design: OH (697-16-42B/OH)

Created By: Rex Hall Date: 2010-04-20



**Scientific Drilling**  
Rocky Mountain Operations

## **OXY USA RMAT**

Garfield County, CO NAD27  
Cascade Creek 697-16A II Pad  
697-16-42B  
OH

**Design: OH**

## **Standard Survey Report**

**20 April, 2010**



<b>Company:</b>	OXY USA RMAT	<b>Local Co-ordinate Reference:</b>	Well 697-16-42B
<b>Project:</b>	Garfield County, CO NAD27	<b>TVD Reference:</b>	GL 8312' & RKB 30' @ 8342.00ft
<b>Site:</b>	Cascade Creek 697-16A II Pad	<b>MD Reference:</b>	GL 8312' & RKB 30' @ 8342.00ft
<b>Well:</b>	697-16-42B	<b>North Reference:</b>	True
<b>Wellbore:</b>	OH	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Design:</b>	OH	<b>Database:</b>	EDM 2003.16 Multi-User Db

<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		

Site		Cascade Creek 697-16A II Pad, Sec 16 T6S R97W			
Site Position:		Northing:	626,314.75 ft	Latitude:	39° 31' 16.584 N
From:	Map	Easting:	1,229,837.54 ft	Longitude:	108° 13' 49.631 W
Position Uncertainty:	0.00 ft	Slot Radius:	in	Grid Convergence:	-1.72 °

Well	697-16-42B					
Well Position	+N/-S	0.00 ft	Northing:	626,539.18 ft	Latitude:	39° 31' 18.780 N
	+E/-W	0.00 ft	Easting:	1,229,765.94 ft	Longitude:	108° 13' 50.630 W
Position Uncertainty		0.00 ft	Wellhead Elevation:	ft	Ground Level:	8,312.00 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>
	IGRF200510	1/17/2008	10.88	65.81	52,578

<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	169.55	

<b>Survey Program</b>	<b>Date</b>	4/20/2010			
<b>From (ft)</b>	<b>To (ft)</b>	<b>Survey (Wellbore)</b>	<b>Tool Name</b>	<b>Description</b>	
175.00	544.00	Survey #1 - Surface Gyro MWD (OH)	Standard Keeper 103	Standard Wireline Keeper ver 1.0.3	
636.00	2,727.00	Survey #2 - Surface MWD (OH)	MWD-SDI	MWD - Standard ISCWSA	
2,791.00	8,686.00	Survey #3 - Production MWD (OH)	MWD-SDI	MWD - Standard ISCWSA	

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)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175.00	0.88	112.76	174.99	-0.52	1.24	0.74	0.50	0.50	0.00	
First SDI Surface GMWD Survey										
267.00	1.32	172.09	266.98	-1.84	2.04	2.18	1.25	0.48	64.49	
359.00	1.23	180.53	358.96	-3.88	2.17	4.21	0.23	-0.10	9.17	
451.00	1.58	155.13	450.93	-6.02	2.70	6.41	0.77	0.38	-27.61	
544.00	3.43	152.49	543.84	-9.65	4.52	10.31	1.99	1.99	-2.84	
Last SDI Surface GMWD Survey										
636.00	4.77	175.46	635.60	-15.90	6.10	16.75	2.28	1.46	24.97	
First SDI Surface MWD Survey										
728.00	5.35	174.85	727.25	-23.99	6.78	24.82	0.63	0.63	-0.66	

**Company:** OXY USA RMAT  
**Project:** Garfield County, CO NAD27  
**Site:** Cascade Creek 697-16A II Pad  
**Well:** 697-16-42B  
**Wellbore:** OH  
**Design:** OH

**Local Co-ordinate Reference:** Well 697-16-42B  
**TVD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**MD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**North Reference:** True  
**Survey Calculation Method:** Minimum Curvature  
**Database:** EDM 2003.16 Multi-User Db

