Form 3160-5
(June 2015)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB NO. 1004-0137
Expires: January 31, 2018

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill or to re-enter an abandoned well. Use form 3160-3 (APD) for such proposals.

Carlsbad Field Office
OCD Artesia

SUBMIT IN TRIPLICATE - Other instructions on page 2

5. Lease Serial No.
NMNM 104066

6. If Indian, Allottee or Tribe Name

7. If Unit or CA/Agreement, Name and/or No.

1. Type of Well
☒ Oil Well ☐ Gas Well ☐ Other

8. Well Name and No.
CAVERNS FEDERAL COM 4H

2. Name of Operator
COG OPERATING LLC
Contact: MAYTE X REYES
E-Mail: mreyes1@concho.com

9. API Well No.
30-015-43291-00-X1

3a. Address
600 W ILLINOIS AVENUE
MIDLAND, TX 79701

3b. Phone No. (include area code)
Ph: 575-748-6945

10. Field and Pool or Exploratory Area
WILDCAT; WOLFCAMP

4. Location of Well *(Footage, Sec., T., R., M., or Survey Description)*
Sec 21 T26S R25E NWNW 400FNL 460FWL
32.033999 N Lat, 104.407205 W Lon

11. County or Parish, State
EDDY COUNTY, NM

12. CHECK THE APPROPRIATE BOX(ES) TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

TYPE OF SUBMISSION	TYPE OF ACTION			
☒ Notice of Intent	☐ Acidize	☐ Deepen	☐ Production (Start/Resume)	☐ Water Shut-Off
☐ Subsequent Report	☐ Alter Casing	☐ Hydraulic Fracturing	☐ Reclamation	☐ Well Integrity
☐ Final Abandonment Notice	☐ Casing Repair	☐ New Construction	☐ Recomplete	☒ Other Change to Original A PD
	☐ Change Plans	☐ Plug and Abandon	☐ Temporarily Abandon	
	☐ Convert to Injection	☐ Plug Back	☐ Water Disposal	

13. Describe Proposed or Completed Operation: Clearly state all pertinent details, including estimated starting date of any proposed work and approximate duration thereof. If the proposal is to deepen directionally or recomplete horizontally, give subsurface locations and measured and true vertical depths of all pertinent markers and zones. Attach the Bond under which the work will be performed or provide the Bond No. on file with BLM/BIA. Required subsequent reports must be filed within 30 days following completion of the involved operations. If the operation results in a multiple completion or recompletion in a new interval, a Form 3160-4 must be filed once testing has been completed. Final Abandonment Notices must be filed only after all requirements, including reclamation, have been completed and the operator has determined that the site is ready for final inspection.

COG Operating LLC, respectfully requests approval for the following changes to the original approved APD.

BHL:
From: 330' FSL & 380' FWL
To: 200' FSL & 380' FWL

Formation:
From: Wildcat S262522F; Bone Spring (Gas)
To: Wildcat; Wolfcamp (Oil)

C102 Attached.

NM OIL CONSERVATION
ARTESIA DISTRICT
FEB 06 2017
RECEIVED

SEE ATTACHED FOR CONDITIONS OF APPROVAL

14. I hereby certify that the foregoing is true and correct.

Electronic Submission #365384 verified by the BLM Well Information System
For COG OPERATING LLC, sent to the Carlsbad
Committed to AFMSS for processing by MUSTAFA HAQUE on 02/01/2017 (17MH0030SE)

Name *(Printed/Typed)* MAYTE X REYES — Title REGULATORY ANALYST

Signature (Electronic Submission) — Date 01/31/2017

THIS SPACE FOR FEDERAL OR STATE OFFICE USE

Approved By MUSTAFA HAQUE — Title PETROLEUM ENGINEER — Date 02/02/2017

Conditions of approval, if any, are attached. Approval of this notice does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.

Office Carlsbad

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(Instructions on page 2)

**** BLM REVISED ** BLM REVISED ** BLM REVISED ** BLM REVISED ** BLM REVISED ****

Additional data for EC transaction #365384 that would not fit on the form

32. Additional remarks, continued

Drilling:
Drilling and directional plans attached.

PECOS DISTRICT
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	COG Operating, LLC.
LEASE NO.:	NMNM-104667
WELL NAME & NO.:	Caverns Federal Com 4H
SURFACE HOLE FOOTAGE:	0400' FNL & 0460' FWL
BOTTOM HOLE FOOTAGE	0200' FSL & 0380' FWL Sec. 33, T. 26 S., R 25 E.
LOCATION:	Section 21, T. 26 S., R 25 E., NMPM
COUNTY:	Eddy County, New Mexico

All previous COAs still apply except for the following:

A. CASING

Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.

Centralizers required on surface casing per Onshore Order 2.III.B.1.f.

Wait on cement (WOC) for Water Basin:
After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements.

No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.

High Cave/Karst.
Possibility of water flows in the Salado and Castile.
Possibility of lost circulation in the Salado and Delaware.
Abnormal pressure may be encountered within the 3rd Bone Spring Sandstone and Wolfcamp formation.

A MINIMUM OF TWO CASING STRINGS CEMENTED TO SURFACE IS REQUIRED IN HIGH CAVE/KARST AREAS. THE CEMENT MUST BE IN A

SOLID SHEATH. THEREFORE, ONE INCH OPERATIONS ARE NOT SUFFICIENT TO PROTECT CAVE KARST RESOURCES. A CASING DESIGN THAT HAS A ONE INCH JOB PERFORMED DOES NOT COUNT AS A SOLID SHEATH. IF THE PRIMARY CEMENT JOB ON THE SURFACE CASING DOES NOT CIRCULATE, THEN THE NEXT TWO CASING STRINGS MUST BE CEMENTED TO SURFACE.

