



NM OIL CONSERVATION
ARTESIA DISTRICT

JAN 18 2018

RECEIVED

COG OPERATING, LLC

Eddy /Lea County, NM (NAD27) NMEZ

Malco 23 Federal COM 13H #13H -

Slot 125'FNL, 1543'FWL , Sec 23/T17S/R28E/UnitC

PP, 693'FNL, 1637'FWL, Sec 23/T17S/R28E/UnitC

30-015-44297

Lateral

Planned BHL - 10'FSL, 1657'FWL, Sec 23/T17S/R28E/UnitN

Actual BHL - 24'FSL, 1658'FWL, SEC23/T17S/R28E/UnitN





Survey Report

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Malco 23 Federal COM 13H
Well: #13H
Wellbore: Lateral
Design: Lateral

Local Co-ordinate Reference: Well #13H - Slot Malco 13H
TVD Reference: 3639+18 @ 3657.00ft (Planning Est)
MD Reference: 3639+18 @ 3657.00ft (Planning Est)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

Project Eddy /Lea County, NM (NAD27) NMEZ

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

System Datum: Mean Sea Level

Site Malco 23 Federal COM 13H

Site Position:
From: Map
Position Uncertainty: 0.00 ft
Northing: 664,672.10 ft
Easting: 556,425.90 ft
Slot Radius: 13.20 in
Latitude: 32° 49' 37.675 N
Longitude: 104° 8' 58.729 W
Grid Convergence: 0.10 °

Well #13H - Slot Malco 13H, SHL 125'FNL, 1443'FWL Sec23

Well Position +N/-S 0.00 ft Northing: 664,672.10 ft Latitude: 32° 49' 37.675 N
+E/-W 0.00 ft Easting: 556,425.90 ft Longitude: 104° 8' 58.729 W
Position Uncertainty 0.00 ft **Wellhead Elevation:** ft **Ground Level:** 3,639.00 ft

Wellbore Lateral

Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	10/11/17	7.23	60.52	48,199

Design Lateral

Audit Notes:

Version: 1.0 **Phase:** ACTUAL **Tie On Depth:** 0.00

Vertical Section:	Depth From (TVD) (ft)	+N/-S (ft)	+E/-W (ft)	Direction (°)
	0.00	0.00	0.00	181.10

Survey Program Date 10/29/17

From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
100.00	1,200.00	Survey #1 (Lateral)	GYD_DP_MS	Gyrodata gyro-compassing and drop
1,290.00	8,605.00	Survey #2 (Lateral)	MWD	MWD v3:standard declination
8,695.00	8,695.00	Survey #3 (Lateral)	Projection	Projection

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
Malco 13H SL									
100.00	0.71	202.19	100.00	-0.57	-0.23	0.58	0.71	0.71	0.00
200.00	0.84	187.00	199.99	-1.87	-0.56	1.89	0.24	0.13	-15.19
300.00	0.74	166.45	299.98	-3.23	-0.50	3.24	0.30	-0.10	-20.55
400.00	0.75	163.67	399.97	-4.49	-0.16	4.49	0.04	0.01	-2.78
500.00	0.79	168.57	499.96	-5.79	0.16	5.79	0.08	0.04	4.90
600.00	0.55	159.09	599.95	-6.91	0.47	6.90	0.26	-0.24	-9.48
700.00	0.56	164.51	699.95	-7.83	0.77	7.82	0.05	0.01	5.42



