

Results of Directional Survey

API number:	30-025-41414		
OGRID:		Operator:	COG PRODUCTION, LLC
		Property:	WINDWARD FEDERAL # 1H

surface	ULSTR:	D	30	T 24S	R 32E
				190 FNL	430 FWL ✓

BH Loc	ULSTR:	M	30	T 24S	R 32E
14872	MD	10507.4	TVD	342 FSL	412 FWL ✓
4938 FNL					

Top Perf/OH	ULSTR:	D	30	T 24S	R 32E
10563	MD	10378.3	TVD	636 FNL	422 FWL

Bot Perf/OH	ULSTR:	M	30	T 24S	R 32E
14743	MD	10504.9	TVD	471 FSL	414 FWL
4809 FNL					

	MD	N/S	E/W	VD
	10531.00	-415.30	-8.40	10369.10
TOP PERFS/OH	10563.00	-446.00	-8.00	10378.30
	10563.00	-446.00	-8.00	10378.30
	14735.00	-4610.80	-16.20	10504.70
BOT PERFS/OH	14743.00	-4618.80	-16.28	10504.87
	14823.00	-4698.80	-17.10	10506.60

NEXT TO LAST	14823.00	-4698.80	-17.10	10506.60
LAST READING	14872.00	-4747.80	-17.60	10507.40
TD	14872.00	-4747.80	-17.60	10507.40

Surface Location	190	FN	430	FW
Projected BHL	4938	FN	412	FW
Location of				
Top Perfs/OH	636	FN	422	FW
Bottom Perfs/OH	4809	FN	414	FW

SUMMARY of Subsurface Locations

Surface Location	D-30-24S-32E	190	FN	430	FW	Vert. Depth
Top Perfs/OH	D-30-24S-32E	636	FN	422	FW	10378.30
Bottom Perfs/OH	M-30-24S-32E	4809	FN	414	FW	10504.87
Projected TD	M-30-24S-32E	4938	FN	412	FW	10507.40

DEC 17 2014



COG Production LLC

Lea County, NM
Windward Federal
#1H

OH

Survey: MWD #1

Survey Report - Geographic

10 September, 2014

HOESOOD

DEC 12 2014

RECEIVED

AM



Wellplanning
Survey Report - Geographic

Company:	COG Production LLC	Local Co-ordinate Reference:	Well #1H
Project:	Lea County, NM	TVD Reference:	WELL @ 3569.1usft (Original Well Elev)
Site:	Windward Federal	MD Reference:	WELL @ 3569.1usft (Original Well Elev)
Well:	#1H	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	OH	Database:	EDM 5000.1 Single User Db

Project	Lea County, NM		
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	Windward Federal		
Site Position:		Northing:	435,194.10 usft
From:	Map	Easting:	690,707.10 usft
Position Uncertainty:	3.0 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 11' 41.866 N
		Longitude:	103° 43' 0.609 W
		Grid Convergence:	0.33 °

Well	#1H		
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	Easting:
Position Uncertainty	3.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 11' 41.847 N
		Longitude:	103° 43' 15.967 W
		Ground Level:	3,539.1 usft

Wellbore	OH		
Magnetics	Model Name	Sample Date	Declination (°)
	IGRF2010	8/1/2013	7.39
		Dip Angle (°)	60.08
		Field Strength (nT)	48,369

Design	OH		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.0	0.0	0.0
		Direction (°)	180.26

Survey Program	Date 9/7/2014		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
239.0	8,884.0	GYRO (OH)	MWD
8,977.0	14,872.0	MWD #1 (OH)	MWD
			Description
			MWD - Standard
			MWD - Standard

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
8,884.0	2.40	207.40	8,882.2	-23.7	14.0	435,160.91	689,401.38	32° 11' 41.612 N	103° 43' 15.806 W
8,977.0	2.00	179.40	8,975.1	-27.0	13.1	435,157.56	689,400.50	32° 11' 41.579 N	103° 43' 15.816 W
9,075.0	2.20	181.00	9,073.0	-30.6	13.1	435,153.97	689,400.49	32° 11' 41.543 N	103° 43' 15.816 W
9,168.0	2.40	195.00	9,166.0	-34.3	12.6	435,150.31	689,399.95	32° 11' 41.507 N	103° 43' 15.823 W
9,263.0	1.00	273.00	9,260.9	-36.2	11.2	435,148.43	689,398.61	32° 11' 41.488 N	103° 43' 15.839 W
9,353.0	2.10	197.40	9,350.9	-37.7	9.9	435,146.90	689,397.33	32° 11' 41.473 N	103° 43' 15.854 W
9,447.0	2.30	227.40	9,444.8	-40.6	8.0	435,143.98	689,395.43	32° 11' 41.444 N	103° 43' 15.876 W
9,541.0	2.10	227.40	9,538.8	-43.1	5.4	435,141.53	689,392.77	32° 11' 41.420 N	103° 43' 15.907 W
9,634.0	1.80	168.40	9,631.7	-45.7	4.4	435,138.95	689,391.81	32° 11' 41.395 N	103° 43' 15.918 W
9,730.0	1.80	259.40	9,727.7	-47.4	3.2	435,137.19	689,390.63	32° 11' 41.378 N	103° 43' 15.932 W
9,791.0	2.40	206.40	9,788.6	-48.7	1.7	435,135.87	689,389.12	32° 11' 41.365 N	103° 43' 15.950 W