1. The **20** inch surface casing shall be set at approximately **350** feet and cemented to the surface. **If salt is encountered, set casing at least 25 feet above the salt. Excess calculates to 22% - Additional cement might be required.**

    a. If cement does not circulate to the surface, the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

    b. Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry.

    c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.

    d. If cement falls back, remedial cementing will be done prior to drilling out that string.

2. The minimum required fill of cement behind the **13-3/8** inch first intermediate casing is:

    ☒ Cement to surface. If cement does not circulate see A.1.a, c-d above. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst.**

3. The minimum required fill of cement behind the **9-5/8** inch second intermediate casing is:

    ☒ Cement should tie-back at least 200 feet into previous casing string. **Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst.**

Pilot hole is required to have a plug at the bottom of the hole. If two plugs are set, the BLM is to be contacted (575-361-2822) prior to tag of bottom plug, which must be a minimum of 200' in length. Operator can set one plug from bottom of pilot hole to kick-off point and save the WOC time for tagging the first plug. Note plug

tops on subsequent drilling report. Excess calculates to 17% - Additional cement might be required.

Formation below the 9-5/8" shoe to be tested according to Onshore Order 2.III.B.1.i. Test to be done as a mud equivalency test using the mud weight necessary for the pore pressure of the formation below the shoe (not the mud weight required to prevent dissolving the salt formation) and the mud weight for the bottom of the hole. Report results to BLM office.

4. The minimum required fill of cement behind the **5-1/2** inch production casing is:

   ☒ Cement should tie-back at least 200 feet into previous casing string. Operator should

4. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.

B. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API 53.

2. Variance approved to use flex line from BOP to choke manifold. Check condition of flexible line from BOP to choke manifold, replace if exterior is damaged or if line fails test. Line to be as straight as possible with no hard bends and is to be anchored according to Manufacturer's requirements. The flexible hose can be exchanged with a hose of equal size and equal or greater pressure rating. **Anchor requirements, specification sheet and hydrostatic pressure test certification matching the hose in service, to be onsite for review. These documents shall be posted in the company man's trailer and on the rig floor.** If the BLM inspector questions the straightness of the hose, a BLM engineer will be contacted and will review in the field or via picture supplied by inspector to determine if changes are required (operator shall expect delays if this occurs).

3. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **2000 (2M)** psi

4. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the **13-3/8** first intermediate casing shoe shall be **3000 (3M)** psi.

5. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the **9-5/8** second intermediate casing shoe shall be

5000 (5M) psi. **5M system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.**

MHH 02022017

COG Operating, LLC, Caverns Federal Com 4H

1. Geologic Formations

TVD of target	7,600	Pilot hole depth	8400'
MD at TD:	19,398	Deepest expected fresh water:	35'

Basin

Formation	Depth (TVD) from KB	Water/Mineral Bearing/ Target Zone?	Hazards*
Rustler	NP	Water	
Top of Salt	400	Salt	
Fletcher Anhydrite	1012	Barren	
Lamar (top of Delaware)	1197	Barren	
Bone Spring	4595	Oil/Gas	
Wolfcamp	7252	Target Oil/Gas	
Strawn	8202	Oil/Gas	

2. Casing Program

Hole Size	Casing Interval From	Casing Interval To	Csg. Size	Weight (lbs)	Grade	Conn.	SF Collapse	SF Burst	SF Tension
26"	0'	350'	20"	94	J55	STC	3.17	3.31	23.7
17.5"	0'	1225'	13-3/8"	54.5	J55	BTC	1.77	0.82	7.67
12.25"	0'	6850'	9.625"	43.5	L80	BTC	1.13	1.33	3.22
8.5"	0'	19398'	5.5"	17	P110	BTC	1.57	2.24	2.92
			BLM Minimum Safety Factor				1.125	1.125	1.6 Dry 1.8 Wet

All casing strings will be tested in accordance with Onshore Oil and Gas Order #2 III.B.1.h

- Burst SF on Surf is 0.82 > 0.7.
- Pilot hole will be drilled to 8,400' TVD after setting the 9-5/8" interemediate.

	Y or N
Is casing new? If used, attach certification as required in Onshore Order #1	Y
Does casing meet API specifications? If no, attach casing specification sheet.	Y
Is premium or uncommon casing planned? If yes attach casing specification sheet.	N
Does the above casing design meet or exceed BLM's minimum standards? If not provide justification (loading assumptions, casing design criteria). (Assumption bulleted above)	N
Will the intermediate pipe be kept at a minimum 1/3 fluid filled to avoid approaching the collapse pressure rating of the casing?	Y
Is well located within Capitan Reef?	N
If yes, does production casing cement tie back a minimum of 50' above the Reef?	
Is well within the designated 4 string boundary.	
Is well located in SOPA but not in R-111-P?	N
If yes, are the first 2 strings cemented to surface and 3rd string cement tied back 500' into previous casing?	
Is well located in R-111-P and SOPA?	N
If yes, are the first three strings cemented to surface?	
Is 2nd string set 100' to 600' below the base of salt?	
Is well located in high Cave/Karst?	Y
If yes, are there two strings cemented to surface?	Y
(For 2 string wells) If yes, is there a contingency casing if lost circulation occurs?	
Is well located in critical Cave/Karst?	N
If yes, are there three strings cemented to surface?	N

3. Cementing Program → SEE COA

Casing	# Sks	Wt. lb/ gal	Yld ft3/ sack	H_20 gal/sk	500# Comp. Strength (hours)	Slurry Description
Surf	600	14.8	1.34	6.53	5-8	Class C + 1% CaCl
Inter 1	550	13.5	1.76	9.37	10-15	Class C + 4% Gel + 1% CaCl
	250	14.8	1.34	6.53	5-8	Class C + 2% CaCl
Inter 2	1000	11.9	2.51	14.7	50-60	50:50:10 H Blend
	400	16.4	1.1	4.45	10-12	Class H
Prod. Csg	150	11.9	2.5	14.7	50-60	50:50:10 H Blend
	3000	14.4	1.23	5.52	15-20	50:50:2 H Blend

Low Cement →

- Due to this being cave/ karst the lead is specified. This presents an issue with the lead due to the time it will take to get to 500 psi. The 11.9# 50:50:10 H cement is the best cement for the lead being pumped at 6850' to ensure quality cement for the life of the well and being able to circulate cmt.

