



COG Operating, LLC

Lea County, NM

Sec. 20, T23S, R34E

Broadcaster 29 Federal #4H

Wellbore #1

Plan: Design #1

QES Well Planning Report

03 February, 2017

HOBBS OCD

FEB 20 2017

RECEIVED



Database: EDM5002
Company: COG Operating, LLC
Project: Lea County, NM
Site: Sec. 20, T23S, R34E
Well: Broadcaster 29 Federal #4H
Wellbore: Wellbore #1
Design: Design #1

Local Co-ordinate Reference: Well Broadcaster 29 Federal #4H
TVD Reference: KB @ 3524.0usft (Noram #21)
MD Reference: KB @ 3524.0usft (Noram #21)
North Reference: Grid
Survey Calculation Method: Minimum Curvature

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	Sec. 20, T23S, R34E		
Site Position:		Northing:	467,761.66 usft
From:	Map	Easting:	762,110.32 usft
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16"
		Latitude:	32° 16' 59.322 N
		Longitude:	103° 29' 6.714 W
		Grid Convergence:	0.45 °

Well	Broadcaster 29 Federal #4H		
Well Position	+N/-S	0.0 usft	Northing: 467,761.66 usft
	+E/-W	0.0 usft	Easting: 762,110.32 usft
Position Uncertainty	0.0 usft	Wellhead Elevation:	0.0 usft
		Latitude:	32° 16' 59.322 N
		Longitude:	103° 29' 6.714 W
		Ground Level:	3,495.0 usft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination
	IGRF2015	2/3/2017	6.96
			Dip Angle
			60.14
			Field Strength
			48,020

Design	Design #1		
Audit Notes:			
Version:	Phase:	PLAN	Tie On Depth: 0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction
			179.48

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00	
11,141.5	0.00	0.00	11,141.5	0.0	0.0	0.00	0.00	0.00	0.00	
11,893.9	90.28	179.48	11,619.0	-479.8	4.4	12.00	12.00	23.86	179.48	
13,914.1	90.28	179.48	11,609.0	-2,499.9	22.7	0.00	0.00	0.00	0.00	T1 Broadcaster 29 Fe
13,960.0	89.36	179.48	11,609.1	-2,545.9	23.2	2.00	-2.00	0.00	180.00	
16,645.1	89.36	179.48	11,639.0	-5,230.6	47.6	0.00	0.00	0.00	0.00	PBHL Broadcaster 29

