

COG OPERATING, LLC

Eddy /Lea County, NM (NAD27) NMEZ

Nelson Federal COM 23H

23H - Slot 23H - SL 2188'FSL, 1895'FWL Sec 15

PP - 2930'FSL, 1700'FWL, Sec 15

Lateral

PLANNED BHL 220'FNL, 1700'FWL Sec10

Platted BHL 330'FNL, 1650'FWL Sec10

ACTUAL BHL 221'FNL, 1676'FWL Sec10

HOBBS OCD
OCT 20 2017
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Survey Report



Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Nelson Federal COM 23H
Well: 23H
Wellbore: Lateral
Design: Lateral PLANNED BHL 352'FWL, 220'FNL

Local Co-ordinate Reference: Well 23H - Slot 23H
TVD Reference: 4044+18 @ 4065.00ft (Patriot 6)
MD Reference: 4044+18 @ 4065.00ft (Patriot 6)
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)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site	Nelson Federal COM 23H, 2188 FSL, 1895'FWL Sec15		
Site Position:		Northing: 667,330.20 ft	Latitude: 32° 49' 59.673 N
From: Map		Easting: 677,279.30 ft	Longitude: 103° 45' 22.259 W
Position Uncertainty:	0.00 ft	Slot Radius: 13.20 in	Grid Convergence: 0.31 °

Well	23H - Slot 23H		
Well Position	+N/-S 0.00 ft	Northing: 667,330.20 ft	Latitude: 32° 49' 59.673 N
	+E/-W 0.00 ft	Easting: 677,279.30 ft	Longitude: 103° 45' 22.259 W
Position Uncertainty	0.00 ft	Wellhead Elevation: 0.00 ft	Ground Level: 4,044.00 ft

Wellbore	Lateral				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	05/19/17	7.09	60.59	48,283

Design	Lateral PLANNED BHL 352'FWL, 220'FNL			
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	358.10

Survey Program	Date 06/13/17			
From (ft)	To (ft)	Survey (Wellbore)	Tool Name	Description
100.00	2,250.00	Survey #1 (Lateral)	GYD_DP_MS	Gyrodatta gyro-compassing and drop
2,387.00	14,090.00	Survey #2 (Lateral)	MWD	MWD v3: standard declination
14,145.00	14,145.00	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
Nelson FedCom 23H SL									
100.00	0.55	126.58	100.00	-0.29	0.39	-0.30	0.55	0.55	0.00
200.00	0.49	90.78	199.99	-0.58	1.20	-0.62	0.32	-0.06	-35.80
300.00	0.25	90.08	299.99	-0.58	1.84	-0.64	0.24	-0.24	-0.70
400.00	0.31	104.63	399.99	-0.65	2.32	-0.73	0.09	0.06	14.55
500.00	0.24	83.60	499.99	-0.70	2.79	-0.79	0.12	-0.07	-21.03
600.00	0.32	69.69	599.99	-0.58	3.26	-0.69	0.10	0.08	-13.91
700.00	0.26	56.08	699.99	-0.35	3.71	-0.48	0.09	-0.06	-13.61

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800.00	0.11	95.05	799.99	-0.24	4.00	-0.37	0.19	-0.15	38.97
900.00	0.33	181.96	899.99	-0.53	4.08	-0.67	0.34	0.22	86.91
1,000.00	0.40	188.17	999.98	-1.17	4.02	-1.30	0.08	0.07	6.21
1,100.00	0.54	203.25	1,099.98	-1.94	3.79	-2.07	0.19	0.14	15.08
1,200.00	0.49	218.36	1,199.98	-2.71	3.34	-2.82	0.14	-0.05	15.11
1,300.00	0.47	225.28	1,299.97	-3.34	2.78	-3.43	0.06	-0.02	6.92
1,400.00	0.34	226.13	1,399.97	-3.83	2.28	-3.90	0.13	-0.13	0.85
1,500.00	0.13	65.49	1,499.97	-3.99	2.16	-4.06	0.46	-0.21	-160.64
1,600.00	0.33	117.73	1,599.97	-4.08	2.52	-4.16	0.27	0.20	52.24
1,700.00	0.87	54.58	1,699.96	-3.77	3.40	-3.88	0.78	0.54	-63.15
1,800.00	1.12	72.26	1,799.95	-3.03	4.95	-3.19	0.39	0.25	17.68
1,900.00	1.19	60.20	1,899.93	-2.22	6.78	-2.44	0.25	0.07	-12.06
2,000.00	1.35	66.46	1,999.91	-1.23	8.76	-1.52	0.21	0.16	6.26
2,100.00	1.32	64.89	2,099.88	-0.27	10.88	-0.63	0.05	-0.03	-1.57
2,200.00	1.34	77.62	2,199.85	0.47	13.07	0.03	0.30	0.02	12.73
2,250.00	1.28	78.45	2,249.84	0.70	14.18	0.23	0.13	-0.12	1.66
2,387.00	1.51	89.60	2,386.80	1.02	17.49	0.44	0.26	0.17	8.14
2,481.00	0.88	67.84	2,480.78	1.30	19.40	0.66	0.81	-0.67	-23.15
2,575.00	2.24	326.22	2,574.75	3.10	19.04	2.47	2.73	1.45	-108.11
2,669.00	2.03	319.87	2,668.69	5.90	16.95	5.34	0.34	-0.22	-6.76
2,764.00	2.88	301.06	2,763.60	8.42	13.82	7.96	1.22	0.89	-19.80
2,859.00	4.20	289.39	2,858.42	10.81	8.49	10.52	1.58	1.39	-12.28
2,953.00	3.69	291.52	2,952.19	13.06	2.43	12.97	0.56	-0.54	2.27
3,047.00	4.23	287.58	3,045.97	15.22	-3.69	15.33	0.64	0.57	-4.19
3,141.00	4.81	287.04	3,139.68	17.42	-10.76	17.77	0.62	0.62	-0.57
3,236.00	3.89	285.02	3,234.40	19.42	-17.68	20.00	0.98	-0.97	-2.13
3,330.00	4.53	290.22	3,328.15	21.53	-24.24	22.32	0.79	0.68	5.53
3,424.00	4.98	278.82	3,421.83	23.44	-31.76	24.48	1.11	0.48	-12.13
3,519.00	5.89	287.71	3,516.40	25.55	-40.48	26.88	1.30	0.96	9.36
3,613.00	5.00	286.36	3,609.98	28.18	-49.00	29.78	0.96	-0.95	-1.44
3,707.00	6.10	293.46	3,703.53	31.32	-57.51	33.21	1.38	1.17	7.55
3,802.00	5.79	291.89	3,798.02	35.11	-66.59	37.30	0.37	-0.33	-1.65
3,896.00	5.73	293.27	3,891.55	38.74	-75.30	41.21	0.16	-0.06	1.47
3,991.00	5.34	289.55	3,986.11	42.09	-83.82	44.84	0.56	-0.41	-3.92
4,086.00	5.32	291.19	4,080.70	45.16	-92.10	48.19	0.16	-0.02	1.73
4,180.00	4.93	291.79	4,174.32	48.23	-99.91	51.52	0.42	-0.41	0.64
4,276.00	5.07	292.31	4,269.95	51.38	-107.66	54.92	0.15	0.15	0.54
4,370.00	4.83	293.50	4,363.60	54.53	-115.14	58.32	0.28	-0.26	1.27
4,465.00	4.88	295.97	4,458.26	57.89	-122.44	61.92	0.23	0.05	2.80
4,560.00	4.69	294.72	4,552.93	61.29	-129.60	65.55	0.23	-0.20	-1.32
4,654.00	4.51	294.11	4,646.63	64.40	-136.46	68.89	0.20	-0.19	-0.65
4,749.00	4.79	296.93	4,741.32	67.73	-143.41	72.44	0.38	0.29	2.97
4,841.00	4.14	286.83	4,833.04	70.43	-150.01	75.36	1.11	-0.71	-10.98