**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)
805.00	4.82	165.26	803.94	-30.69	7.93	31.62	1.30	-0.69	-12.45
900.00	5.14	165.13	898.58	-38.67	10.04	39.84	0.34	0.34	-0.14
994.00	5.71	168.66	992.16	-47.32	12.04	48.72	0.70	0.61	3.76
1,088.00	6.30	174.80	1,085.65	-57.04	13.42	58.53	0.93	0.63	6.53
1,183.00	7.71	179.66	1,179.94	-68.61	13.93	70.00	1.61	1.48	5.12
1,277.00	7.90	176.29	1,273.07	-81.36	14.39	82.62	0.53	0.20	-3.59
1,372.00	7.52	169.65	1,367.21	-93.99	15.93	95.32	1.02	-0.40	-6.99
1,466.00	7.09	172.09	1,460.45	-105.78	17.83	107.26	0.56	-0.46	2.60
1,561.00	7.33	166.96	1,554.70	-117.50	20.01	119.18	0.72	0.25	-5.40
1,656.00	6.54	165.52	1,649.00	-128.64	22.73	130.63	0.85	-0.83	-1.52
1,750.00	6.81	167.07	1,742.36	-139.25	25.31	141.53	0.35	0.29	1.65
1,844.00	7.21	168.75	1,835.66	-150.47	27.71	153.00	0.48	0.43	1.79
1,939.00	8.37	172.26	1,929.78	-163.17	29.80	165.87	1.32	1.22	3.69
2,034.00	7.24	170.84	2,023.90	-175.93	31.69	178.76	1.21	-1.19	-1.49
2,128.00	6.85	171.30	2,117.19	-187.32	33.48	190.29	0.42	-0.41	0.49
2,223.00	7.27	168.24	2,211.47	-198.81	35.56	201.96	0.59	0.44	-3.22
2,317.00	8.03	172.83	2,304.64	-211.14	37.59	214.46	1.04	0.81	4.88
2,411.00	8.21	175.06	2,397.69	-224.34	38.99	227.69	0.39	0.19	2.37
2,506.00	8.39	172.39	2,491.70	-237.97	40.49	241.37	0.45	0.19	-2.81
2,601.00	8.66	171.29	2,585.65	-251.91	42.49	255.44	0.33	0.28	-1.16
2,727.00	7.24	170.54	2,710.44	-269.12	45.24	272.86	1.13	-1.13	-0.60
<b>Last SDI Surface MWD Survey</b>									
2,791.00	6.60	167.50	2,773.97	-276.69	46.69	280.57	1.15	-1.00	-4.75
<b>First SDI Production MWD Survey</b>									
2,886.00	7.21	164.16	2,868.28	-287.75	49.50	291.96	0.77	0.64	-3.52
2,981.00	6.70	161.78	2,962.58	-298.75	52.86	303.39	0.62	-0.54	-2.51
3,075.00	5.89	176.46	3,056.02	-308.78	54.88	313.61	1.91	-0.86	15.62
3,170.00	6.86	173.39	3,150.43	-319.28	55.83	324.11	1.08	1.02	-3.23
3,264.00	7.65	171.63	3,243.68	-331.04	57.39	335.96	0.87	0.84	-1.87
3,359.00	8.09	167.94	3,337.78	-343.84	59.70	348.96	0.71	0.46	-3.88
3,453.00	7.21	170.22	3,430.95	-356.12	62.09	361.47	0.99	-0.94	2.43
3,548.00	6.51	167.67	3,525.27	-367.26	64.25	372.82	0.80	-0.74	-2.68
3,642.00	7.47	169.17	3,618.57	-378.46	66.54	384.25	1.04	1.02	1.60
3,737.00	6.60	166.97	3,712.85	-389.85	68.93	395.88	0.96	-0.92	-2.32
3,831.00	7.30	168.29	3,806.16	-400.96	71.36	407.25	0.76	0.74	1.40
3,926.00	6.77	168.82	3,900.44	-412.36	73.67	418.88	0.56	-0.56	0.56
4,020.00	7.21	170.31	3,993.74	-423.61	75.74	430.32	0.51	0.47	1.59
4,115.00	6.51	173.03	4,088.06	-434.83	77.39	441.66	0.81	-0.74	2.86
4,210.00	7.65	168.73	4,182.34	-446.38	79.28	453.36	1.32	1.20	-4.53
4,304.00	7.03	168.82	4,275.57	-458.16	81.62	465.37	0.66	-0.66	0.10
4,399.00	8.53	164.42	4,369.69	-470.65	84.64	478.20	1.70	1.58	-4.63
4,494.00	7.47	158.09	4,463.77	-483.17	88.84	491.27	1.45	-1.12	-6.66
4,588.00	6.42	153.79	4,557.08	-493.55	93.44	502.31	1.25	-1.12	-4.57
4,683.00	6.24	159.94	4,651.50	-503.17	97.55	512.52	0.74	-0.19	6.47
4,777.00	6.68	168.90	4,744.90	-513.33	100.36	523.02	1.17	0.47	9.53
4,872.00	7.30	178.13	4,839.20	-524.79	101.62	534.51	1.35	0.65	9.72
4,966.00	8.79	172.95	4,932.27	-537.88	102.70	547.59	1.76	1.59	-5.51
5,061.00	9.85	173.91	5,026.02	-553.17	104.45	562.94	1.13	1.12	1.01
5,155.00	9.23	176.46	5,118.72	-568.69	105.77	578.44	0.80	-0.66	2.71
5,250.00	8.00	169.43	5,212.65	-582.79	107.45	592.61	1.70	-1.29	-7.40
5,345.00	7.56	170.31	5,306.77	-595.45	109.72	605.47	0.48	-0.46	0.93
5,439.00	7.39	167.41	5,399.97	-607.45	112.07	617.70	0.44	-0.18	-3.09
5,534.00	6.86	166.27	5,494.24	-618.92	114.75	629.47	0.58	-0.56	-1.20
5,629.00	6.60	165.65	5,588.59	-629.72	117.45	640.58	0.28	-0.27	-0.65