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North Reference: Grid
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Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00
100.0	0.00	0.00	100.0	0.0	0.0	0.0	0.00	0.00	0.00
200.0	0.00	0.00	200.0	0.0	0.0	0.0	0.00	0.00	0.00
300.0	0.00	0.00	300.0	0.0	0.0	0.0	0.00	0.00	0.00
400.0	0.00	0.00	400.0	0.0	0.0	0.0	0.00	0.00	0.00
500.0	0.00	0.00	500.0	0.0	0.0	0.0	0.00	0.00	0.00
600.0	0.00	0.00	600.0	0.0	0.0	0.0	0.00	0.00	0.00
700.0	0.00	0.00	700.0	0.0	0.0	0.0	0.00	0.00	0.00
800.0	0.00	0.00	800.0	0.0	0.0	0.0	0.00	0.00	0.00
900.0	0.00	0.00	900.0	0.0	0.0	0.0	0.00	0.00	0.00
Rustler									
984.0	0.00	0.00	984.0	0.0	0.0	0.0	0.00	0.00	0.00
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.0	0.00	0.00	0.00
1,100.0	0.00	0.00	1,100.0	0.0	0.0	0.0	0.00	0.00	0.00
1,200.0	0.00	0.00	1,200.0	0.0	0.0	0.0	0.00	0.00	0.00
TOS									
1,294.0	0.00	0.00	1,294.0	0.0	0.0	0.0	0.00	0.00	0.00
1,300.0	0.00	0.00	1,300.0	0.0	0.0	0.0	0.00	0.00	0.00
1,400.0	0.00	0.00	1,400.0	0.0	0.0	0.0	0.00	0.00	0.00
1,500.0	0.00	0.00	1,500.0	0.0	0.0	0.0	0.00	0.00	0.00
1,600.0	0.00	0.00	1,600.0	0.0	0.0	0.0	0.00	0.00	0.00
1,700.0	0.00	0.00	1,700.0	0.0	0.0	0.0	0.00	0.00	0.00
1,800.0	0.00	0.00	1,800.0	0.0	0.0	0.0	0.00	0.00	0.00
1,900.0	0.00	0.00	1,900.0	0.0	0.0	0.0	0.00	0.00	0.00
2,000.0	0.00	0.00	2,000.0	0.0	0.0	0.0	0.00	0.00	0.00
2,100.0	0.00	0.00	2,100.0	0.0	0.0	0.0	0.00	0.00	0.00
2,200.0	0.00	0.00	2,200.0	0.0	0.0	0.0	0.00	0.00	0.00
2,300.0	0.00	0.00	2,300.0	0.0	0.0	0.0	0.00	0.00	0.00
2,400.0	0.00	0.00	2,400.0	0.0	0.0	0.0	0.00	0.00	0.00
2,500.0	0.00	0.00	2,500.0	0.0	0.0	0.0	0.00	0.00	0.00
2,600.0	0.00	0.00	2,600.0	0.0	0.0	0.0	0.00	0.00	0.00
2,700.0	0.00	0.00	2,700.0	0.0	0.0	0.0	0.00	0.00	0.00
2,800.0	0.00	0.00	2,800.0	0.0	0.0	0.0	0.00	0.00	0.00
2,900.0	0.00	0.00	2,900.0	0.0	0.0	0.0	0.00	0.00	0.00
3,000.0	0.00	0.00	3,000.0	0.0	0.0	0.0	0.00	0.00	0.00
3,100.0	0.00	0.00	3,100.0	0.0	0.0	0.0	0.00	0.00	0.00
3,200.0	0.00	0.00	3,200.0	0.0	0.0	0.0	0.00	0.00	0.00
3,300.0	0.00	0.00	3,300.0	0.0	0.0	0.0	0.00	0.00	0.00
3,400.0	0.00	0.00	3,400.0	0.0	0.0	0.0	0.00	0.00	0.00
3,500.0	0.00	0.00	3,500.0	0.0	0.0	0.0	0.00	0.00	0.00
3,600.0	0.00	0.00	3,600.0	0.0	0.0	0.0	0.00	0.00	0.00
3,700.0	0.00	0.00	3,700.0	0.0	0.0	0.0	0.00	0.00	0.00
3,800.0	0.00	0.00	3,800.0	0.0	0.0	0.0	0.00	0.00	0.00
3,900.0	0.00	0.00	3,900.0	0.0	0.0	0.0	0.00	0.00	0.00
4,000.0	0.00	0.00	4,000.0	0.0	0.0	0.0	0.00	0.00	0.00
4,100.0	0.00	0.00	4,100.0	0.0	0.0	0.0	0.00	0.00	0.00
4,200.0	0.00	0.00	4,200.0	0.0	0.0	0.0	0.00	0.00	0.00
4,300.0	0.00	0.00	4,300.0	0.0	0.0	0.0	0.00	0.00	0.00
4,400.0	0.00	0.00	4,400.0	0.0	0.0	0.0	0.00	0.00	0.00
4,500.0	0.00	0.00	4,500.0	0.0	0.0	0.0	0.00	0.00	0.00
4,600.0	0.00	0.00	4,600.0	0.0	0.0	0.0	0.00	0.00	0.00
4,700.0	0.00	0.00	4,700.0	0.0	0.0	0.0	0.00	0.00	0.00
4,800.0	0.00	0.00	4,800.0	0.0	0.0	0.0	0.00	0.00	0.00