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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)
800.00	0.48	178.89	799.95	-8.72	0.91	8.70	0.15	-0.08	14.38
900.00	0.22	166.27	899.94	-9.33	0.96	9.31	0.27	-0.26	-12.62
1,000.00	0.30	189.89	999.94	-9.77	0.96	9.75	0.13	0.08	23.62
1,100.00	0.39	194.64	1,099.94	-10.36	0.83	10.34	0.09	0.09	4.75
1,200.00	0.47	218.07	1,199.94	-11.01	0.49	11.00	0.19	0.08	23.43
1,290.00	0.10	233.49	1,289.94	-11.35	0.20	11.34	0.42	-0.41	17.13
1,322.00	0.12	145.32	1,321.94	-11.39	0.20	11.39	0.48	0.06	-275.53
1,417.00	2.06	20.67	1,416.92	-9.88	0.86	9.86	2.24	2.04	-131.21
1,512.00	2.93	24.32	1,511.83	-6.07	2.46	6.02	0.93	0.92	3.84
1,607.00	3.88	31.99	1,606.66	-1.13	5.16	1.03	1.11	1.00	8.07
1,702.00	4.81	35.82	1,701.38	4.83	9.20	-5.00	1.02	0.98	4.03
1,797.00	5.48	36.04	1,796.00	11.72	14.20	-12.00	0.71	0.71	0.23
1,892.00	7.19	41.25	1,890.42	19.86	20.79	-20.26	1.90	1.80	5.48
1,987.00	8.33	40.52	1,984.55	29.56	29.18	-30.12	1.20	1.20	-0.77
2,081.00	8.57	39.22	2,077.53	40.17	38.03	-40.89	0.33	0.26	-1.38
2,178.00	8.51	40.69	2,173.45	51.21	47.28	-52.11	0.23	-0.06	1.52
2,273.00	8.72	40.10	2,267.38	62.05	56.50	-63.12	0.24	0.22	-0.62
2,367.00	8.88	40.65	2,360.27	73.00	65.82	-74.25	0.19	0.17	0.59
2,461.00	8.01	39.05	2,453.25	83.59	74.67	-85.01	0.96	-0.93	-1.70
2,556.00	6.86	38.65	2,547.45	93.16	82.38	-94.73	1.21	-1.21	-0.42
2,650.00	5.55	39.98	2,640.90	101.03	88.81	-102.72	1.40	-1.39	1.41
2,745.00	3.81	38.61	2,735.58	107.02	93.73	-108.80	1.84	-1.83	-1.44
2,840.00	2.75	42.98	2,830.42	111.15	97.26	-113.00	1.15	-1.12	4.60
2,935.00	0.97	88.60	2,925.37	112.84	99.61	-114.73	2.30	-1.87	48.02
3,030.00	1.54	153.92	3,020.35	111.71	100.98	-113.63	1.51	0.60	68.76
3,047.43	1.55	154.50	3,037.78	111.29	101.18	-113.21	0.10	0.05	3.33
Malco 13H Tgt p2 (Nudge)									
3,093.00	1.57	155.99	3,083.33	110.16	101.70	-112.10	0.10	0.05	3.27
3,124.00	3.13	171.27	3,114.30	108.94	102.00	-110.88	5.38	5.03	49.29
3,156.00	6.06	179.20	3,146.20	106.39	102.16	-108.33	9.35	9.16	24.78
3,188.00	9.92	181.02	3,177.88	101.94	102.13	-103.88	12.09	12.06	5.69
3,219.00	14.11	181.03	3,208.19	95.49	102.02	-97.43	13.52	13.52	0.03
3,251.00	18.04	181.49	3,238.94	86.63	101.82	-88.57	12.29	12.28	1.44
3,282.00	20.79	181.73	3,268.17	76.33	101.53	-78.27	8.87	8.87	0.77
3,313.00	23.15	181.81	3,296.92	64.74	101.17	-66.67	7.61	7.61	0.26
3,345.00	25.79	181.29	3,326.04	51.49	100.81	-53.42	8.28	8.25	-1.63
3,377.00	28.12	180.71	3,354.56	36.99	100.56	-38.91	7.33	7.28	-1.81
3,408.00	30.91	180.21	3,381.54	21.72	100.44	-23.64	9.03	9.00	-1.61
3,440.00	34.99	179.76	3,408.39	4.32	100.45	-6.25	12.77	12.75	-1.41
3,472.00	38.77	179.59	3,433.98	-14.88	100.56	12.95	11.82	11.81	-0.53
3,503.00	41.44	179.60	3,457.69	-34.85	100.70	32.91	8.61	8.61	0.03
3,535.00	43.58	179.57	3,481.27	-56.47	100.86	54.52	6.69	6.69	-0.09
3,566.00	44.58	179.73	3,503.54	-78.04	100.99	76.08	3.25	3.23	0.52