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Survey

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4,936.00	4.02	288.28	4,927.80	72.47	-156.45	77.61	0.17	-0.13	1.53
5,031.00	4.00	290.58	5,022.57	74.67	-162.72	80.03	0.17	-0.02	2.42
5,125.00	4.02	291.46	5,116.33	77.03	-168.85	82.59	0.07	0.02	0.94
5,219.00	3.93	291.52	5,210.11	79.42	-174.92	85.18	0.10	-0.10	0.06
5,313.00	4.07	294.51	5,303.88	81.99	-180.95	87.94	0.27	0.15	3.18
5,408.00	3.30	288.07	5,398.68	84.23	-186.62	90.37	0.92	-0.81	-6.78
5,504.00	1.86	287.49	5,494.58	85.56	-190.73	91.83	1.50	-1.50	-0.60
5,598.00	0.27	259.29	5,588.56	85.97	-192.40	92.31	1.73	-1.69	-30.00
5,623.87	0.20	282.24	5,614.44	85.97	-192.51	92.31	0.45	-0.27	88.70
Nelson FedCom 23H Tgt p3									
5,640.88	0.18	304.59	5,631.44	85.99	-192.56	92.33	0.45	-0.11	131.43
Nelson FedCom 23H Tgt									
5,693.00	0.29	358.14	5,683.56	86.17	-192.63	92.51	0.45	0.21	102.75
5,724.00	2.16	358.73	5,714.56	86.84	-192.67	93.18	6.03	6.03	-4.55
5,756.00	4.60	3.65	5,746.50	88.72	-192.62	95.06	7.72	7.63	21.63
5,788.00	7.50	6.08	5,778.32	92.08	-192.32	98.40	9.10	9.06	7.59
5,819.00	10.98	5.98	5,808.91	97.03	-191.79	103.33	11.23	11.23	-0.32
5,851.00	13.90	5.09	5,840.15	103.89	-191.13	110.17	9.14	9.13	-2.78
5,883.00	17.28	2.75	5,870.97	112.46	-190.57	118.72	10.74	10.56	-7.31
5,915.00	20.73	0.45	5,901.22	122.88	-190.29	129.12	11.03	10.78	-7.19
5,946.00	23.94	358.66	5,929.90	134.66	-190.40	140.89	10.58	10.35	-5.77
5,978.00	27.55	357.10	5,958.71	148.54	-190.92	154.79	11.48	11.28	-4.88
6,010.00	31.21	358.33	5,986.59	164.21	-191.83	170.48	11.50	11.44	-2.41
6,041.00	34.56	357.18	6,012.62	181.01	-192.78	187.31	10.91	10.81	2.74
6,073.00	37.72	358.57	6,038.46	199.87	-193.47	206.18	10.20	9.88	4.34
6,105.00	40.09	359.69	6,063.36	219.96	-193.77	226.27	7.73	7.41	3.50
6,135.00	43.68	0.36	6,085.69	239.99	-193.75	246.28	12.06	11.97	2.23
6,167.00	45.17	0.39	6,108.55	262.39	-193.61	268.66	4.66	4.66	0.09
6,199.00	45.67	0.37	6,131.01	285.18	-193.46	291.44	1.56	1.56	-0.06
6,231.00	46.03	0.41	6,153.30	308.14	-193.30	314.38	1.13	1.13	0.13
6,262.00	46.32	0.33	6,174.76	330.50	-193.16	336.73	0.95	0.94	-0.26
6,293.00	46.58	0.26	6,196.12	352.97	-193.04	359.18	0.85	0.84	-0.23
6,324.00	46.91	0.29	6,217.36	375.55	-192.93	381.74	1.07	1.06	0.10
6,356.00	47.93	0.12	6,239.02	399.11	-192.85	405.29	3.21	3.19	-0.53
6,388.00	50.85	359.07	6,259.84	423.40	-193.02	429.57	9.46	9.13	-3.28
6,420.00	51.91	359.02	6,279.82	448.40	-193.44	454.57	3.31	3.31	-0.16
6,451.00	53.44	358.62	6,298.61	473.04	-193.95	479.21	5.04	4.94	-1.29
6,483.00	57.17	358.92	6,316.82	499.34	-194.51	505.52	11.68	11.66	0.94
6,514.00	62.16	359.77	6,332.48	526.09	-194.81	532.26	16.27	16.10	2.74
6,546.00	67.35	0.39	6,346.12	555.02	-194.77	561.17	16.31	16.22	1.94
6,578.00	72.60	0.54	6,357.07	585.08	-194.52	591.20	16.41	16.41	0.47
6,610.00	77.92	0.12	6,365.21	616.01	-194.35	622.12	16.67	16.63	-1.31
6,641.00	81.46	0.50	6,370.76	646.50	-194.18	652.59	11.48	11.42	1.23
6,672.00	86.34	0.07	6,374.05	677.32	-194.03	683.38	15.80	15.74	-1.39