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
BOS (Castile)									
4,844.0	0.00	0.00	4,844.0	0.0	0.0	0.0	0.00	0.00	0.00
4,900.0	0.00	0.00	4,900.0	0.0	0.0	0.0	0.00	0.00	0.00
5,000.0	0.00	0.00	5,000.0	0.0	0.0	0.0	0.00	0.00	0.00
5,100.0	0.00	0.00	5,100.0	0.0	0.0	0.0	0.00	0.00	0.00
Delaware (Lamar)									
5,146.0	0.00	0.00	5,146.0	0.0	0.0	0.0	0.00	0.00	0.00
5,200.0	0.00	0.00	5,200.0	0.0	0.0	0.0	0.00	0.00	0.00
5,300.0	0.00	0.00	5,300.0	0.0	0.0	0.0	0.00	0.00	0.00
5,400.0	0.00	0.00	5,400.0	0.0	0.0	0.0	0.00	0.00	0.00
5,500.0	0.00	0.00	5,500.0	0.0	0.0	0.0	0.00	0.00	0.00
5,600.0	0.00	0.00	5,600.0	0.0	0.0	0.0	0.00	0.00	0.00
5,700.0	0.00	0.00	5,700.0	0.0	0.0	0.0	0.00	0.00	0.00
5,800.0	0.00	0.00	5,800.0	0.0	0.0	0.0	0.00	0.00	0.00
5,900.0	0.00	0.00	5,900.0	0.0	0.0	0.0	0.00	0.00	0.00
CYCN									
5,980.0	0.00	0.00	5,980.0	0.0	0.0	0.0	0.00	0.00	0.00
6,000.0	0.00	0.00	6,000.0	0.0	0.0	0.0	0.00	0.00	0.00
6,100.0	0.00	0.00	6,100.0	0.0	0.0	0.0	0.00	0.00	0.00
6,200.0	0.00	0.00	6,200.0	0.0	0.0	0.0	0.00	0.00	0.00
6,300.0	0.00	0.00	6,300.0	0.0	0.0	0.0	0.00	0.00	0.00
6,400.0	0.00	0.00	6,400.0	0.0	0.0	0.0	0.00	0.00	0.00
6,500.0	0.00	0.00	6,500.0	0.0	0.0	0.0	0.00	0.00	0.00
6,600.0	0.00	0.00	6,600.0	0.0	0.0	0.0	0.00	0.00	0.00
6,700.0	0.00	0.00	6,700.0	0.0	0.0	0.0	0.00	0.00	0.00
6,800.0	0.00	0.00	6,800.0	0.0	0.0	0.0	0.00	0.00	0.00
6,900.0	0.00	0.00	6,900.0	0.0	0.0	0.0	0.00	0.00	0.00
7,000.0	0.00	0.00	7,000.0	0.0	0.0	0.0	0.00	0.00	0.00
7,100.0	0.00	0.00	7,100.0	0.0	0.0	0.0	0.00	0.00	0.00
7,200.0	0.00	0.00	7,200.0	0.0	0.0	0.0	0.00	0.00	0.00
7,300.0	0.00	0.00	7,300.0	0.0	0.0	0.0	0.00	0.00	0.00
BYCN									
7,304.0	0.00	0.00	7,304.0	0.0	0.0	0.0	0.00	0.00	0.00
7,400.0	0.00	0.00	7,400.0	0.0	0.0	0.0	0.00	0.00	0.00
7,500.0	0.00	0.00	7,500.0	0.0	0.0	0.0	0.00	0.00	0.00
7,600.0	0.00	0.00	7,600.0	0.0	0.0	0.0	0.00	0.00	0.00
7,700.0	0.00	0.00	7,700.0	0.0	0.0	0.0	0.00	0.00	0.00
7,800.0	0.00	0.00	7,800.0	0.0	0.0	0.0	0.00	0.00	0.00
7,900.0	0.00	0.00	7,900.0	0.0	0.0	0.0	0.00	0.00	0.00
8,000.0	0.00	0.00	8,000.0	0.0	0.0	0.0	0.00	0.00	0.00
8,100.0	0.00	0.00	8,100.0	0.0	0.0	0.0	0.00	0.00	0.00
8,200.0	0.00	0.00	8,200.0	0.0	0.0	0.0	0.00	0.00	0.00
8,300.0	0.00	0.00	8,300.0	0.0	0.0	0.0	0.00	0.00	0.00
8,400.0	0.00	0.00	8,400.0	0.0	0.0	0.0	0.00	0.00	0.00
8,500.0	0.00	0.00	8,500.0	0.0	0.0	0.0	0.00	0.00	0.00
8,600.0	0.00	0.00	8,600.0	0.0	0.0	0.0	0.00	0.00	0.00
Bone Spring (BSGL)									
8,644.0	0.00	0.00	8,644.0	0.0	0.0	0.0	0.00	0.00	0.00
8,700.0	0.00	0.00	8,700.0	0.0	0.0	0.0	0.00	0.00	0.00
8,800.0	0.00	0.00	8,800.0	0.0	0.0	0.0	0.00	0.00	0.00
8,900.0	0.00	0.00	8,900.0	0.0	0.0	0.0	0.00	0.00	0.00
U Avalon Sh									
8,969.0	0.00	0.00	8,969.0	0.0	0.0	0.0	0.00	0.00	0.00