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3,598.00	45.10	180.69	3,526.23	-100.60	100.91	98.64	2.67	1.63	3.00
3,629.00	45.17	180.03	3,548.10	-122.57	100.77	120.61	1.53	0.23	-2.13
3,661.00	45.27	180.48	3,570.64	-145.28	100.67	143.32	1.05	0.31	1.41
3,692.00	45.27	180.39	3,592.46	-167.31	100.50	165.35	0.21	0.00	-0.29
3,724.00	45.27	179.71	3,614.98	-190.04	100.48	188.08	1.51	0.00	-2.13
3,756.00	45.46	179.49	3,637.46	-212.81	100.64	210.84	0.77	0.59	-0.69
3,787.00	47.83	179.64	3,658.74	-235.35	100.81	233.37	7.65	7.65	0.48
3,819.00	52.02	179.65	3,679.34	-259.83	100.96	257.84	13.09	13.09	0.03
3,857.00	57.45	178.96	3,701.27	-290.84	101.35	288.84	14.37	14.29	-1.82
3,889.00	60.05	178.51	3,717.87	-318.19	101.95	316.17	8.21	8.13	-1.41
3,920.00	64.23	178.40	3,732.35	-345.58	102.69	343.55	13.49	13.48	-0.35
3,951.00	68.78	178.38	3,744.71	-373.99	103.49	371.94	14.68	14.68	-0.06
3,983.00	72.10	178.32	3,755.42	-404.13	104.36	402.05	10.38	10.38	-0.19
4,014.00	73.90	178.26	3,764.48	-433.76	105.24	431.66	5.81	5.81	-0.19
4,046.00	75.71	179.01	3,772.87	-464.63	105.98	462.51	6.09	5.66	2.34
4,077.00	78.21	179.68	3,779.87	-494.83	106.32	492.69	8.33	8.06	2.16
4,109.00	79.98	180.10	3,785.92	-526.25	106.38	524.11	5.68	5.53	1.31
4,140.00	81.79	180.50	3,790.83	-556.85	106.22	554.71	5.98	5.84	1.29
4,144.74	82.18	180.49	3,791.49	-561.55	106.18	559.41	8.29	8.29	-0.19
Malco 13H LP p2									
4,171.00	84.36	180.44	3,794.57	-587.62	105.97	585.48	8.29	8.29	-0.19
4,203.00	87.59	180.15	3,796.81	-619.54	105.80	617.40	10.13	10.09	-0.91
4,234.00	89.87	180.08	3,797.50	-650.53	105.74	648.38	7.36	7.35	-0.23
4,266.00	90.19	179.96	3,797.48	-682.53	105.73	680.38	1.07	1.00	-0.38
4,361.00	90.40	179.39	3,796.99	-777.53	106.27	775.34	0.64	0.22	-0.60
4,456.00	90.41	178.98	3,796.32	-872.52	107.62	870.29	0.43	0.01	-0.43
4,550.00	91.37	179.95	3,794.86	-966.50	108.50	964.24	1.45	1.02	1.03
4,645.00	91.58	180.01	3,792.42	-1,061.47	108.53	1,059.19	0.23	0.22	0.06
4,740.00	91.72	179.59	3,789.68	-1,156.43	108.86	1,154.12	0.47	0.15	-0.44
4,834.00	91.76	179.48	3,786.83	-1,250.38	109.63	1,248.04	0.12	0.04	-0.12
4,927.00	91.78	178.99	3,783.96	-1,343.33	110.87	1,340.95	0.53	0.02	-0.53
5,022.00	91.80	178.81	3,780.99	-1,438.26	112.69	1,435.83	0.19	0.02	-0.19
5,116.00	91.99	178.73	3,777.88	-1,532.19	114.71	1,529.71	0.22	0.20	-0.09
5,211.00	92.23	178.61	3,774.38	-1,627.10	116.91	1,624.56	0.28	0.25	-0.13
5,305.00	91.61	180.01	3,771.23	-1,721.04	118.04	1,718.45	1.63	-0.66	1.49
5,400.00	91.93	179.74	3,768.30	-1,815.99	118.25	1,813.39	0.44	0.34	-0.28
5,494.00	92.08	179.61	3,765.01	-1,909.93	118.78	1,907.30	0.21	0.16	-0.14
5,589.00	90.73	180.96	3,762.68	-2,004.90	118.31	2,002.26	2.01	-1.42	1.42
5,684.00	90.97	180.91	3,761.27	-2,099.88	116.76	2,097.25	0.26	0.25	-0.05
5,776.00	91.23	181.21	3,759.50	-2,191.84	115.06	2,189.23	0.43	0.28	0.33
5,871.00	91.45	180.93	3,757.28	-2,286.80	113.28	2,284.20	0.37	0.23	-0.29
5,965.00	91.44	180.99	3,754.91	-2,380.76	111.71	2,378.17	0.06	-0.01	0.06
6,060.00	91.35	181.02	3,752.60	-2,475.71	110.04	2,473.14	0.10	-0.09	0.03
6,155.00	91.13	180.09	3,750.54	-2,570.69	109.12	2,568.12	1.01	-0.23	-0.98