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6,704.00	88.43	0.08	6,375.51	709.28	-193.99	715.33	6.53	6.53	0.03
6,736.95	89.05	359.21	6,376.24	742.22	-194.19	748.25	3.23	1.87	-2.63
Nelson FedCom 23H LP p3									
6,742.00	89.14	359.08	6,376.32	747.27	-194.27	753.30	3.23	1.87	-2.63
6,777.58	89.32	359.08	6,376.80	782.85	-194.84	788.88	0.49	0.49	0.01
Nelson FedCom 23H LP p1									
6,837.00	89.61	359.09	6,377.35	842.26	-195.78	848.28	0.49	0.49	0.01
6,932.00	89.29	359.74	6,378.27	937.25	-196.75	943.25	0.76	-0.34	0.68
7,027.00	88.83	0.05	6,379.82	1,032.23	-196.93	1,038.19	0.58	-0.48	0.33
7,122.00	89.94	359.70	6,380.84	1,127.23	-197.13	1,133.14	1.23	1.17	-0.37
7,218.00	91.05	359.37	6,380.01	1,223.22	-197.91	1,229.11	1.21	1.16	-0.34
7,312.00	91.00	358.38	6,378.33	1,317.18	-199.76	1,323.08	1.05	-0.05	-1.05
7,408.00	91.09	359.05	6,376.58	1,413.14	-201.91	1,419.06	0.70	0.09	0.70
7,502.00	90.99	359.96	6,374.88	1,507.12	-202.72	1,513.01	0.97	-0.11	0.97
7,597.00	91.24	359.23	6,373.03	1,602.10	-203.39	1,607.96	0.81	0.26	-0.77
7,692.00	91.59	358.74	6,370.68	1,697.06	-205.08	1,702.92	0.63	0.37	-0.52
7,787.00	90.62	358.57	6,368.85	1,792.01	-207.31	1,797.90	1.04	-1.02	-0.18
7,882.00	89.11	0.20	6,369.07	1,887.00	-208.33	1,892.87	2.34	-1.59	1.72
7,977.00	89.76	0.68	6,370.01	1,981.99	-207.60	1,987.79	0.85	0.68	0.51
8,073.00	88.98	359.00	6,371.07	2,077.98	-207.86	2,083.73	1.93	-0.81	-1.75
8,167.00	89.19	359.96	6,372.57	2,171.96	-208.72	2,177.69	1.05	0.22	1.02
8,263.00	89.97	359.53	6,373.27	2,267.96	-209.14	2,273.65	0.93	0.81	-0.45
8,358.00	90.19	0.16	6,373.14	2,362.96	-209.40	2,368.60	0.70	0.23	0.66
8,453.00	89.87	359.85	6,373.09	2,457.96	-209.39	2,463.55	0.47	-0.34	-0.33
8,548.00	89.20	359.64	6,373.86	2,552.95	-209.82	2,558.51	0.74	-0.71	-0.22
8,643.00	89.49	358.65	6,374.94	2,647.94	-211.23	2,653.48	1.09	0.31	-1.04
8,738.00	89.51	358.23	6,375.77	2,742.90	-213.82	2,748.48	0.44	0.02	-0.44
8,833.00	89.99	358.51	6,376.19	2,837.86	-216.52	2,843.48	0.58	0.51	0.29
8,928.00	90.19	359.64	6,376.04	2,932.84	-218.06	2,938.46	1.21	0.21	1.19
9,024.00	90.46	359.77	6,375.49	3,028.84	-218.55	3,034.42	0.31	0.28	0.14
9,119.00	90.82	359.36	6,374.43	3,123.83	-219.27	3,129.38	0.57	0.38	-0.43
9,214.00	90.92	0.45	6,372.99	3,218.82	-219.43	3,224.32	1.15	0.11	1.15
9,309.00	90.40	359.56	6,371.90	3,313.81	-219.42	3,319.26	1.08	-0.55	-0.94
9,408.00	90.90	359.42	6,370.77	3,412.80	-220.30	3,418.23	0.52	0.51	-0.14
9,502.00	89.77	359.29	6,370.22	3,506.79	-221.36	3,512.20	1.21	-1.20	-0.14
9,597.00	89.39	1.04	6,370.92	3,601.78	-221.09	3,607.13	1.88	-0.40	1.84
9,691.00	88.50	359.54	6,372.65	3,695.76	-220.61	3,701.05	1.86	-0.95	-1.60
9,786.00	88.37	358.96	6,375.25	3,790.72	-221.85	3,795.99	0.63	-0.14	-0.61
9,814.00	88.90	359.17	6,375.91	3,818.71	-222.31	3,823.98	2.04	1.89	0.75
9,908.00	90.15	359.19	6,376.69	3,912.69	-223.66	3,917.96	1.33	1.33	0.02
10,001.00	90.48	357.80	6,376.18	4,005.66	-226.10	4,010.95	1.54	0.35	-1.49
10,095.00	90.98	357.47	6,374.98	4,099.57	-229.98	4,104.94	0.64	0.53	-0.35
10,190.00	90.33	359.91	6,373.90	4,194.53	-232.15	4,199.92	2.66	-0.68	2.57
10,283.00	91.03	0.36	6,372.79	4,287.52	-231.93	4,292.86	0.89	0.75	0.48