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9,000.0	0.00	0.00	9,000.0	0.0	0.0	0.0	0.00	0.00	0.00
9,100.0	0.00	0.00	9,100.0	0.0	0.0	0.0	0.00	0.00	0.00
L Avalon Sh									
9,129.0	0.00	0.00	9,129.0	0.0	0.0	0.0	0.00	0.00	0.00
9,200.0	0.00	0.00	9,200.0	0.0	0.0	0.0	0.00	0.00	0.00
9,300.0	0.00	0.00	9,300.0	0.0	0.0	0.0	0.00	0.00	0.00
9,400.0	0.00	0.00	9,400.0	0.0	0.0	0.0	0.00	0.00	0.00
9,500.0	0.00	0.00	9,500.0	0.0	0.0	0.0	0.00	0.00	0.00
9,600.0	0.00	0.00	9,600.0	0.0	0.0	0.0	0.00	0.00	0.00
9,700.0	0.00	0.00	9,700.0	0.0	0.0	0.0	0.00	0.00	0.00
FBSG_sand									
9,759.0	0.00	0.00	9,759.0	0.0	0.0	0.0	0.00	0.00	0.00
9,800.0	0.00	0.00	9,800.0	0.0	0.0	0.0	0.00	0.00	0.00
9,900.0	0.00	0.00	9,900.0	0.0	0.0	0.0	0.00	0.00	0.00
10,000.0	0.00	0.00	10,000.0	0.0	0.0	0.0	0.00	0.00	0.00
10,100.0	0.00	0.00	10,100.0	0.0	0.0	0.0	0.00	0.00	0.00
10,200.0	0.00	0.00	10,200.0	0.0	0.0	0.0	0.00	0.00	0.00
SBSG_sand									
10,277.0	0.00	0.00	10,277.0	0.0	0.0	0.0	0.00	0.00	0.00
10,300.0	0.00	0.00	10,300.0	0.0	0.0	0.0	0.00	0.00	0.00
10,400.0	0.00	0.00	10,400.0	0.0	0.0	0.0	0.00	0.00	0.00
10,500.0	0.00	0.00	10,500.0	0.0	0.0	0.0	0.00	0.00	0.00
10,600.0	0.00	0.00	10,600.0	0.0	0.0	0.0	0.00	0.00	0.00
10,700.0	0.00	0.00	10,700.0	0.0	0.0	0.0	0.00	0.00	0.00
10,800.0	0.00	0.00	10,800.0	0.0	0.0	0.0	0.00	0.00	0.00
10,900.0	0.00	0.00	10,900.0	0.0	0.0	0.0	0.00	0.00	0.00
11,000.0	0.00	0.00	11,000.0	0.0	0.0	0.0	0.00	0.00	0.00
11,100.0	0.00	0.00	11,100.0	0.0	0.0	0.0	0.00	0.00	0.00
KOP: Build 12°/100' @ 11141.5' MD									
11,141.5	0.00	0.00	11,141.5	0.0	0.0	0.0	0.00	0.00	0.00
11,150.0	1.02	179.48	11,150.0	-0.1	0.0	0.1	12.00	12.00	0.00
11,175.0	4.02	179.48	11,175.0	-1.2	0.0	1.2	12.00	12.00	0.00
11,200.0	7.02	179.48	11,199.9	-3.6	0.0	3.6	12.00	12.00	0.00
11,225.0	10.02	179.48	11,224.6	-7.3	0.1	7.3	12.00	12.00	0.00
11,250.0	13.02	179.48	11,249.1	-12.3	0.1	12.3	12.00	12.00	0.00
11,275.0	16.02	179.48	11,273.3	-18.5	0.2	18.5	12.00	12.00	0.00
TBSG_sand									
11,296.8	18.64	179.48	11,294.1	-25.0	0.2	25.0	12.00	12.00	0.00
11,300.0	19.02	179.48	11,297.1	-26.1	0.2	26.1	12.00	12.00	0.00
11,325.0	22.02	179.48	11,320.5	-34.8	0.3	34.8	12.00	12.00	0.00
11,350.0	25.02	179.48	11,343.4	-44.8	0.4	44.8	12.00	12.00	0.00
11,375.0	28.02	179.48	11,365.8	-56.0	0.5	56.0	12.00	12.00	0.00
11,400.0	31.02	179.48	11,387.6	-68.3	0.6	68.3	12.00	12.00	0.00
11,425.0	34.02	179.48	11,408.6	-81.7	0.7	81.7	12.00	12.00	0.00
11,450.0	37.02	179.48	11,429.0	-96.2	0.9	96.2	12.00	12.00	0.00
11,475.0	40.02	179.48	11,448.5	-111.8	1.0	111.8	12.00	12.00	0.00
11,500.0	43.02	179.48	11,467.3	-128.4	1.2	128.4	12.00	12.00	0.00
11,525.0	46.02	179.48	11,485.1	-145.9	1.3	145.9	12.00	12.00	0.00
11,550.0	49.02	179.48	11,502.0	-164.3	1.5	164.3	12.00	12.00	0.00
11,575.0	52.02	179.48	11,517.8	-183.6	1.7	183.6	12.00	12.00	0.00
11,600.0	55.02	179.48	11,532.7	-203.7	1.9	203.7	12.00	12.00	0.00
11,625.0	58.02	179.48	11,546.5	-224.6	2.0	224.6	12.00	12.00	0.00
11,650.0	61.02	179.48	11,559.2	-246.1	2.2	246.1	12.00	12.00	0.00