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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)
6,250.00	91.06	179.98	3,748.73	-2,665.67	109.06	2,663.08	0.14	-0.07	-0.12
6,345.00	91.14	180.42	3,746.90	-2,760.65	108.73	2,758.05	0.47	0.08	0.46
6,440.00	91.00	180.29	3,745.13	-2,855.63	108.14	2,853.03	0.20	-0.15	-0.14
6,534.00	91.10	180.26	3,743.41	-2,949.61	107.69	2,947.00	0.11	0.11	-0.03
6,629.00	91.03	180.08	3,741.64	-3,044.60	107.41	3,041.97	0.20	-0.07	-0.19
6,723.00	91.08	180.43	3,739.91	-3,138.58	106.99	3,135.95	0.38	0.05	0.37
6,819.00	91.05	180.58	3,738.13	-3,234.56	106.15	3,231.93	0.16	-0.03	0.16
6,913.00	91.09	180.72	3,736.37	-3,328.54	105.08	3,325.91	0.15	0.04	0.15
7,009.00	90.93	180.87	3,734.68	-3,424.51	103.75	3,421.89	0.23	-0.17	0.16
7,103.00	90.60	180.36	3,733.42	-3,518.50	102.74	3,515.88	0.65	-0.35	-0.54
7,198.00	90.60	181.04	3,732.43	-3,613.49	101.58	3,610.87	0.72	0.00	0.72
7,292.00	91.59	181.99	3,730.63	-3,707.43	99.10	3,704.85	1.46	1.05	1.01
7,386.00	91.52	182.14	3,728.08	-3,801.34	95.71	3,798.80	0.18	-0.07	0.16
7,481.00	91.31	181.95	3,725.74	-3,896.25	92.32	3,893.76	0.30	-0.22	-0.20
7,575.00	91.57	181.18	3,723.37	-3,990.18	89.75	3,987.73	0.86	0.28	-0.82
7,670.00	91.54	181.18	3,720.80	-4,085.13	87.80	4,082.69	0.03	-0.03	0.00
7,765.00	91.27	180.37	3,718.47	-4,180.09	86.51	4,177.66	0.90	-0.28	-0.85
7,860.00	92.21	180.81	3,715.58	-4,275.04	85.54	4,272.61	1.09	0.99	0.46
7,953.00	92.40	180.98	3,711.84	-4,367.95	84.09	4,365.53	0.27	0.20	0.18
8,048.00	91.70	181.29	3,708.44	-4,462.87	82.20	4,460.47	0.81	-0.74	0.33
8,143.00	91.80	181.13	3,705.54	-4,557.81	80.20	4,555.43	0.20	0.11	-0.17
8,238.00	91.69	180.96	3,702.65	-4,652.75	78.47	4,650.38	0.21	-0.12	-0.18
8,332.00	91.95	181.42	3,699.66	-4,746.68	76.52	4,744.34	0.56	0.28	0.49
8,386.00	91.98	181.96	3,697.81	-4,800.62	74.92	4,798.30	1.00	0.06	1.00
8,480.00	91.84	181.82	3,694.68	-4,894.52	71.83	4,892.24	0.21	-0.15	-0.15
8,575.00	91.82	182.51	3,691.65	-4,989.40	68.24	4,987.18	0.73	-0.02	0.73
8,605.00	91.74	182.35	3,690.71	-5,019.36	66.97	5,017.15	0.60	-0.27	-0.53
8,695.00	91.74	182.35	3,687.98	-5,109.25	63.28	5,107.09	0.00	0.00	0.00