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Nelson Federal COM 23H
Well: 23H
Wellbore: Lateral
Design: Lateral PLANNED BHL 352'FWL, 220'FNL

Local Co-ordinate Reference: Well 23H - Slot 23H
TVD Reference: 4044+18 @ 4065.00ft (Patriot 6)
MD Reference: 4044+18 @ 4065.00ft (Patriot 6)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
10,378.00	90.58	1.33	6,371.46	4,382.50	-230.53	4,387.74	1.13	-0.47	1.02
10,472.00	89.06	357.76	6,371.75	4,476.48	-231.27	4,481.69	4.13	-1.62	-3.80
10,567.00	89.60	358.36	6,372.86	4,571.42	-234.49	4,576.68	0.85	0.57	0.63
10,660.00	90.06	358.64	6,373.14	4,664.39	-236.92	4,669.68	0.58	0.49	0.30
10,755.00	90.47	359.29	6,372.70	4,759.37	-238.64	4,764.66	0.81	0.43	0.68
10,850.00	90.76	359.72	6,371.68	4,854.36	-239.46	4,859.63	0.55	0.31	0.45
10,944.00	89.03	359.59	6,371.85	4,948.35	-240.03	4,953.59	1.85	-1.84	-0.14
11,039.00	89.54	0.13	6,373.04	5,043.35	-240.26	5,048.54	0.78	0.54	0.57
11,133.00	89.75	359.98	6,373.62	5,137.34	-240.17	5,142.48	0.27	0.22	-0.16
11,227.00	90.27	0.44	6,373.61	5,231.34	-239.82	5,236.42	0.74	0.55	0.49
11,322.00	90.41	0.77	6,373.04	5,326.34	-238.82	5,331.33	0.38	0.15	0.35
11,417.00	89.95	359.73	6,372.74	5,421.33	-238.41	5,426.26	1.20	-0.48	-1.09
11,512.00	88.92	358.32	6,373.68	5,516.31	-240.02	5,521.24	1.84	-1.08	-1.48
11,607.00	88.89	358.46	6,375.50	5,611.26	-242.69	5,616.22	0.15	-0.03	0.15
11,702.00	89.05	358.41	6,377.20	5,706.21	-245.29	5,711.20	0.18	0.17	-0.05
11,797.00	89.32	358.16	6,378.55	5,801.15	-248.13	5,806.19	0.39	0.28	-0.26
11,890.00	89.67	358.61	6,379.37	5,894.11	-250.75	5,899.18	0.61	0.38	0.48
11,984.00	89.68	358.59	6,379.91	5,988.08	-253.05	5,993.18	0.02	0.01	-0.02
12,078.00	90.03	358.75	6,380.15	6,082.06	-255.23	6,087.17	0.41	0.37	0.17
12,173.00	90.99	359.45	6,379.30	6,177.04	-256.72	6,182.15	1.25	1.01	0.74
12,268.00	91.22	359.97	6,377.47	6,272.02	-257.20	6,277.10	0.60	0.24	0.55
12,362.00	90.27	0.33	6,376.25	6,366.01	-256.95	6,371.03	1.08	-1.01	0.38
12,456.00	90.86	359.91	6,375.32	6,460.01	-256.76	6,464.97	0.77	0.63	-0.45
12,549.00	91.08	0.14	6,373.74	6,552.99	-256.72	6,557.90	0.34	0.24	0.25
12,643.00	89.51	359.30	6,373.26	6,646.99	-257.18	6,651.86	1.89	-1.67	-0.89
12,737.00	89.63	0.11	6,373.97	6,740.98	-257.66	6,745.82	0.87	0.13	0.86
12,831.00	89.55	359.23	6,374.64	6,834.98	-258.20	6,839.78	0.94	-0.09	-0.94
12,924.00	89.62	359.16	6,375.31	6,927.96	-259.51	6,932.76	0.11	0.08	-0.08
13,019.00	89.92	359.41	6,375.69	7,022.96	-260.69	7,027.74	0.41	0.32	0.26
13,113.00	89.92	359.51	6,375.82	7,116.95	-261.58	7,121.71	0.11	0.00	0.11
13,208.00	90.07	359.52	6,375.83	7,211.95	-262.38	7,216.68	0.16	0.16	0.01
13,301.00	90.07	359.72	6,375.72	7,304.95	-263.00	7,309.65	0.22	0.00	0.22
13,395.00	90.05	359.63	6,375.62	7,398.94	-263.53	7,403.61	0.10	-0.02	-0.10
13,489.00	90.54	359.90	6,375.14	7,492.94	-263.92	7,497.57	0.60	0.52	0.29
13,584.00	90.90	0.23	6,373.94	7,587.93	-263.81	7,592.51	0.51	0.38	0.35
13,676.00	89.58	359.46	6,373.56	7,679.93	-264.06	7,684.46	1.66	-1.43	-0.84
13,770.00	89.74	359.63	6,374.12	7,773.93	-264.81	7,778.43	0.25	0.17	0.18
13,864.00	89.99	359.54	6,374.34	7,867.92	-265.49	7,872.40	0.28	0.27	-0.10
13,953.00	90.38	0.18	6,374.05	7,956.92	-265.71	7,961.36	0.84	0.44	0.72
13,985.00	90.38	0.36	6,373.84	7,988.92	-265.55	7,993.33	0.56	0.00	0.56
14,036.00	91.18	0.63	6,373.14	8,039.91	-265.11	8,044.28	1.66	1.57	0.53
Wellpath Crosses 330°HL @ Toe									
14,079.00	91.86	0.86	6,372.00	8,082.89	-264.55	8,087.22	1.66	1.57	0.53