Database: EDM5002
Company: COG Operating, LLC
Project: Lea County, NM
Site: Sec. 20, T23S, R34E
Well: Broadcaster 29 Federal #4H
Wellbore: Wellbore #1
Design: Design #1

Local Co-ordinate Reference: Well Broadcaster 29 Federal #4H
TVD Reference: KB @ 3524.0usft (Noram #21)
MD Reference: KB @ 3524.0usft (Noram #21)
North Reference: Grid
Survey Calculation Method: Minimum Curvature

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
11,675.0	64.02	179.48	11,570.7	-268.3	2.4	268.3	12.00	12.00	0.00
11,700.0	67.02	179.48	11,581.1	-291.0	2.6	291.1	12.00	12.00	0.00
11,725.0	70.02	179.48	11,590.2	-314.3	2.9	314.3	12.00	12.00	0.00
11,750.0	73.02	179.48	11,598.2	-338.0	3.1	338.0	12.00	12.00	0.00
11,775.0	76.02	179.48	11,604.8	-362.1	3.3	362.1	12.00	12.00	0.00
11,800.0	79.02	179.48	11,610.2	-386.5	3.5	386.5	12.00	12.00	0.00
11,825.0	82.02	179.48	11,614.3	-411.2	3.7	411.2	12.00	12.00	0.00
11,850.0	85.02	179.48	11,617.2	-436.0	4.0	436.0	12.00	12.00	0.00
11,875.0	88.02	179.48	11,618.7	-460.9	4.2	461.0	12.00	12.00	0.00
EOC: 11893.9' MD, 90.28° Inc, 179.48° Azm									
11,893.9	90.28	179.48	11,619.0	-479.8	4.4	479.8	12.00	12.00	0.00
11,900.0	90.28	179.48	11,618.9	-485.9	4.4	486.0	0.00	0.00	0.00
12,000.0	90.28	179.48	11,618.4	-585.9	5.3	586.0	0.00	0.00	0.00
12,100.0	90.28	179.48	11,617.9	-685.9	6.2	686.0	0.00	0.00	0.00
12,200.0	90.28	179.48	11,617.4	-785.9	7.2	786.0	0.00	0.00	0.00
12,300.0	90.28	179.48	11,617.0	-885.9	8.1	886.0	0.00	0.00	0.00
12,400.0	90.28	179.48	11,616.5	-985.9	9.0	986.0	0.00	0.00	0.00
12,500.0	90.28	179.48	11,616.0	-1,085.9	9.9	1,086.0	0.00	0.00	0.00
12,600.0	90.28	179.48	11,615.5	-1,185.9	10.8	1,186.0	0.00	0.00	0.00
12,700.0	90.28	179.48	11,615.0	-1,285.9	11.7	1,286.0	0.00	0.00	0.00
12,800.0	90.28	179.48	11,614.5	-1,385.9	12.6	1,386.0	0.00	0.00	0.00
12,900.0	90.28	179.48	11,614.0	-1,485.9	13.5	1,486.0	0.00	0.00	0.00
13,000.0	90.28	179.48	11,613.5	-1,585.9	14.4	1,586.0	0.00	0.00	0.00
13,100.0	90.28	179.48	11,613.0	-1,685.9	15.3	1,686.0	0.00	0.00	0.00
13,200.0	90.28	179.48	11,612.5	-1,785.9	16.3	1,785.9	0.00	0.00	0.00
13,300.0	90.28	179.48	11,612.0	-1,885.9	17.2	1,885.9	0.00	0.00	0.00
13,400.0	90.28	179.48	11,611.5	-1,985.9	18.1	1,985.9	0.00	0.00	0.00
13,500.0	90.28	179.48	11,611.0	-2,085.9	19.0	2,085.9	0.00	0.00	0.00
13,600.0	90.28	179.48	11,610.5	-2,185.9	19.9	2,185.9	0.00	0.00	0.00
13,700.0	90.28	179.48	11,610.1	-2,285.8	20.8	2,285.9	0.00	0.00	0.00
13,800.0	90.28	179.48	11,609.6	-2,385.8	21.7	2,385.9	0.00	0.00	0.00
13,900.0	90.28	179.48	11,609.1	-2,485.8	22.6	2,485.9	0.00	0.00	0.00
Drop 2°/100' - T1 @ 11609' TVD / 2500' VS									
13,914.1	90.28	179.48	11,609.0	-2,499.9	22.8	2,500.0	0.00	0.00	0.00
Hold 89.36° Inc., 179.48° Azm									
13,960.0	89.36	179.48	11,609.1	-2,545.9	23.2	2,546.0	2.00	-2.00	0.00
14,000.0	89.36	179.48	11,609.6	-2,585.8	23.5	2,585.9	0.00	0.00	0.00
14,100.0	89.36	179.48	11,610.7	-2,685.8	24.4	2,685.9	0.00	0.00	0.00
14,200.0	89.36	179.48	11,611.8	-2,785.8	25.4	2,785.9	0.00	0.00	0.00
14,300.0	89.36	179.48	11,612.9	-2,885.8	26.3	2,885.9	0.00	0.00	0.00
14,400.0	89.36	179.48	11,614.0	-2,985.8	27.2	2,985.9	0.00	0.00	0.00
14,500.0	89.36	179.48	11,615.1	-3,085.8	28.1	3,085.9	0.00	0.00	0.00
14,600.0	89.36	179.48	11,616.3	-3,185.8	29.0	3,185.9	0.00	0.00	0.00
14,700.0	89.36	179.48	11,617.4	-3,285.8	29.9	3,285.9	0.00	0.00	0.00
14,800.0	89.36	179.48	11,618.5	-3,385.7	30.8	3,385.9	0.00	0.00	0.00
14,900.0	89.36	179.48	11,619.6	-3,485.7	31.7	3,485.9	0.00	0.00	0.00
15,000.0	89.36	179.48	11,620.7	-3,585.7	32.6	3,585.9	0.00	0.00	0.00
15,100.0	89.36	179.48	11,621.8	-3,685.7	33.5	3,685.9	0.00	0.00	0.00
15,200.0	89.36	179.48	11,622.9	-3,785.7	34.5	3,785.9	0.00	0.00	0.00
15,300.0	89.36	179.48	11,624.0	-3,885.7	35.4	3,885.9	0.00	0.00	0.00
15,400.0	89.36	179.48	11,625.2	-3,985.7	36.3	3,985.9	0.00	0.00	0.00
15,500.0	89.36	179.48	11,626.3	-4,085.7	37.2	4,085.8	0.00	0.00	0.00
15,600.0	89.36	179.48	11,627.4	-4,185.7	38.1	4,185.8	0.00	0.00	0.00