**Company:** OXY USA RMAT  
**Project:** Garfield County, CO NAD27  
**Site:** Cascade Creek 697-16A II Pad  
**Well:** 697-16-42B  
**Wellbore:** OH  
**Design:** OH

**Local Co-ordinate Reference:** Well 697-16-42B  
**TVD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**MD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**North Reference:** True  
**Survey Calculation Method:** Minimum Curvature  
**Database:** EDM 2003.16 Multi-User Db

**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)
5,724.00	6.77	166.00	5,682.94	-640.44	120.16	651.61	0.18	0.18	0.37
5,819.00	6.33	163.19	5,777.32	-650.89	123.03	662.41	0.57	-0.46	-2.96
5,913.00	5.63	165.21	5,870.81	-660.31	125.71	672.16	0.78	-0.74	2.15
6,008.00	5.01	167.76	5,965.40	-668.87	127.77	680.95	0.70	-0.65	2.68
6,103.00	5.89	170.93	6,059.97	-677.73	129.42	689.97	0.98	0.93	3.34
6,197.00	5.54	174.70	6,153.50	-687.02	130.60	699.31	0.55	-0.37	4.01
6,292.00	5.98	168.82	6,248.02	-696.44	131.98	708.82	0.77	0.46	-6.19
6,387.00	5.80	167.23	6,342.52	-705.97	134.01	718.57	0.26	-0.19	-1.67
6,481.00	5.28	164.25	6,436.08	-714.77	136.23	727.62	0.63	-0.55	-3.17
6,576.00	5.28	165.92	6,530.68	-723.21	138.48	736.34	0.16	0.00	1.76
6,671.00	6.42	169.26	6,625.18	-732.67	140.53	746.01	1.25	1.20	3.52
6,765.00	6.16	170.66	6,718.62	-742.81	142.33	756.31	0.32	-0.28	1.49
6,860.00	5.54	171.80	6,813.12	-752.38	143.81	765.99	0.66	-0.65	1.20
6,955.00	5.01	168.90	6,907.72	-760.99	145.26	774.72	0.62	-0.56	-3.05
7,049.00	4.66	172.86	7,001.38	-768.81	146.53	782.63	0.51	-0.37	4.21
7,144.00	4.13	172.95	7,096.10	-776.03	147.43	789.90	0.56	-0.56	0.09
7,239.00	3.78	172.77	7,190.88	-782.53	148.24	796.44	0.37	-0.37	-0.19
7,334.00	3.52	176.64	7,285.69	-788.55	148.81	802.46	0.38	-0.27	4.07
7,428.00	3.17	174.88	7,379.53	-794.02	149.21	807.91	0.39	-0.37	-1.87
7,523.00	3.52	188.94	7,474.37	-799.52	148.99	813.28	0.94	0.37	14.80
7,618.00	5.19	184.28	7,569.09	-806.68	148.22	820.19	1.80	1.76	-4.91
7,713.00	6.07	183.49	7,663.63	-815.98	147.59	829.22	0.93	0.93	-0.83
7,808.00	5.28	184.20	7,758.16	-825.36	146.96	838.32	0.83	-0.83	0.75
7,902.00	4.75	183.23	7,851.80	-833.55	146.43	846.29	0.57	-0.56	-1.03
7,997.00	4.31	188.77	7,946.51	-841.01	145.66	853.48	0.65	-0.46	5.83
8,092.00	4.31	192.55	8,041.24	-848.02	144.34	860.14	0.30	0.00	3.98
8,187.00	4.22	197.29	8,135.97	-854.84	142.53	866.52	0.38	-0.09	4.99
8,282.00	3.87	196.77	8,230.74	-861.25	140.56	872.46	0.37	-0.37	-0.55
8,376.00	3.96	196.77	8,324.52	-867.40	138.71	878.17	0.10	0.10	0.00
8,471.00	3.96	202.57	8,419.29	-873.57	136.51	883.84	0.42	0.00	6.11
8,566.00	3.87	206.78	8,514.07	-879.46	133.80	889.14	0.32	-0.09	4.43
8,629.00	3.78	207.84	8,576.93	-883.19	131.87	892.46	0.18	-0.14	1.68
<b>Last SDI Production MWD Survey</b>									
8,686.00	3.78	207.84	8,633.81	-886.51	130.12	895.41	0.00	0.00	0.00
<b>Projection To TD - BHL = 625649.15, 1229869.36</b>									