- Pilot Hole Cement Plugs:
  - Bottom Plug: 375 sx Class H (17.2 ppg / 0.98 yd) from 7,600' to 8,400'.
  - Kick off Plug: 375 sx Class H (17.2 ppg / 0.98 yd) from 7,600' 6,800'.

Casing String	TOC	% Excess
Surface	0'	50%
Intermediate	0'	50%
Intermediate 2	0'	40%
Production	6000'	30%

4. Pressure Control Equipment → SEE COA

	A variance is requested for the use of a diverter on the surface casing. See attached for schematic.

BOP installed and tested before drilling which hole?	Size?	System Rated WP	Type	✓	Tested to:
17.5"	20"	2M	Annular	X	50% of working pressure
			Blind Ram		WP
			Pipe Ram		
			Double Ram		
			Other*		
12.25"	13-5/8"	3M	Annular	X	50% testing pressure
			Blind Ram	X	WP
			Pipe Ram	X	
			Double Ram		
			Other*		
8.5"	13-5/8"	5M	Annular	X	50% testing pressure
			Blind Ram	X	WP
			Pipe Ram	X	
			Double Ram		
			Other*		

*Specify if additional ram is utilized.

BOP/BOPE will be tested by an independent service company to 250 psi low and the high pressure indicated above per Onshore Order 2 requirements. The System may be upgraded to a higher pressure but still tested to the working pressure listed in the table above. If the system is upgraded all the components installed will be functional and tested.

Pipe rams will be operationally checked each 24 hour period. Blind rams will be operationally checked on each trip out of the hole. These checks will be noted on the daily tour sheets. Other accessories to the BOP equipment will include a Kelly cock and floor safety valve (inside BOP) and choke lines and choke manifold. See attached schematics.

Y	Formation integrity test will be performed per Onshore Order #2. On Exploratory wells or on that portion of any well approved for a 5M BOPE system or greater, a pressure integrity test of each casing shoe shall be performed. Will be tested in accordance with Onshore Oil and Gas Order #2 III.B.1.i.
Y	A variance is requested for the use of a flexible choke line from the BOP to Choke Manifold. See attached for specs and hydrostatic test chart.
N	Are anchors required by manufacturer?
N	A multibowl wellhead is being used. The BOP will be tested per Onshore Order #2 after installation on the surface casing which will cover testing requirements for a maximum of 30 days. If any seal subject to test pressure is broken the system must be tested. See attached schematic.

5. Mud Program

Depth		Type	Weight (ppg)	Viscosity	Water Loss
From	**To**				
0'	Surf Shoe	Fresh Water	8.4 – 8.6	28 – 34	N/C
Surf Shoe	Intrmd Shoe	Saturated Brine	10.0-10.2	28-34	N/C
Intrmd Shoe	Intrd 2 Shoe	Cut Brine	8.9-9.4	28-34	N/C
Intrd 2 Shoe	PHTD	Cut Brine	9.2 – 9.6	28-34	N/C
KOP	TD	OBM	11.0-12.0	40-60	~20

Sufficient mud materials to maintain mud properties and meet minimum lost circulation and weight increase requirements will be kept on location at all times.

What will be used to monitor the loss or gain of fluid?	PVT/Pason/Visual Monitoring

6. Logging and Testing Procedures

Logging, Coring and Testing.	
Y	Will run GR/CNL from TD to surface (horizontal well – vertical portion of hole). Stated logs run will be in the Completion Report and submitted to the BLM.
N	No Logs are planned based on well control or offset log information.
N	Drill stem test? If yes, explain
N	Coring? If yes, explain – NA

7. Drilling Conditions

Condition	Specify what type and where?
BH Pressure at deepest TVD	4800 psi
Abnormal Temperature	No

Hydrogen Sulfide (H2S) monitors will be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the operator will comply with the provisions of Onshore Oil and Gas Order #6. If Hydrogen Sulfide is encountered, measured values and formations will be provided to the BLM.	
N	H2S is present
Y	H2S Plan attached

8. Other facets of operation

Is this a walking operation? NO. If yes, describe.
Will be pre-setting casing? NO. If yes, describe.

Attachments
_Y_ Directional Plan

COG OPERATING LLC

EDDY COUNTY, NM
HELLFIRE
CAVERNS FEDERAL COM #4H

OWB

Plan: PWP0

Survey Report - Geographic

22 November, 2016

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	**Local Co-ordinate Reference:**	Well CAVERNS FEDERAL COM #4H
Project:	EDDY COUNTY, NM	**TVD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Site:	HELLFIRE	**MD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Well:	CAVERNS FEDERAL COM #4H	**North Reference:**	Grid
Wellbore:	OWB	**Survey Calculation Method:**	Minimum Curvature
Design:	PWP0	**Database:**	EDM_Users

Project	EDDY 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	HELLFIRE				
Site Position:		**Northing:**	376,102.80 usft	**Latitude:**	32° 2' 2.399 N
From:	Map	**Easting:**	477,108.80 usft	**Longitude:**	104° 24' 25.936 W
Position Uncertainty:	0.0 usft	**Slot Radius:**	13-3/16 "	**Grid Convergence:**	-0.04 °