Wellplanning

Survey Report - Geographic

Company:	COG Production LLC	Local Co-ordinate Reference:	Well #1H
Project:	Lea County, NM	TVD Reference:	WELL @ 3569.1usft (Original Well Elev)
Site:	Windward Federal	MD Reference:	WELL @ 3569.1usft (Original Well Elev)
Well:	#1H	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	OH	Database:	EDM 5000.1 Single User Db

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
9,817.0	2.50	211.90	9,814.6	-49.7	1.2	435,134.90	689,388.58	32° 11' 41.355 N	103° 43' 15.956 W
9,848.0	4.90	194.30	9,845.6	-51.6	0.5	435,133.05	689,387.90	32° 11' 41.337 N	103° 43' 15.964 W
9,879.0	8.10	191.50	9,876.4	-55.0	-0.3	435,129.62	689,387.13	32° 11' 41.303 N	103° 43' 15.973 W
9,911.0	10.20	185.90	9,907.9	-60.0	-1.0	435,124.60	689,386.39	32° 11' 41.253 N	103° 43' 15.982 W
9,942.0	10.60	179.90	9,938.4	-65.6	-1.3	435,119.01	689,386.11	32° 11' 41.198 N	103° 43' 15.986 W
9,973.0	13.40	178.90	9,968.8	-72.0	-1.2	435,112.57	689,386.19	32° 11' 41.134 N	103° 43' 15.986 W
10,005.0	15.00	180.30	9,999.8	-79.9	-1.2	435,104.72	689,386.24	32° 11' 41.057 N	103° 43' 15.986 W
10,036.0	17.90	181.30	10,029.5	-88.7	-1.3	435,095.94	689,386.11	32° 11' 40.970 N	103° 43' 15.988 W
10,067.0	20.20	181.70	10,058.8	-98.8	-1.6	435,085.83	689,385.84	32° 11' 40.870 N	103° 43' 15.991 W
10,099.0	21.80	181.70	10,088.7	-110.2	-1.9	435,074.37	689,385.50	32° 11' 40.756 N	103° 43' 15.996 W
10,130.0	24.50	183.80	10,117.2	-122.4	-2.5	435,062.20	689,384.91	32° 11' 40.636 N	103° 43' 16.004 W
10,161.0	27.30	183.10	10,145.1	-135.9	-3.3	435,048.68	689,384.09	32° 11' 40.502 N	103° 43' 16.014 W
10,192.0	29.70	183.80	10,172.3	-150.7	-4.2	435,033.92	689,383.20	32° 11' 40.356 N	103° 43' 16.026 W
10,224.0	32.90	183.10	10,199.6	-167.3	-5.2	435,017.33	689,382.21	32° 11' 40.192 N	103° 43' 16.038 W
10,256.0	37.80	182.70	10,225.7	-185.8	-6.1	434,998.84	689,381.27	32° 11' 40.009 N	103° 43' 16.050 W
10,287.0	43.10	183.40	10,249.3	-205.8	-7.2	434,978.77	689,380.20	32° 11' 39.810 N	103° 43' 16.064 W
10,318.0	48.70	183.80	10,270.9	-228.0	-8.6	434,956.56	689,378.80	32° 11' 39.591 N	103° 43' 16.082 W
10,350.0	53.70	182.70	10,290.9	-252.9	-10.0	434,931.67	689,377.39	32° 11' 39.344 N	103° 43' 16.100 W
10,381.0	57.90	180.60	10,308.4	-278.6	-10.7	434,906.05	689,376.66	32° 11' 39.091 N	103° 43' 16.110 W
10,413.0	62.50	179.20	10,324.3	-306.3	-10.7	434,878.29	689,376.72	32° 11' 38.816 N	103° 43' 16.111 W
10,438.0	65.10	178.90	10,335.3	-328.7	-10.3	434,855.86	689,377.09	32° 11' 38.594 N	103° 43' 16.108 W
10,469.0	67.70	178.20	10,347.7	-357.1	-9.6	434,827.46	689,377.81	32° 11' 38.313 N	103° 43' 16.102 W
10,501.0	69.90	178.90	10,359.3	-387.0	-8.8	434,797.64	689,378.57	32° 11' 38.018 N	103° 43' 16.095 W
10,531.0	72.00	179.20	10,369.1	-415.3	-8.4	434,769.29	689,379.04	32° 11' 37.738 N	103° 43' 16.092 W
10,563.0	74.60	179.60	10,378.3	-446.0	-8.0	434,738.64	689,379.36	32° 11' 37.434 N	103° 43' 16.090 W
10,594.0	77.20	180.30	10,385.8	-476.0	-8.0	434,708.58	689,379.38	32° 11' 37.137 N	103° 43' 16.092 W