Company: COG OPERATING, LLC
Project: Eddy /Lea County, NM (NAD27) NMEZ
Site: Nelson Federal COM 23H
Well: 23H
Wellbore: Lateral
Design: Lateral PLANNED BHL 352'FWL, 220'FNL

Local Co-ordinate Reference: Well 23H - Slot 23H
TVD Reference: 4044+18 @ 4065.00ft (Patriot 6)
MD Reference: 4044+18 @ 4065.00ft (Patriot 6)
North Reference: Grid
Survey Calculation Method: Minimum Curvature
Database: VON_EDM

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)
14,090.00	92.17	0.84	6,371.61	8,093.89	-264.39	8,098.20	2.82	2.82	-0.18
14,145.00	92.17	0.84	6,369.53	8,148.84	-263.59	8,153.10	0.00	0.00	0.00

TD @ 221'FNL, 1676'FWL - Nelson FedCom 23H BHL - Nelson FedCom 23H PBHL

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Northing (ft)	Easting (ft)	Latitude	Longitude
- hit/miss target									
- Shape									
Nelson FedCom 23H SL	0.00	0.00	0.00	0.00	0.00	667,330.20	677,279.30	32° 49' 59.673 N	103° 45' 22.259 W
- actual wellpath hits target center									
- Point									
Nelson FedCom 23H BL	0.00	0.00	6,369.53	8,148.84	-263.59	675,479.04	677,015.71	32° 51' 20.319 N	103° 45' 24.827 W
- actual wellpath hits target center									
- Point									

Design Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates	Comment
		+N/-S (ft)	+E/-W (ft)
14,036.00	6,373.14	8,039.91	-265.11
14,145.00	6,369.53	8,148.84	-263.59

Wellpath Crosses 330'HL @ Toe
 TD @ 221'FNL, 1676'FWL

Checked By: _____ Approved By: _____ Date: _____

COG OPERATING, LLC

Project: Eddy /Lea County, NM (NAD27) NMEZ
 Site: Nelson Federal COM 23H
 Well: 23H
 Wellbore: Lateral
 Design: Lateral PLANNED BHL 352'FWL, 220'FNL

4044+18 @ 4065.00ft (Patriot 6)
 NAD 1927 (NADCON CONUS)

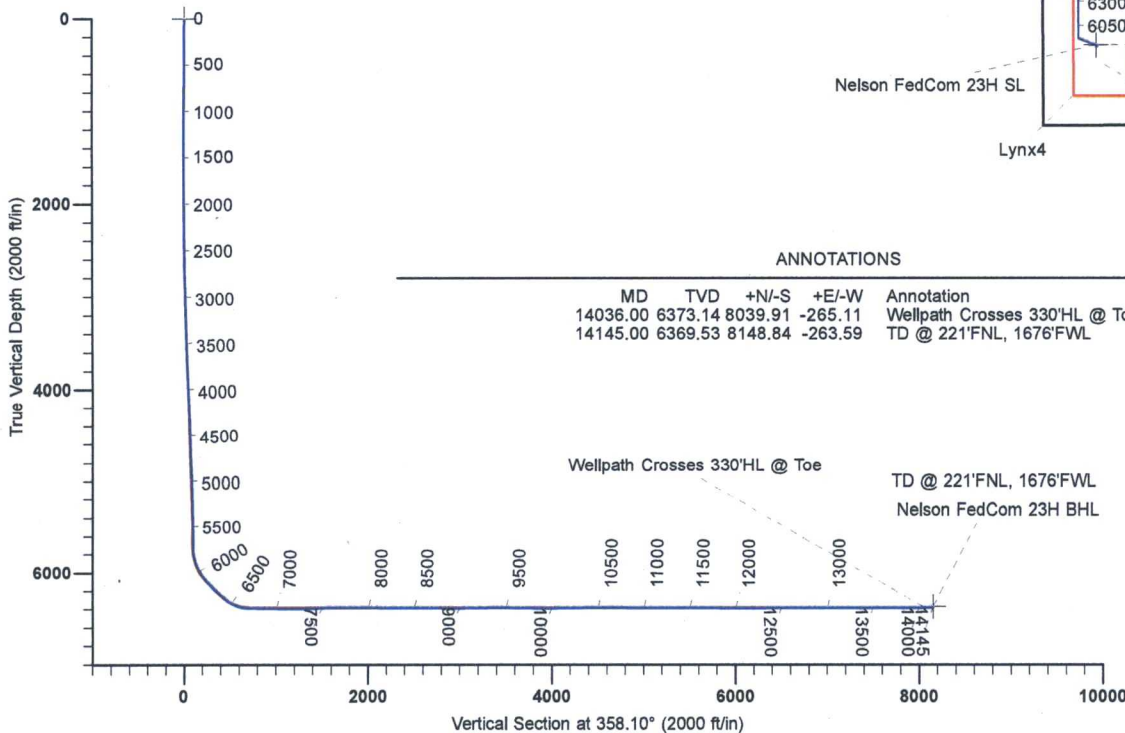
West(-)/East(+) (2000 ft/in)



Azimuths to Grid North
 True North: -0.31°
 Magnetic North: 6.78°

Magnetic Field
 Strength: 48283.4snT
 Dip Angle: 60.59°
 Date: 05/19/2017
 Model: IGRF2015