Well	CAVERNS FEDERAL COM #4H					
Well Position	**+N/-S**	0.0 usft	**Northing:**	376,102.80 usf	**Latitude:**	32° 2' 2.399 N
	+E/-W	0.0 usft	**Easting:**	477,108.80 usf	**Longitude:**	104° 24' 25.936 W
Position Uncertainty		3.0 usft	**Wellhead Elevation:**	usf	**Ground Level:**	3,727.2 usf

Wellbore	OWB				
Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	WMM2015	11/22/2016	7.40	59.74	47,779.62387225

Design	PWP0				
Audit Notes:					
Version:		**Phase:**	PROTOTYPE	**Tie On Depth:**	0.0
Vertical Section:	**Depth From (TVD) (usft)**	**+N/-S (usft)**	**+E/-W (usft)**	**Direction (°)**	
	7,600.0	0.0	0.0	180.47	

Survey Tool Program	**Date** 11/22/2016			
From (usft)	**To (usft)**	**Survey (Wellbore)**	**Tool Name**	**Description**
0.0	19,397.6	PWP0 (OWB)	MWD	OWSG MWD - Standard

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.0	0.00	0.00	0.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
100.0	0.00	0.00	100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
200.0	0.00	0.00	200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
300.0	0.00	0.00	300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
400.0	0.00	0.00	400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
500.0	0.00	0.00	500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
600.0	0.00	0.00	600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
700.0	0.00	0.00	700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
800.0	0.00	0.00	800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
900.0	0.00	0.00	900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,000.0	0.00	0.00	1,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,100.0	0.00	0.00	1,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	**Local Co-ordinate Reference:**	Well CAVERNS FEDERAL COM #4H
Project:	EDDY COUNTY, NM	**TVD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Site:	HELLFIRE	**MD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Well:	CAVERNS FEDERAL COM #4H	**North Reference:**	Grid
Wellbore:	OWB	**Survey Calculation Method:**	Minimum Curvature
Design:	PWP0	**Database:**	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
1,200.0	0.00	0.00	1,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,300.0	0.00	0.00	1,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,400.0	0.00	0.00	1,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,500.0	0.00	0.00	1,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,600.0	0.00	0.00	1,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,700.0	0.00	0.00	1,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,800.0	0.00	0.00	1,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
1,900.0	0.00	0.00	1,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,000.0	0.00	0.00	2,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,100.0	0.00	0.00	2,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,200.0	0.00	0.00	2,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,300.0	0.00	0.00	2,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,400.0	0.00	0.00	2,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,500.0	0.00	0.00	2,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,600.0	0.00	0.00	2,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,700.0	0.00	0.00	2,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,800.0	0.00	0.00	2,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
2,900.0	0.00	0.00	2,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,000.0	0.00	0.00	3,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,100.0	0.00	0.00	3,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,200.0	0.00	0.00	3,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,300.0	0.00	0.00	3,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,400.0	0.00	0.00	3,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,500.0	0.00	0.00	3,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,600.0	0.00	0.00	3,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,700.0	0.00	0.00	3,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,800.0	0.00	0.00	3,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
3,900.0	0.00	0.00	3,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,000.0	0.00	0.00	4,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,100.0	0.00	0.00	4,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,200.0	0.00	0.00	4,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,300.0	0.00	0.00	4,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,400.0	0.00	0.00	4,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,500.0	0.00	0.00	4,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,600.0	0.00	0.00	4,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,700.0	0.00	0.00	4,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,800.0	0.00	0.00	4,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
4,900.0	0.00	0.00	4,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,000.0	0.00	0.00	5,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,100.0	0.00	0.00	5,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,200.0	0.00	0.00	5,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,300.0	0.00	0.00	5,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,400.0	0.00	0.00	5,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,500.0	0.00	0.00	5,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,600.0	0.00	0.00	5,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,700.0	0.00	0.00	5,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,800.0	0.00	0.00	5,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
5,900.0	0.00	0.00	5,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,000.0	0.00	0.00	6,000.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,100.0	0.00	0.00	6,100.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,200.0	0.00	0.00	6,200.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,300.0	0.00	0.00	6,300.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,400.0	0.00	0.00	6,400.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,500.0	0.00	0.00	6,500.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,600.0	0.00	0.00	6,600.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	**Local Co-ordinate Reference:**	Well CAVERNS FEDERAL COM #4H