Database: EDM5002
Company: COG Operating, LLC
Project: Lea County, NM
Site: Sec. 20, T23S, R34E
Well: Broadcaster 29 Federal #4H
Wellbore: Wellbore #1
Design: Design #1

Local Co-ordinate Reference: Well Broadcaster 29 Federal #4H
TVD Reference: KB @ 3524.0usft (Noram #21)
MD Reference: KB @ 3524.0usft (Noram #21)
North Reference: Grid
Survey Calculation Method: Minimum Curvature

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
15,700.0	89.36	179.48	11,628.5	-4,285.7	39.0	4,285.8	0.00	0.00	0.00
15,800.0	89.36	179.48	11,629.6	-4,385.6	39.9	4,385.8	0.00	0.00	0.00
15,900.0	89.36	179.48	11,630.7	-4,485.6	40.8	4,485.8	0.00	0.00	0.00
16,000.0	89.36	179.48	11,631.8	-4,585.6	41.7	4,585.8	0.00	0.00	0.00
16,100.0	89.36	179.48	11,632.9	-4,685.6	42.6	4,685.8	0.00	0.00	0.00
16,200.0	89.36	179.48	11,634.1	-4,785.6	43.6	4,785.8	0.00	0.00	0.00
16,300.0	89.36	179.48	11,635.2	-4,885.6	44.5	4,885.8	0.00	0.00	0.00
16,400.0	89.36	179.48	11,636.3	-4,985.6	45.4	4,985.8	0.00	0.00	0.00
16,500.0	89.36	179.48	11,637.4	-5,085.6	46.3	5,085.8	0.00	0.00	0.00
16,600.0	89.36	179.48	11,638.5	-5,185.6	47.2	5,185.8	0.00	0.00	0.00
TD @ 16645.1' MD/11639.0' TVD									
16,645.1	89.36	179.48	11,639.0	-5,230.6	47.6	5,230.9	0.00	0.00	0.00

Design Targets

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
FTP Broadcaster 29 Fec	0.00	0.00	0.0	-480.0	4.4	467,281.68	762,114.77	32° 16' 54.572 N	103° 29' 6.707 W
- plan misses target center by 480.0usft at 0.0usft MD (0.0 TVD, 0.0 N, 0.0 E)									
- Point									
LTP Broadcaster 29 Fed	0.00	0.00	0.0	-5,100.7	46.5	462,660.97	762,156.80	32° 16' 8.846 N	103° 29' 6.643 W
- plan misses target center by 5100.9usft at 0.0usft MD (0.0 TVD, 0.0 N, 0.0 E)									
- Point									
T1 Broadcaster 29 Fed #	0.00	0.00	11,609.0	-2,499.9	22.7	465,261.76	762,133.07	32° 16' 34.583 N	103° 29' 6.680 W
- plan hits target center									
- Point									
PBHL Broadcaster 29 Fe	0.00	0.00	11,639.0	-5,230.6	47.6	462,531.01	762,157.92	32° 16' 7.560 N	103° 29' 6.641 W
- plan hits target center									
- Point									