To convert a Magnetic Direction to a Grid Direction, Add 6.78°



ANNOTATIONS

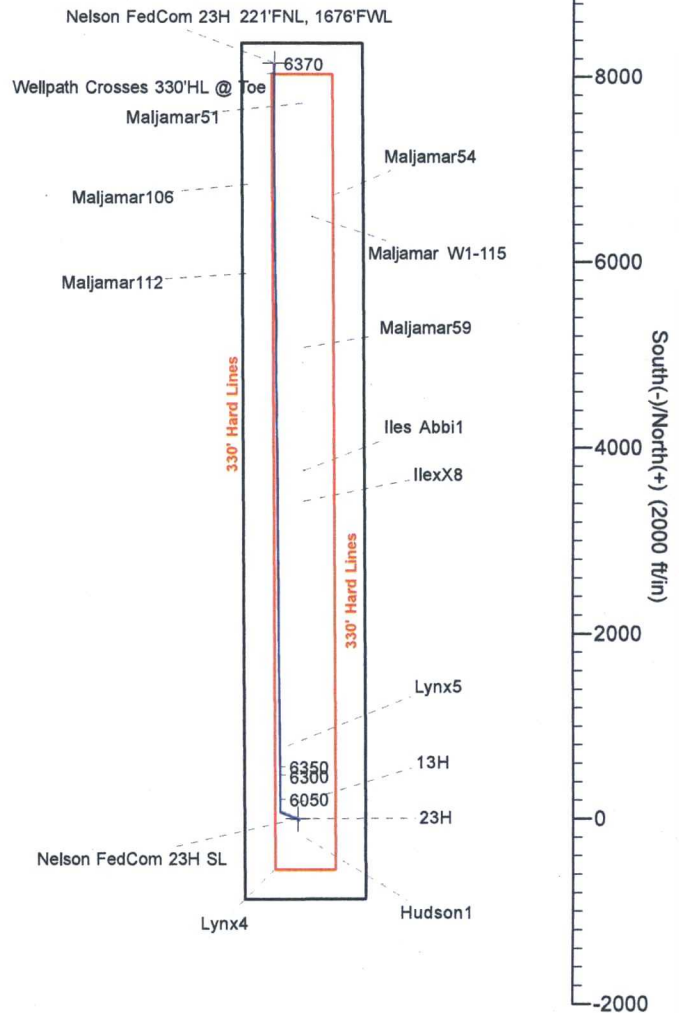
MD	TVD	+N/-S	+E/-W	Annotation
14036.00	6373.14	8039.91	-265.11	Wellpath Crosses 330°HL @ Toe
14145.00	6369.53	8148.84	-263.59	TD @ 221°FNL, 1676'FWL

Wellpath Crosses 330°HL @ Toe

TD @ 221°FNL, 1676'FWL
 Nelson FedCom 23H BHL

TARGET DETAILS

Name	TVD	+N/-S	+E/-W	Northing	Easting	Shape
Nelson FedCom 23H SL	0.00	0.00	0.00	667330.20	677279.30	Point
Nelson FedCom 23H BHL	6369.53	8148.84	-263.59	675479.04	677015.71	Point



Design: Lateral PLANNED BHL 352'FWL, 220'FNL (23H/Lateral)
 Created By: Mekka Williams
 eSomina Well Design
 mekka@esominawell.com
 7:02, June 13 2017

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



May 31, 2017

Concho Resources, Inc.
One Concho Center
600 W. Illinois Avenue
Midland, Texas 79701

Attn: Kanicia Castillo

RE: **Nelson Federal Com No. 023H**

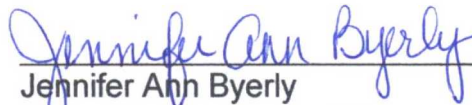
Please find enclosed a copy of the survey from 0' to 2250' ran on the above referenced well.

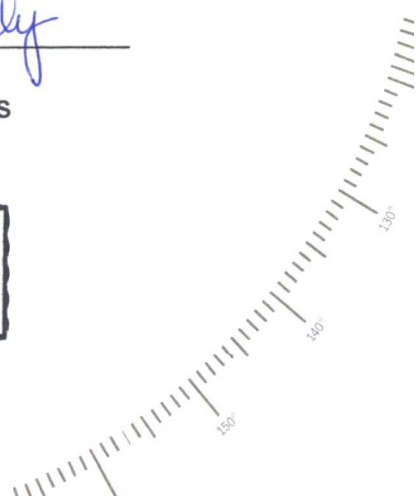
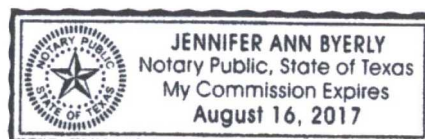
Sincerely,

Keith Havelka
Operations

STATE OF TEXAS §
 §
COUNTY OF NUECES §

This instrument was acknowledged before me on the 31st day of May,
A.D., 2017, by Keith Havelka.


Jennifer Ann Byerly
Notary Public, State of Texas



Company: COG OPERATING
Lease/Well: NELSON FEDERAL COM No./023H



Rig Name: PATRIOT 6
State/County: NEW MEXICO/LEA
VS-Azi: 359.45 Degrees
Latitude: 32.83337, Longitude: -103.75668
Grid North = True North -0.31 degs (NAD 27)
Grid Correction Applied = -0.31 degs



Depth Reference : RKB=18 FEET

DRILLOG HA GYRO SURVEY CALCULATIONS

Filename: e-line gyro-de_01.ut
Minimum Curvature Method
Report Date/Time: 5/31/2017 / 16:10