Project:	EDDY COUNTY, NM	**TVD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Site:	HELLFIRE	**MD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Well:	CAVERNS FEDERAL COM #4H	**North Reference:**	Grid
Wellbore:	OWB	**Survey Calculation Method:**	Minimum Curvature
Design:	PWP0	**Database:**	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
6,700.0	0.00	0.00	6,700.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,800.0	0.00	0.00	6,800.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,900.0	0.00	0.00	6,900.0	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
6,972.5	0.00	0.00	6,972.5	0.0	0.0	376,102.80	477,108.80	32° 2' 2.399 N	104° 24' 25.936 W
7,000.0	3.30	180.47	7,000.0	-0.8	0.0	376,102.01	477,108.79	32° 2' 2.391 N	104° 24' 25.936 W
7,100.0	15.30	180.47	7,098.5	-16.9	-0.1	376,085.88	477,108.66	32° 2' 2.231 N	104° 24' 25.937 W
7,200.0	27.30	180.47	7,191.5	-53.2	-0.4	376,049.63	477,108.36	32° 2' 1.872 N	104° 24' 25.941 W
7,300.0	39.29	180.47	7,274.9	-108.0	-0.9	375,994.83	477,107.92	32° 2' 1.330 N	104° 24' 25.945 W
7,400.0	51.29	180.47	7,345.1	-178.9	-1.5	375,923.90	477,107.33	32° 2' 0.628 N	104° 24' 25.952 W
7,500.0	63.29	180.47	7,399.1	-262.9	-2.2	375,839.91	477,106.64	32° 1' 59.797 N	104° 24' 25.959 W
7,600.0	75.29	180.47	7,434.4	-356.3	-2.9	375,746.55	477,105.88	32° 1' 58.873 N	104° 24' 25.967 W
7,700.0	87.29	180.47	7,449.5	-454.9	-3.7	375,647.88	477,105.07	32° 1' 57.896 N	104° 24' 25.976 W
7,716.5	89.26	180.47	7,450.0	-471.4	-3.9	375,631.44	477,104.93	32° 1' 57.734 N	104° 24' 25.977 W
7,794.5	89.26	180.47	7,451.0	-549.4	-4.5	375,553.36	477,104.29	32° 1' 56.961 N	104° 24' 25.984 W
7,800.0	89.26	180.47	7,451.1	-554.9	-4.6	375,547.90	477,104.25	32° 1' 56.907 N	104° 24' 25.984 W
7,900.0	89.26	180.47	7,452.4	-654.9	-5.4	375,447.91	477,103.43	32° 1' 55.917 N	104° 24' 25.993 W
8,000.0	89.26	180.47	7,453.7	-754.9	-6.2	375,347.93	477,102.61	32° 1' 54.928 N	104° 24' 26.002 W
8,100.0	89.26	180.47	7,455.0	-854.9	-7.0	375,247.94	477,101.79	32° 1' 53.938 N	104° 24' 26.011 W
8,200.0	89.26	180.47	7,456.2	-954.8	-7.8	375,147.95	477,100.97	32° 1' 52.949 N	104° 24' 26.019 W
8,300.0	89.26	180.47	7,457.5	-1,054.8	-8.7	375,047.96	477,100.15	32° 1' 51.959 N	104° 24' 26.028 W
8,400.0	89.26	180.47	7,458.8	-1,154.8	-9.5	374,947.97	477,099.33	32° 1' 50.970 N	104° 24' 26.037 W
8,500.0	89.26	180.47	7,460.1	-1,254.8	-10.3	374,847.98	477,098.51	32° 1' 49.980 N	104° 24' 26.046 W
8,600.0	89.26	180.47	7,461.4	-1,354.8	-11.1	374,748.00	477,097.69	32° 1' 48.990 N	104° 24' 26.054 W
8,700.0	89.26	180.47	7,462.7	-1,454.8	-11.9	374,648.01	477,096.87	32° 1' 48.001 N	104° 24' 26.063 W
8,800.0	89.26	180.47	7,464.0	-1,554.8	-12.8	374,548.02	477,096.05	32° 1' 47.011 N	104° 24' 26.072 W
8,900.0	89.26	180.47	7,465.3	-1,654.8	-13.6	374,448.03	477,095.23	32° 1' 46.022 N	104° 24' 26.081 W
9,000.0	89.26	180.47	7,466.6	-1,754.8	-14.4	374,348.04	477,094.40	32° 1' 45.032 N	104° 24' 26.089 W
9,100.0	89.26	180.47	7,467.9	-1,854.7	-15.2	374,248.05	477,093.58	32° 1' 44.043 N	104° 24' 26.098 W
9,200.0	89.26	180.47	7,469.2	-1,954.7	-16.0	374,148.07	477,092.76	32° 1' 43.053 N	104° 24' 26.107 W
9,300.0	89.26	180.47	7,470.4	-2,054.7	-16.9	374,048.08	477,091.94	32° 1' 42.064 N	104° 24' 26.115 W
9,400.0	89.26	180.47	7,471.7	-2,154.7	-17.7	373,948.09	477,091.12	32° 1' 41.074 N	104° 24' 26.124 W
9,500.0	89.26	180.47	7,473.0	-2,254.7	-18.5	373,848.10	477,090.30	32° 1' 40.084 N	104° 24' 26.133 W
9,600.0	89.26	180.47	7,474.3	-2,354.7	-19.3	373,748.11	477,089.48	32° 1' 39.095 N	104° 24' 26.142 W
9,700.0	89.26	180.47	7,475.6	-2,454.7	-20.1	373,648.12	477,088.66	32° 1' 38.105 N	104° 24' 26.150 W
9,800.0	89.26	180.47	7,476.9	-2,554.7	-21.0	373,548.14	477,087.84	32° 1' 37.116 N	104° 24' 26.159 W
9,900.0	89.26	180.47	7,478.2	-2,654.7	-21.8	373,448.15	477,087.02	32° 1' 36.126 N	104° 24' 26.168 W
10,000.0	89.26	180.47	7,479.5	-2,754.6	-22.6	373,348.16	477,086.20	32° 1' 35.137 N	104° 24' 26.177 W
10,100.0	89.26	180.47	7,480.8	-2,854.6	-23.4	373,248.17	477,085.38	32° 1' 34.147 N	104° 24' 26.185 W
10,200.0	89.26	180.47	7,482.1	-2,954.6	-24.2	373,148.18	477,084.56	32° 1' 33.157 N	104° 24' 26.194 W
10,300.0	89.26	180.47	7,483.4	-3,054.6	-25.1	373,048.19	477,083.74	32° 1' 32.168 N	104° 24' 26.203 W
10,400.0	89.26	180.47	7,484.7	-3,154.6	-25.9	372,948.21	477,082.92	32° 1' 31.178 N	104° 24' 26.212 W
10,500.0	89.26	180.47	7,485.9	-3,254.6	-26.7	372,848.22	477,082.10	32° 1' 30.189 N	104° 24' 26.220 W
10,600.0	89.26	180.47	7,487.2	-3,354.6	-27.5	372,748.23	477,081.28	32° 1' 29.199 N	104° 24' 26.229 W
10,700.0	89.26	180.47	7,488.5	-3,454.6	-28.3	372,648.24	477,080.46	32° 1' 28.210 N	104° 24' 26.238 W
10,800.0	89.26	180.47	7,489.8	-3,554.5	-29.2	372,548.25	477,079.64	32° 1' 27.220 N	104° 24' 26.246 W
10,900.0	89.26	180.47	7,491.1	-3,654.5	-30.0	372,448.26	477,078.82	32° 1' 26.231 N	104° 24' 26.255 W
11,000.0	89.26	180.47	7,492.4	-3,754.5	-30.8	372,348.28	477,078.00	32° 1' 25.241 N	104° 24' 26.264 W
11,100.0	89.26	180.47	7,493.7	-3,854.5	-31.6	372,248.29	477,077.18	32° 1' 24.251 N	104° 24' 26.273 W
11,200.0	89.26	180.47	7,495.0	-3,954.5	-32.4	372,148.30	477,076.36	32° 1' 23.262 N	104° 24' 26.281 W
11,300.0	89.26	180.47	7,496.3	-4,054.5	-33.3	372,048.31	477,075.54	32° 1' 22.272 N	104° 24' 26.290 W
11,400.0	89.26	180.47	7,497.6	-4,154.5	-34.1	371,948.32	477,074.72	32° 1' 21.283 N	104° 24' 26.299 W
11,500.0	89.26	180.47	7,498.9	-4,254.5	-34.9	371,848.33	477,073.90	32° 1' 20.293 N	104° 24' 26.308 W
11,600.0	89.26	180.47	7,500.2	-4,354.5	-35.7	371,748.35	477,073.08	32° 1' 19.304 N	104° 24' 26.316 W
11,700.0	89.26	180.47	7,501.4	-4,454.4	-36.5	371,648.36	477,072.26	32° 1' 18.314 N	104° 24' 26.325 W
11,800.0	89.26	180.47	7,502.7	-4,554.4	-37.4	371,548.37	477,071.44	32° 1' 17.325 N	104° 24' 26.334 W