10,626.0	79.90	180.60	10,392.2	-507.4	-8.3	434,677.22	689,379.14	32° 11' 36.826 N	103° 43' 16.097 W
10,657.0	82.50	181.30	10,396.9	-538.0	-8.8	434,646.59	689,378.63	32° 11' 36.523 N	103° 43' 16.104 W
10,688.0	85.20	182.00	10,400.2	-568.8	-9.7	434,615.79	689,377.74	32° 11' 36.219 N	103° 43' 16.117 W
10,720.0	88.00	181.70	10,402.1	-600.7	-10.7	434,583.86	689,376.71	32° 11' 35.903 N	103° 43' 16.131 W
10,751.0	89.20	181.70	10,402.9	-631.7	-11.6	434,552.89	689,375.79	32° 11' 35.596 N	103° 43' 16.144 W
10,782.0	89.70	181.70	10,403.2	-662.7	-12.5	434,521.90	689,374.87	32° 11' 35.290 N	103° 43' 16.156 W
10,877.0	90.10	180.60	10,403.3	-757.7	-14.4	434,426.92	689,372.96	32° 11' 34.350 N	103° 43' 16.185 W
10,971.0	89.40	179.20	10,403.7	-851.7	-14.3	434,332.93	689,373.13	32° 11' 33.420 N	103° 43' 16.189 W
11,065.0	88.20	177.80	10,405.7	-945.6	-11.8	434,238.98	689,375.59	32° 11' 32.490 N	103° 43' 16.167 W
11,159.0	87.40	177.40	10,409.3	-1,039.5	-7.9	434,145.14	689,379.52	32° 11' 31.561 N	103° 43' 16.127 W
11,253.0	89.20	176.70	10,412.1	-1,133.3	-3.0	434,051.31	689,384.36	32° 11' 30.632 N	103° 43' 16.077 W
11,347.0	88.20	177.40	10,414.2	-1,227.1	1.8	433,957.46	689,389.19	32° 11' 29.703 N	103° 43' 16.027 W
11,441.0	87.40	177.80	10,417.9	-1,321.0	5.7	433,863.61	689,393.13	32° 11' 28.774 N	103° 43' 15.988 W
11,536.0	88.30	177.40	10,421.4	-1,415.8	9.7	433,768.76	689,397.10	32° 11' 27.835 N	103° 43' 15.948 W
11,630.0	89.20	177.40	10,423.5	-1,509.7	14.0	433,674.88	689,401.36	32° 11' 26.906 N	103° 43' 15.904 W
11,724.0	87.80	177.80	10,425.9	-1,603.6	17.9	433,581.00	689,405.30	32° 11' 25.977 N	103° 43' 15.865 W
11,818.0	88.20	177.10	10,429.2	-1,697.4	22.1	433,487.15	689,409.48	32° 11' 25.048 N	103° 43' 15.822 W
11,912.0	88.90	176.70	10,431.6	-1,791.3	27.2	433,393.32	689,414.56	32° 11' 24.119 N	103° 43' 15.769 W
12,006.0	88.50	177.80	10,433.7	-1,885.1	31.7	433,299.45	689,419.07	32° 11' 23.190 N	103° 43' 15.723 W
12,100.0	88.90	177.40	10,435.9	-1,979.0	35.6	433,205.56	689,423.00	32° 11' 22.261 N	103° 43' 15.684 W
12,194.0	88.00	179.20	10,438.4	-2,073.0	38.4	433,111.64	689,425.79	32° 11' 21.331 N	103° 43' 15.657 W
12,289.0	89.40	178.90	10,440.6	-2,167.9	40.0	433,016.68	689,427.37	32° 11' 20.391 N	103° 43' 15.645 W
12,382.0	88.00	179.20	10,442.7	-2,260.9	41.5	432,923.72	689,428.91	32° 11' 19.471 N	103° 43' 15.634 W
12,476.0	88.30	178.90	10,445.7	-2,354.8	43.1	432,829.78	689,430.47	32° 11' 18.542 N	103° 43' 15.622 W
12,571.0	89.00	178.50	10,447.9	-2,449.8	45.2	432,734.83	689,432.62	32° 11' 17.602 N	103° 43' 15.603 W
12,665.0	88.20	179.60	10,450.2	-2,543.7	46.8	432,640.88	689,434.18	32° 11' 16.672 N	103° 43' 15.591 W
12,759.0	87.10	179.20	10,454.1	-2,637.6	47.8	432,546.96	689,435.16	32° 11' 15.743 N	103° 43' 15.586 W
12,853.0	90.30	180.60	10,456.2	-2,731.6	47.9	432,453.00	689,435.33	32° 11' 14.813 N	103° 43' 15.590 W
12,947.0	88.20	181.70	10,457.5	-2,825.6	46.0	432,359.03	689,433.44	32° 11' 13.883 N	103° 43' 15.618 W