VES Survey International
Midland, Texas
432-563-5444

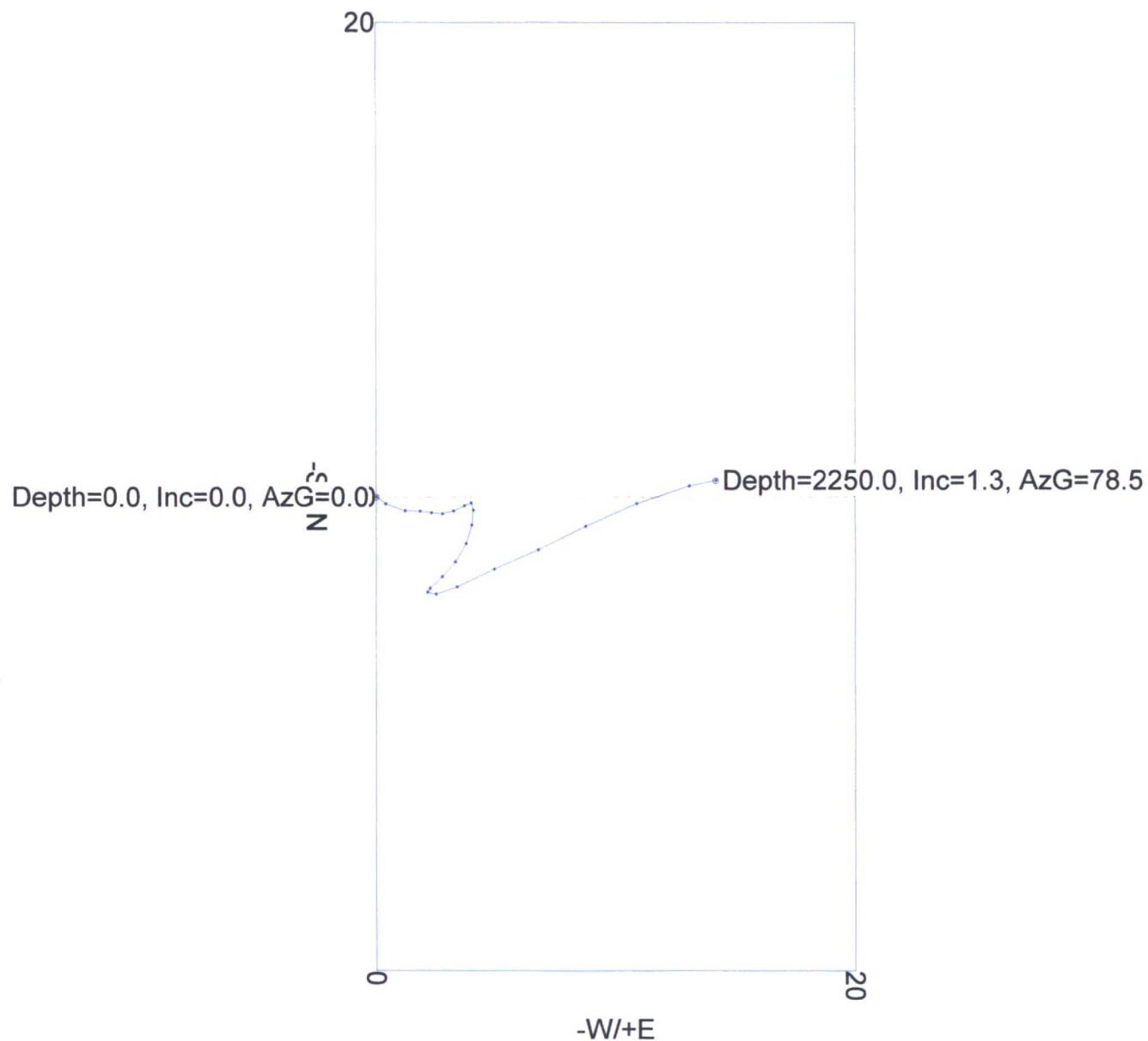
Surveyor: Michael Cook
Nelson Federal Com No. 023H / API 30-025-43706

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
100.00	0.55	126.58	100.00	-0.29	0.39	-0.29	0.48	126.58	0.55
200.00	0.49	90.78	199.99	-0.58	1.20	-0.59	1.33	115.84	0.33
300.00	0.25	90.08	299.99	-0.59	1.84	-0.60	1.93	107.69	0.24
400.00	0.31	104.63	399.99	-0.65	2.31	-0.68	2.41	105.79	0.09
500.00	0.24	83.60	499.99	-0.70	2.78	-0.73	2.87	104.12	0.12
600.00	0.32	69.69	599.99	-0.58	3.24	-0.61	3.30	100.13	0.10
700.00	0.26	56.08	699.99	-0.36	3.69	-0.39	3.71	95.54	0.09
800.00	0.11	95.05	799.99	-0.24	3.98	-0.28	3.98	93.46	0.18
900.00	0.33	181.96	899.99	-0.54	4.07	-0.58	4.10	97.55	0.34
1000.00	0.40	188.17	999.98	-1.17	4.01	-1.21	4.17	106.32	0.08
1100.00	0.54	203.25	1099.98	-1.95	3.77	-1.99	4.25	117.41	0.19
1200.00	0.49	218.36	1199.98	-2.73	3.32	-2.76	4.29	129.44	0.15
1300.00	0.47	225.28	1299.97	-3.35	2.76	-3.38	4.34	140.50	0.06
1400.00	0.34	226.13	1399.97	-3.84	2.26	-3.86	4.46	149.54	0.13
1500.00	0.13	65.49	1499.97	-4.00	2.15	-4.02	4.54	151.72	0.47
1600.00	0.33	117.73	1599.97	-4.08	2.51	-4.11	4.79	148.41	0.27

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
1700.00	0.87	54.58	1699.96	-3.77	3.38	-3.81	5.07	138.11	0.78
1800.00	1.12	72.26	1799.95	-3.03	4.93	-3.08	5.79	121.59	0.39
1900.00	1.19	60.20	1899.93	-2.22	6.76	-2.29	7.12	108.18	0.25
2000.00	1.35	66.46	1999.91	-1.23	8.75	-1.32	8.84	98.01	0.21
2100.00	1.32	64.89	2099.88	-0.27	10.88	-0.37	10.88	91.42	0.05
2200.00	1.34	77.62	2199.85	0.47	13.07	0.35	13.07	87.94	0.30
2250.00	1.28	78.45	2249.84	0.71	14.18	0.57	14.20	87.14	0.13



VES Survey International
Midland, Texas
432-563-5444
Surveyor: Michael Cook
Nelson Federal Com No. 023H / API 30-025-43706



V.E.S. Survey Date: 5/25/2017



I Michael Cook certify that I am employed by VES Survey International. That I did on the day(s) of 05/25/17 through 05/25/17 conduct or supervise the taking of a Rate Gyro survey from a depth of 0.00 feet to a depth of 2,250.00 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Vaughn Energy Services, that I am authorized and qualified to make this report; that this survey was conducted at the request of COG Operating for the Nelson Federal Com Well # 023H API # 30-025-43706 in Lea County / Parish New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by VES Survey International.