Formations

Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)
984.0	984.0	Rustler		0.24	179.48
1,294.0	1,294.0	TOS		0.24	179.48
4,844.0	4,844.0	BOS (Castile)		0.24	179.48
5,146.0	5,146.0	Delaware (Lamar)		0.24	179.48
5,980.0	5,980.0	CYCN		0.24	179.48
7,304.0	7,304.0	BYCN		0.24	179.48
8,644.0	8,644.0	Bone Spring (BSGL)		0.24	179.48
8,969.0	8,969.0	U Avalon Sh		0.24	179.48
9,129.0	9,129.0	L Avalon Sh		0.24	179.48
9,759.0	9,759.0	FBSG_sand		0.24	179.48
10,277.0	10,277.0	SBSG_sand		0.24	179.48
11,296.8	11,294.1	TBSG_sand		0.24	179.48

Database: EDM5002
Company: COG Operating, LLC
Project: Lea County, NM
Site: Sec. 20, T23S, R34E
Well: Broadcaster 29 Federal #4H
Wellbore: Wellbore #1
Design: Design #1

Local Co-ordinate Reference: Well Broadcaster 29 Federal #4H
TVD Reference: KB @ 3524.0usft (Noram #21)
MD Reference: KB @ 3524.0usft (Noram #21)
North Reference: Grid
Survey Calculation Method: Minimum Curvature

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
11,141.5	11,141.5	0.0	0.0	KOP: Build 12"/100' @ 11141.5' MD
11,893.9	11,619.0	-479.8	4.4	EOC: 11893.9' MD, 90.28° Inc, 179.48° Azm
13,914.1	11,609.0	-2,499.9	22.7	Drop 2"/100'
13,914.1	11,609.0	-2,499.9	22.8	T1 @ 11609' TVD / 2500' VS
13,960.0	11,609.1	-2,545.9	23.2	Hold 89.36° Inc., 179.48° Azm
16,645.1	11,639.0	-5,230.6	47.6	TD @ 16645.1' MD/11639.0' TVD

Company Name: COG Operating, LLC
 Broadcaster 29 Federal #4H
 Lea County, NM
 Rig: Noram #21
 Created By: Shelly Cale Peterkin
 Date: 2/3/2017

Broadcaster 29 Federal #4H
 Lea County, NM
 Q170*** & WT-170***
 Design #1



DESIGN TARGET DETAILS

Name	TVD	+N-S	+E-W	North	East	Latitude	Longitude
FTP Broadcaster 29 Fed #4H	0.0	-489.0	4.4	467261.68	762114.77	32° 16' 54.572 N	103° 29' 6.707 W
LTP Broadcaster 29 Fed #4H	0.0	-5106.7	46.5	462669.97	762196.89	32° 16' 8.846 N	103° 29' 6.643 W
T1 Broadcaster 29 Fed #4H	11609.0	-2489.9	22.7	462591.76	762133.07	32° 16' 34.983 N	103° 29' 6.680 W
PBHL Broadcaster 29 Fed #4H	11639.0	-5239.6	47.6	462531.01	762157.92	32° 16' 7.560 N	103° 29' 6.641 W

ANNOTATIONS

MD	Inc	Azi	TVD	+N-S	+E-W	Vsect	Departure	Annotation
11141.5	0.00	0.00	11141.5	0.0	0.0	0.0	0.0	KOP: Build 12°/100' @ 11141.5' MD
11893.9	90.28	179.48	11893.9	-479.8	4.4	479.8	479.8	EOC: 11893.9' MD, 90.28° Inc, 179.48° Azm
13914.1	90.28	179.48	11609.0	-2489.9	22.7	2500.0	2500.0	Drop 2°/100'
13914.1	90.28	179.48	11609.0	-2489.9	22.8	2500.0	2500.0	T1 @ 11609' TVD / 2500' VS
13980.0	89.36	179.48	11639.0	-2545.9	23.2	2548.0	2548.0	Hold 89.36° Inc., 179.48° Azm
16645.1	89.36	179.48	11639.0	-5239.6	47.6	5239.9	5239.9	TD @ 16645.1' MD/11639.0' TVD