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	**Local Co-ordinate Reference:**	Well CAVERNS FEDERAL COM #4H
Project:	EDDY COUNTY, NM	**TVD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Site:	HELLFIRE	**MD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Well:	CAVERNS FEDERAL COM #4H	**North Reference:**	Grid
Wellbore:	OWB	**Survey Calculation Method:**	Minimum Curvature
Design:	PWP0	**Database:**	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
11,900.0	89.26	180.47	7,504.0	-4,654.4	-38.2	371,448.38	477,070.62	32° 1' 16.335 N	104° 24' 26.343 W
12,000.0	89.26	180.47	7,505.3	-4,754.4	-39.0	371,348.39	477,069.80	32° 1' 15.345 N	104° 24' 26.351 W
12,100.0	89.26	180.47	7,506.6	-4,854.4	-39.8	371,248.41	477,068.98	32° 1' 14.356 N	104° 24' 26.360 W
12,200.0	89.26	180.47	7,507.9	-4,954.4	-40.6	371,148.42	477,068.16	32° 1' 13.366 N	104° 24' 26.369 W
12,300.0	89.26	180.47	7,509.2	-5,054.4	-41.5	371,048.43	477,067.34	32° 1' 12.377 N	104° 24' 26.377 W
12,400.0	89.26	180.47	7,510.5	-5,154.4	-42.3	370,948.44	477,066.52	32° 1' 11.387 N	104° 24' 26.386 W
12,500.0	89.26	180.47	7,511.8	-5,254.3	-43.1	370,848.45	477,065.70	32° 1' 10.398 N	104° 24' 26.395 W
12,600.0	89.26	180.47	7,513.1	-5,354.3	-43.9	370,748.46	477,064.88	32° 1' 9.408 N	104° 24' 26.404 W
12,700.0	89.26	180.47	7,514.4	-5,454.3	-44.7	370,648.48	477,064.06	32° 1' 8.419 N	104° 24' 26.412 W
12,800.0	89.26	180.47	7,515.7	-5,554.3	-45.6	370,548.49	477,063.24	32° 1' 7.429 N	104° 24' 26.421 W
12,900.0	89.26	180.47	7,516.9	-5,654.3	-46.4	370,448.50	477,062.42	32° 1' 6.439 N	104° 24' 26.430 W
13,000.0	89.26	180.47	7,518.2	-5,754.3	-47.2	370,348.51	477,061.60	32° 1' 5.450 N	104° 24' 26.439 W
13,100.0	89.26	180.47	7,519.5	-5,854.3	-48.0	370,248.52	477,060.78	32° 1' 4.460 N	104° 24' 26.447 W
13,200.0	89.26	180.47	7,520.8	-5,954.3	-48.8	370,148.53	477,059.96	32° 1' 3.471 N	104° 24' 26.456 W
13,300.0	89.26	180.47	7,522.1	-6,054.3	-49.7	370,048.55	477,059.14	32° 1' 2.481 N	104° 24' 26.465 W
13,400.0	89.26	180.47	7,523.4	-6,154.2	-50.5	369,948.56	477,058.31	32° 1' 1.492 N	104° 24' 26.474 W
13,500.0	89.26	180.47	7,524.7	-6,254.2	-51.3	369,848.57	477,057.49	32° 1' 0.502 N	104° 24' 26.482 W
13,600.0	89.26	180.47	7,526.0	-6,354.2	-52.1	369,748.58	477,056.67	32° 0' 59.512 N	104° 24' 26.491 W
13,700.0	89.26	180.47	7,527.3	-6,454.2	-52.9	369,648.59	477,055.85	32° 0' 58.523 N	104° 24' 26.500 W
13,800.0	89.26	180.47	7,528.6	-6,554.2	-53.8	369,548.60	477,055.03	32° 0' 57.533 N	104° 24' 26.508 W
13,900.0	89.26	180.47	7,529.9	-6,654.2	-54.6	369,448.62	477,054.21	32° 0' 56.544 N	104° 24' 26.517 W
14,000.0	89.26	180.47	7,531.1	-6,754.2	-55.4	369,348.63	477,053.39	32° 0' 55.554 N	104° 24' 26.526 W
14,100.0	89.26	180.47	7,532.4	-6,854.2	-56.2	369,248.64	477,052.57	32° 0' 54.565 N	104° 24' 26.535 W
14,200.0	89.26	180.47	7,533.7	-6,954.1	-57.0	369,148.65	477,051.75	32° 0' 53.575 N	104° 24' 26.543 W
14,300.0	89.26	180.47	7,535.0	-7,054.1	-57.9	369,048.66	477,050.93	32° 0' 52.586 N	104° 24' 26.552 W