**Company:** OXY USA RMAT  
**Project:** Garfield County, CO NAD27  
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**Well:** 697-16-42B  
**Wellbore:** OH  
**Design:** OH

**Local Co-ordinate Reference:** Well 697-16-42B  
**TVD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**MD Reference:** GL 8312' & RKB 30' @ 8342.00ft  
**North Reference:** True  
**Survey Calculation Method:** Minimum Curvature  
**Database:** EDM 2003.16 Multi-User Db

**Targets**
**Target Name**

- hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
CC 697-16-42B Target / - actual wellpath misses target center by 7.69ft at 7851.49ft MD (7801.48 TVD, -829.26 N, 146.69 E) - Circle (radius 50.00)	-8.00	169.39	7,802.00	-823.66	151.93	625,711.32	1,229,893.05	39° 31' 10.639 N	108° 13' 48.691 W
697-16-42B Target - actual wellpath misses target center by 2.54ft at 7800.84ft MD (7751.03 TVD, -824.69 N, 147.01 E) - Circle (radius 50.00)	0.00	0.00	7,751.00	-825.15	149.51	625,709.91	1,229,890.58	39° 31' 10.624 N	108° 13' 48.722 W
697-16-42B WF Target - actual wellpath misses target center by 7.62ft at 7850.50ft MD (7800.49 TVD, -829.17 N, 146.70 E) - Circle (radius 50.00)	-6.57	169.55	7,801.00	-823.66	151.93	625,711.32	1,229,893.05	39° 31' 10.639 N	108° 13' 48.691 W

**Design Annotations**

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
175.00	174.99	-0.52	1.24	First SDI Surface GMWD Survey
544.00	543.84	-9.65	4.52	Last SDI Surface GMWD Survey
636.00	635.60	-15.90	6.10	First SDI Surface MWD Survey
2,727.00	2,710.44	-269.12	45.24	Last SDI Surface MWD Survey
2,791.00	2,773.97	-276.69	46.69	First SDI Production MWD Survey
8,629.00	8,576.93	-883.19	131.87	Last SDI Production MWD Survey
8,686.00	8,633.81	-886.51	130.12	Projection To TD
8,686.00	8,633.81	-886.51	130.12	BHL = 625649.15, 1229869.36

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