WELL DETAILS: Broadcaster 29 Federal #4H

+N-S	+E-W	North	Ground Level:	Latitude	Longitude	Slot
0.0	0.0	467261.68	3485.9	32° 16' 59.322 N	103° 29' 6.714 W	

PROJECT DETAILS: Lea County, NM

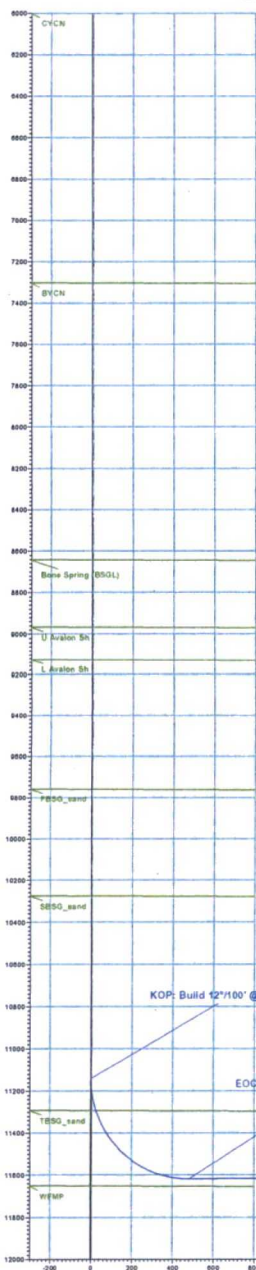
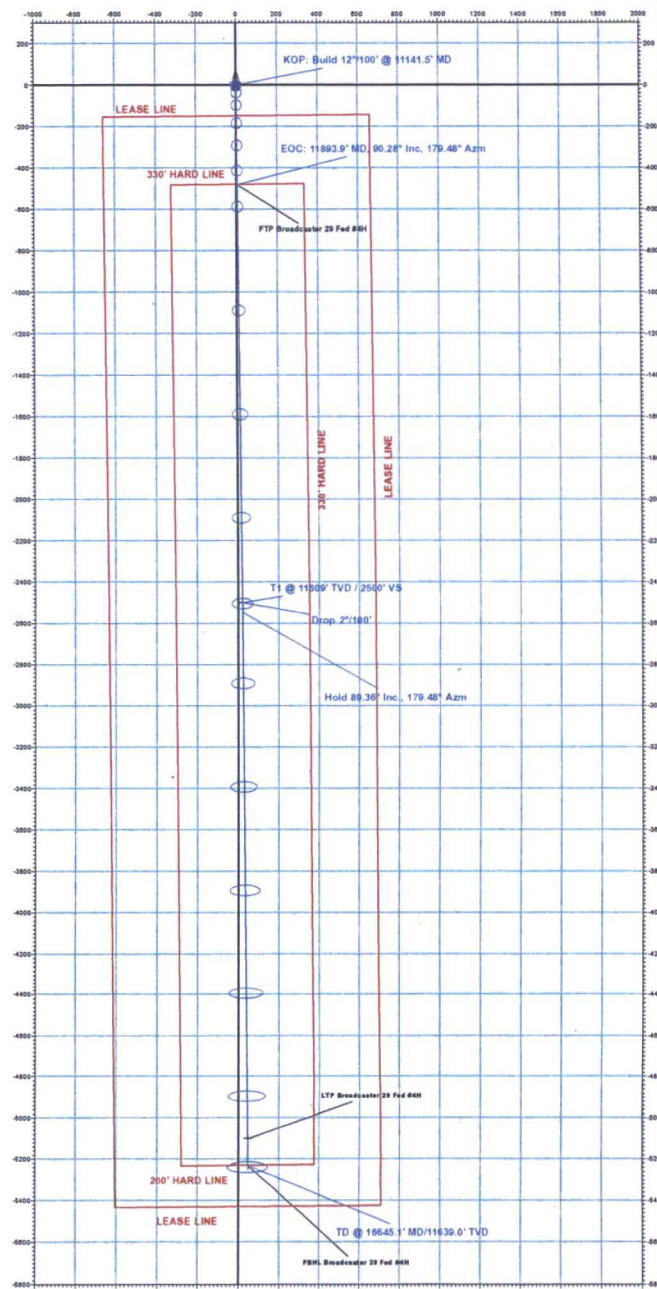
Geodetic System: US State Plane 1927 (Exact solution)
 Datum: NAD 1927 (NADCON CONUS)
 Ellipsoid: Clarke 1866
 Zone: New Mexico East 3001
 System Datum: Mean Sea Level



Azimuths to Grid North

Correction: 6.50°

Magnetic Field
 Strength: 48019.8snT
 Dip Angle: 60.14°
 Date: 2/3/2017
 Model: IGRF2015



Vertical Section at 179.48° (200 usf/in)