14,400.0	89.26	180.47	7,536.3	-7,154.1	-58.7	368,948.67	477,050.11	32° 0' 51.596 N	104° 24' 26.561 W
14,500.0	89.26	180.47	7,537.6	-7,254.1	-59.5	368,848.69	477,049.29	32° 0' 50.606 N	104° 24' 26.570 W
14,600.0	89.26	180.47	7,538.9	-7,354.1	-60.3	368,748.70	477,048.47	32° 0' 49.617 N	104° 24' 26.578 W
14,700.0	89.26	180.47	7,540.2	-7,454.1	-61.1	368,648.71	477,047.65	32° 0' 48.627 N	104° 24' 26.587 W
14,800.0	89.26	180.47	7,541.5	-7,554.1	-62.0	368,548.72	477,046.83	32° 0' 47.638 N	104° 24' 26.596 W
14,900.0	89.26	180.47	7,542.8	-7,654.1	-62.8	368,448.73	477,046.01	32° 0' 46.648 N	104° 24' 26.604 W
15,000.0	89.26	180.47	7,544.1	-7,754.1	-63.6	368,348.74	477,045.19	32° 0' 45.659 N	104° 24' 26.613 W
15,100.0	89.26	180.47	7,545.4	-7,854.0	-64.4	368,248.76	477,044.37	32° 0' 44.669 N	104° 24' 26.622 W
15,200.0	89.26	180.47	7,546.6	-7,954.0	-65.2	368,148.77	477,043.55	32° 0' 43.680 N	104° 24' 26.631 W
15,300.0	89.26	180.47	7,547.9	-8,054.0	-66.1	368,048.78	477,042.73	32° 0' 42.690 N	104° 24' 26.639 W
15,400.0	89.26	180.47	7,549.2	-8,154.0	-66.9	367,948.79	477,041.91	32° 0' 41.700 N	104° 24' 26.648 W
15,500.0	89.26	180.47	7,550.5	-8,254.0	-67.7	367,848.80	477,041.09	32° 0' 40.711 N	104° 24' 26.657 W
15,600.0	89.26	180.47	7,551.8	-8,354.0	-68.5	367,748.81	477,040.27	32° 0' 39.721 N	104° 24' 26.666 W
15,700.0	89.26	180.47	7,553.1	-8,454.0	-69.4	367,648.83	477,039.45	32° 0' 38.732 N	104° 24' 26.674 W
15,800.0	89.26	180.47	7,554.4	-8,554.0	-70.2	367,548.84	477,038.63	32° 0' 37.742 N	104° 24' 26.683 W
15,900.0	89.26	180.47	7,555.7	-8,653.9	-71.0	367,448.85	477,037.81	32° 0' 36.753 N	104° 24' 26.692 W
16,000.0	89.26	180.47	7,557.0	-8,753.9	-71.8	367,348.86	477,036.99	32° 0' 35.763 N	104° 24' 26.701 W
16,100.0	89.26	180.47	7,558.3	-8,853.9	-72.6	367,248.87	477,036.17	32° 0' 34.773 N	104° 24' 26.709 W
16,200.0	89.26	180.47	7,559.6	-8,953.9	-73.5	367,148.88	477,035.35	32° 0' 33.784 N	104° 24' 26.718 W
16,300.0	89.26	180.47	7,560.9	-9,053.9	-74.3	367,048.90	477,034.53	32° 0' 32.794 N	104° 24' 26.727 W
16,400.0	89.26	180.47	7,562.1	-9,153.9	-75.1	366,948.91	477,033.71	32° 0' 31.805 N	104° 24' 26.735 W
16,500.0	89.26	180.47	7,563.4	-9,253.9	-75.9	366,848.92	477,032.89	32° 0' 30.815 N	104° 24' 26.744 W
16,600.0	89.26	180.47	7,564.7	-9,353.9	-76.7	366,748.93	477,032.07	32° 0' 29.826 N	104° 24' 26.753 W
16,700.0	89.26	180.47	7,566.0	-9,453.9	-77.6	366,648.94	477,031.25	32° 0' 28.836 N	104° 24' 26.762 W
16,800.0	89.26	180.47	7,567.3	-9,553.8	-78.4	366,548.96	477,030.43	32° 0' 27.847 N	104° 24' 26.770 W
16,900.0	89.26	180.47	7,568.6	-9,653.8	-79.2	366,448.97	477,029.61	32° 0' 26.857 N	104° 24' 26.779 W
17,000.0	89.26	180.47	7,569.9	-9,753.8	-80.0	366,348.98	477,028.79	32° 0' 25.867 N	104° 24' 26.788 W
17,100.0	89.26	180.47	7,571.2	-9,853.8	-80.8	366,248.99	477,027.97	32° 0' 24.878 N	104° 24' 26.797 W
17,200.0	89.26	180.47	7,572.5	-9,953.8	-81.7	366,149.00	477,027.15	32° 0' 23.888 N	104° 24' 26.805 W
17,300.0	89.26	180.47	7,573.8	-10,053.8	-82.5	366,049.01	477,026.33	32° 0' 22.899 N	104° 24' 26.814 W