Malco 13H PBHL p2

Design 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
Malco 13H SL - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	664,672.10	556,425.90	32° 49' 37.675 N	104° 8' 58.729 W
Malco 13H BHL - actual wellpath hits target center - Point	0.00	0.00	3,687.98	-5,109.25	63.28	659,562.85	556,489.18	32° 48' 47.116 N	104° 8' 58.091 W



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Design Annotations

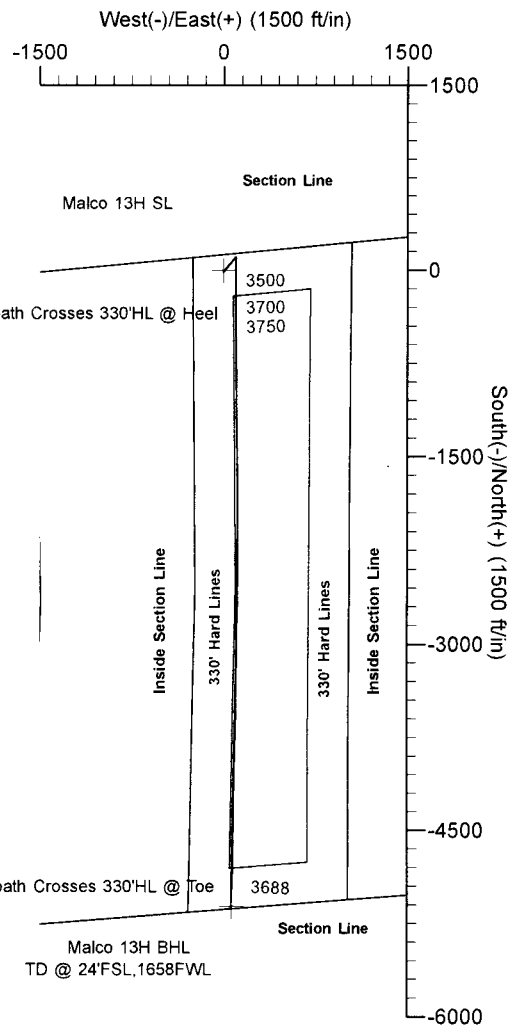
Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
3,734.00	3,622.01	-197.15	100.52	Wellpath Crosses 330'HL @ Heel
8,386.00	3,697.81	-4,800.62	74.92	Wellpath Crosses 330'HL @ Toe
8,695.00	3,687.98	-5,109.25	63.28	TD @ 24'FSL, 1658FWL