Michael Cook
Service Technician
VES Survey International



I Michael Cook certify that I am employed by VES Survey International. That I did on the day(s) of 05/25/17 through 05/25/17 conduct or supervise the taking of a Rate Gyro survey from a depth of 0.00 feet to a depth of 2,250.00 feet; that the data is true, correct, complete and within the limitations of the tool as set forth by Vaughn Energy Services, that I am authorized and qualified to make this report; that this survey was conducted at the request of COG Operating for the Nelson Federal Com Well # 023H API # 30-025-43706 in Lea County / Parish New Mexico; and that I have reviewed this report and find that it conforms to the principles and procedures as set forth by VES Survey International.

A handwritten signature in blue ink, appearing to read "M. COOK", is written over a horizontal line.

Michael Cook
Service Technician
VES Survey International

SITE FACILITY DIAGRAM

NELSON FEDERAL 23H BATTERY

SECT 15, T17S, R32E

LEASE NO. NM0054687

WELLS:

NELSON FEDERAL COM 13H - 30-025-43705

NELSON FEDERAL COM 23H - 30-025-43706

NELSON FEDERAL COM 14H - NOT DRILLED

NELSON FEDERAL COM 24H - NOT DRILLED

Production Phase

Oil Tank #1:

- Open Valves: 1, 5, 6, 7

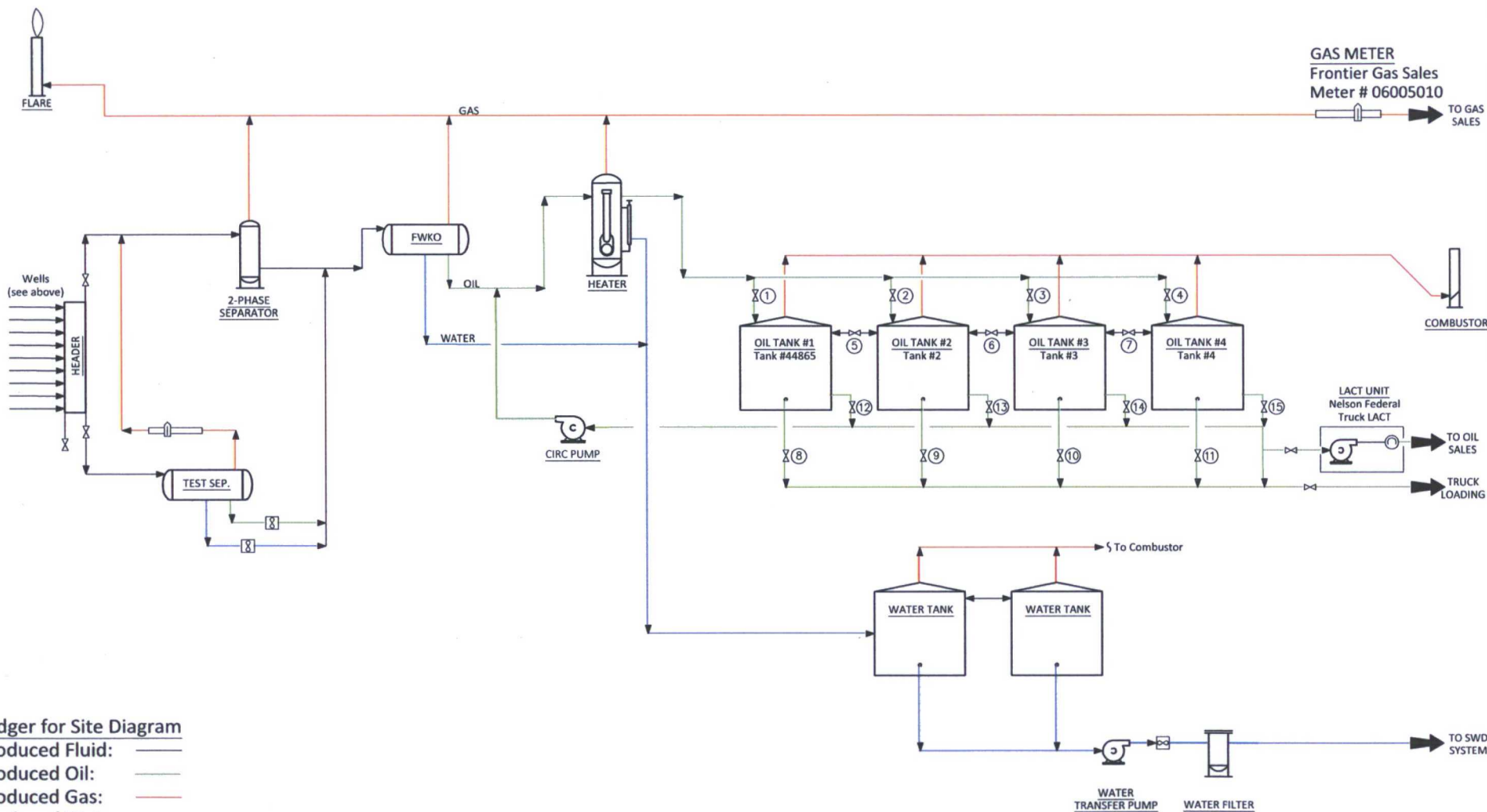
- Closed Valves: 2, 3, 4, 8, 9, 10, 12, 13, 14, 15

Sales Phase

Oil Tank #1:

- Open Valves: 2, 6, 7, 8

- Closed Valves: 1, 3, 4, 5, 9, 10, 12, 13, 14, 15



Ledger for Site Diagram

Produced Fluid: —

Produced Oil: —

Produced Gas: —

Produced Water: —



Location of Site Security Plan:

COG Operating, LLC.

600 W. Illinois

Midland, TX 79701

DATE	BY	REVISION DESCRIPTION

SITE FACILITY DIAGRAM

Nelson Federal Com 23H Battery

Lea County, NM