COG Operating LLC

Survey Report - Geographic

Company:	COG OPERATING LLC	**Local Co-ordinate Reference:**	Well CAVERNS FEDERAL COM #4H
Project:	EDDY COUNTY, NM	**TVD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Site:	HELLFIRE	**MD Reference:**	RKB=3727.2+25 @ 3752.2usft (LATSHAW 44)
Well:	CAVERNS FEDERAL COM #4H	**North Reference:**	Grid
Wellbore:	OWB	**Survey Calculation Method:**	Minimum Curvature
Design:	PWP0	**Database:**	EDM_Users

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
17,400.0	89.26	180.47	7,575.1	-10,153.8	-83.3	365,949.03	477,025.51	32° 0' 21.909 N	104° 24' 26.823 W
17,500.0	89.26	180.47	7,576.4	-10,253.8	-84.1	365,849.04	477,024.69	32° 0' 20.920 N	104° 24' 26.831 W
17,600.0	89.26	180.47	7,577.6	-10,353.7	-84.9	365,749.05	477,023.87	32° 0' 19.930 N	104° 24' 26.840 W
17,700.0	89.26	180.47	7,578.9	-10,453.7	-85.8	365,649.06	477,023.05	32° 0' 18.940 N	104° 24' 26.849 W
17,800.0	89.26	180.47	7,580.2	-10,553.7	-86.6	365,549.07	477,022.22	32° 0' 17.951 N	104° 24' 26.858 W
17,900.0	89.26	180.47	7,581.5	-10,653.7	-87.4	365,449.08	477,021.40	32° 0' 16.961 N	104° 24' 26.866 W
18,000.0	89.26	180.47	7,582.8	-10,753.7	-88.2	365,349.10	477,020.58	32° 0' 15.972 N	104° 24' 26.875 W
18,100.0	89.26	180.47	7,584.1	-10,853.7	-89.0	365,249.11	477,019.76	32° 0' 14.982 N	104° 24' 26.884 W
18,200.0	89.26	180.47	7,585.4	-10,953.7	-89.9	365,149.12	477,018.94	32° 0' 13.993 N	104° 24' 26.893 W
18,300.0	89.26	180.47	7,586.7	-11,053.7	-90.7	365,049.13	477,018.12	32° 0' 13.003 N	104° 24' 26.901 W
18,400.0	89.26	180.47	7,588.0	-11,153.7	-91.5	364,949.14	477,017.30	32° 0' 12.014 N	104° 24' 26.910 W
18,500.0	89.26	180.47	7,589.3	-11,253.6	-92.3	364,849.15	477,016.48	32° 0' 11.024 N	104° 24' 26.919 W
18,600.0	89.26	180.47	7,590.6	-11,353.6	-93.1	364,749.17	477,015.66	32° 0' 10.034 N	104° 24' 26.928 W
18,700.0	89.26	180.47	7,591.9	-11,453.6	-94.0	364,649.18	477,014.84	32° 0' 9.045 N	104° 24' 26.936 W
18,800.0	89.26	180.47	7,593.1	-11,553.6	-94.8	364,549.19	477,014.02	32° 0' 8.055 N	104° 24' 26.945 W
18,900.0	89.26	180.47	7,594.4	-11,653.6	-95.6	364,449.20	477,013.20	32° 0' 7.066 N	104° 24' 26.954 W
19,000.0	89.26	180.47	7,595.7	-11,753.6	-96.4	364,349.21	477,012.38	32° 0' 6.076 N	104° 24' 26.962 W
19,100.0	89.26	180.47	7,597.0	-11,853.6	-97.2	364,249.22	477,011.56	32° 0' 5.087 N	104° 24' 26.971 W
19,200.0	89.26	180.47	7,598.3	-11,953.6	-98.1	364,149.24	477,010.74	32° 0' 4.097 N	104° 24' 26.980 W
19,300.0	89.26	180.47	7,599.6	-12,053.6	-98.9	364,049.25	477,009.92	32° 0' 3.107 N	104° 24' 26.989 W
19,397.7	89.26	180.47	7,600.0	-12,151.2	-100.0	363,951.60	477,008.80	32° 0' 2.141 N	104° 24' 27.001 W

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
PBHL-Caverns Fed - plan hits target center - Point	0.00	0.00	7,600.0	-12,151.2	-100.0	363,951.60	477,008.80	32° 0' 2.141 N	104° 24' 27.001 W

Checked By: _____ Approved By: _____ Date: _____

WELL DETAILS: ***CAVERNS FEDERAL COM #4H***

3727.2

+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	376102.80	477108.80	32° 2' 2.399 N	104° 24' 25.936 W	

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Annotation
1	0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.0	
2	6972.5	0.00	0.00	6972.5	0.0	0.0	0.00	0.00	0.0	
3	7716.5	89.26	180.47	7450.0	-471.4	-3.9	12.00	180.47	471.4	
4	7794.5	89.26	180.47	7451.0	-549.4	-4.5	0.00	0.00	549.5	
5	19397.7	89.26	180.47	7600.0	-12151.2	-100.0	0.00	0.00	12151.6	

LEGEND

PWP0