Checked By: _____ Approved By: _____ Date: _____

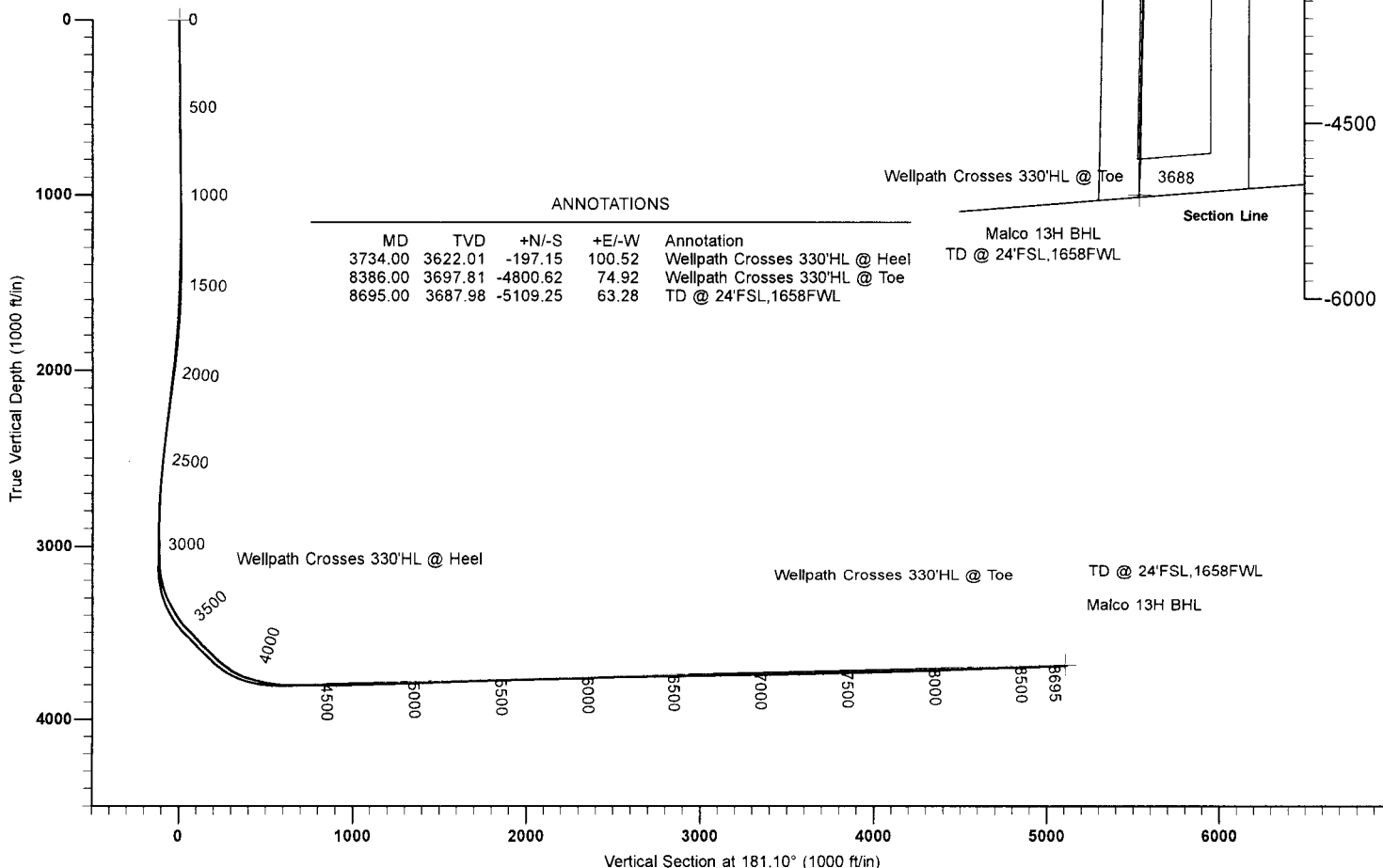
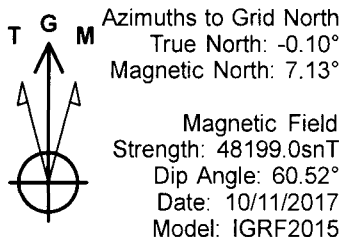
COG OPERATING, LLC

Project: Eddy /Lea County, NM (NAD27) NMEZ
 Site: Malco 23 Federal COM 13H
 Well: #13H
 Wellbore: Lateral
 Design: Lateral

3639+18 @ 3657.00ft (Planning Est)
 NAD 1927 (NADCON CONUS)



To convert a Magnetic Direction to a Grid Direction, Add 7.13°



ANNOTATIONS

MD	TVD	+N/-S	+E/-W	Annotation
3734.00	3622.01	-197.15	100.52	Wellpath Crosses 330'HL @ Heel
8386.00	3697.81	-4800.62	74.92	Wellpath Crosses 330'HL @ Toe
8695.00	3687.98	-5109.25	63.28	TD @ 24'FSL,1658FWL

Malco 13H BHL
 TD @ 24'FSL,1658FWL

Wellpath Crosses 330'HL @ Toe
 TD @ 24'FSL,1658FWL
 Malco 13H BHL

TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Shape
Malco 13H SL	0.00	0.00	0.00	664672.10	556425.90	Point
Malco 13H BHL	3687.98	-5109.25	63.28	659562.85	556489.18	Point

Design: Lateral (#13H/Lateral)
 Created By: Mekka Williams
 eSovina Well Design
 mekka@esominawell.com
 11:16, October 29 2017

VON DIRECTIONAL
 12074 FM 3083 Conroe, Texas 77301
 936-756-2400