Wellplanning
Survey Report - Geographic

Company:	COG Production LLC	Local Co-ordinate Reference:	Well #1H
Project:	Lea County, NM	TVD Reference:	WELL @ 3569.1usft (Original Well Elev)
Site:	Windward Federal	MD Reference:	WELL @ 3569.1usft (Original Well Elev)
Well:	#1H	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	OH	Database:	EDM 5000.1 Single User Db

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
13,041.0	88.70	181.70	10,460.0	-2,919.5	43.3	432,265.11	689,430.65	32° 11' 12.954 N	103° 43' 15.657 W
13,135.0	89.40	181.00	10,461.6	-3,013.4	41.0	432,171.15	689,428.44	32° 11' 12.024 N	103° 43' 15.689 W
13,229.0	88.50	181.70	10,463.3	-3,107.4	38.8	432,077.19	689,426.22	32° 11' 11.094 N	103° 43' 15.721 W
13,323.0	89.60	181.00	10,464.8	-3,201.4	36.6	431,983.24	689,424.01	32° 11' 10.165 N	103° 43' 15.753 W
13,418.0	89.70	182.40	10,465.4	-3,296.3	33.8	431,888.28	689,421.19	32° 11' 9.225 N	103° 43' 15.792 W
13,512.0	88.90	183.80	10,466.6	-3,390.2	28.7	431,794.43	689,416.11	32° 11' 8.297 N	103° 43' 15.857 W
13,606.0	87.30	184.50	10,469.7	-3,483.9	21.9	431,700.73	689,409.31	32° 11' 7.370 N	103° 43' 15.943 W
13,700.0	86.70	184.80	10,474.6	-3,577.4	14.3	431,607.17	689,401.70	32° 11' 6.444 N	103° 43' 16.037 W
13,794.0	87.40	184.50	10,479.4	-3,671.0	6.7	431,513.60	689,394.09	32° 11' 5.519 N	103° 43' 16.132 W
13,888.0	88.30	184.10	10,483.0	-3,764.7	-0.3	431,419.93	689,387.05	32° 11' 4.592 N	103° 43' 16.220 W
13,982.0	89.90	183.10	10,484.4	-3,858.5	-6.2	431,326.14	689,381.15	32° 11' 3.664 N	103° 43' 16.295 W
14,076.0	91.30	181.70	10,483.5	-3,952.4	-10.2	431,232.23	689,377.21	32° 11' 2.735 N	103° 43' 16.347 W
14,170.0	89.60	181.00	10,482.7	-4,046.3	-12.4	431,138.26	689,375.00	32° 11' 1.806 N	103° 43' 16.379 W
14,264.0	88.70	181.00	10,484.1	-4,140.3	-14.0	431,044.29	689,373.36	32° 11' 0.876 N	103° 43' 16.404 W
14,358.0	87.60	180.30	10,487.1	-4,234.3	-15.1	430,950.34	689,372.29	32° 10' 59.946 N	103° 43' 16.423 W
14,452.0	86.90	180.30	10,491.7	-4,328.1	-15.6	430,856.45	689,371.80	32° 10' 59.017 N	103° 43' 16.435 W
14,547.0	86.40	179.60	10,497.2	-4,423.0	-15.5	430,761.62	689,371.88	32° 10' 58.079 N	103° 43' 16.440 W
14,641.0	88.00	180.30	10,501.8	-4,516.9	-15.4	430,667.73	689,371.96	32° 10' 57.149 N	103° 43' 16.446 W
14,735.0	88.50	180.60	10,504.7	-4,610.8	-16.2	430,573.78	689,371.22	32° 10' 56.220 N	103° 43' 16.460 W
14,823.0	89.00	180.60	10,506.6	-4,698.8	-17.1	430,485.81	689,370.30	32° 10' 55.349 N	103° 43' 16.477 W
14,872.0	89.00	180.60	10,507.4	-4,747.8	-17.6	430,436.82	689,369.79	32° 10' 54.864 N	103° 43' 16.486 W

PBHL(Windward#1H)

Checked By: _____ Approved By: _____ Date: _____