Form 3160-5
(June 2015)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Carlsbad Field Office
OCD Artesia

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.

SUBMIT IN TRIPLICATE - Other instructions on page 2

1. Type of Well ☒ Oil Well ☐ Gas Well ☐ Other	5. Lease Serial No. NMNM104667
	6. If Indian, Allottee or Tribe Name
	7. If Unit or CA/Agreement, Name and/or No.
	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
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
C102 Attached

Formation:
From: Wildcat S262522F; Bone Spring (Gas)
To: Wildcat; Wolfcamp (Oil)
C102 Attached

- Surface casing depth & surface hole drilling fluid (saturated brine) is not approved by BLM geologist. see attached email.

NM OIL CONSERVATION
ARTESIA DISTRICT
FEB 06 2017
RECEIVED

DENIED

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

Electronic Submission #360822 verified by the BLM Well Information System
For COG OPERATING LLC, sent to the Carlsbad
Committed to AFMSS for processing by JENNIFER SANCHEZ on 12/20/2016 (17JAS0225SE)

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

Signature (Electronic Submission) — Date 12/13/2016

THIS SPACE FOR FEDERAL OR STATE OFFICE USE

Approved By DENIED — MUSTAFA HAQUE, Title PETROLEUM ENGINEER — Date 01/24/2017

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 #360822 that would not fit on the form

32. Additional remarks, continued

Drilling:
Drilling and directional plans attached.

DISTRICT I
1625 N. FRENCH DR., HOBBS, NM 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. FIRST ST., ARTESIA, NM 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 RIO BRAZOS RD., AZTEC, NM 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. ST. FRANCIS DR., SANTA FE, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department
OIL CONSERVATION DIVISION
1220 SOUTH ST. FRANCIS DR.
Santa Fe, New Mexico 87505

Form C-102
Revised August 1, 2011
Submit one copy to appropriate
District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name
30-015-43291		Wildcat; Wolfcamp

Property Code	Property Name	Well Number
315067	CAVERNS FEDERAL COM	#4H

OGRID No.	Operator Name	Elevation
229137	COG OPERATING, LLC	3727.2'

Surface Location

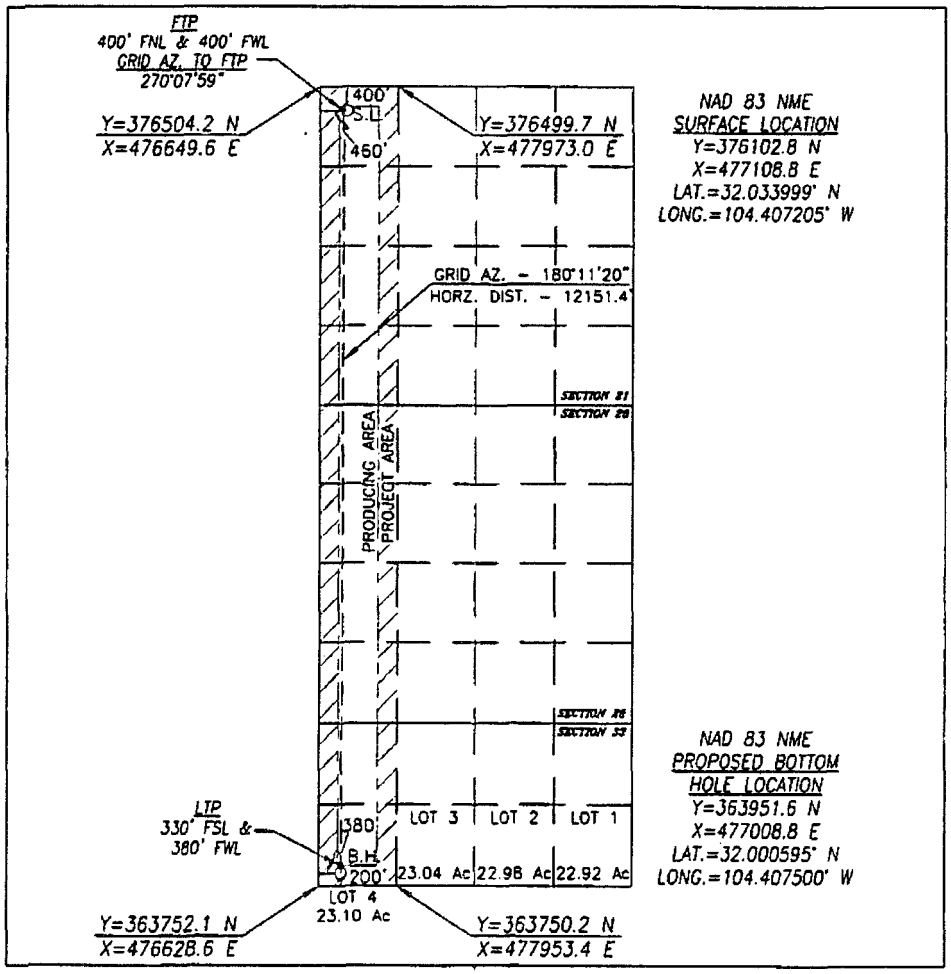
UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	21	26-S	25-E		400	NORTH	460	WEST	EDDY

Bottom Hole Location If Different From Surface

UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
4	33	26-S	25-E		200	SOUTH	380	WEST	EDDY

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
382.83			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



OPERATOR CERTIFICATION

I hereby certify that the information herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Mayte Reyes 12-13-16
Signature Date

Mayte Reyes
Printed Name

mreyes1@concho.com
E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

MAY 30, 2014
Date of Survey

Signature & Seal of Professional Surveyor

CHAD L. HARCROW
NEW MEXICO
17777
LICENSED PROFESSIONAL SURVEYOR

Chad Harcrow 10/28/16
Certificate No. CHAD HARCROW 17777

W.O. # 16-835 DRAWN BY: SP

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	Surface	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
17.5"	0'	1225'	13-3/8"	54.5	J55	STC	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

- A 20" conductor that will be set at 120' GL.
- 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?	N
(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

Casing	# Sks	Wt. lb/ gal	Yld ft3/ sack	H_20 gal/sk	500# Comp. Strength (hours)	Slurry Description
Surf.	550	13.5	1.76	9.37	10-15	Class C + 4% Gel + 1% CaCl
	250	14.8	1.36	6.53	5-8	Class C + 2% CaCl
Inter.	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

- 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'.

Low cement – SEE COA

Casing String	TOC	% Excess
Surface	0'	50%
Intermediate Stage 2	0'	40%
Production	600'	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:
12.25"	13-5/8"	3M	Annular	X	50% of working pressure
			Blind Ram		WP
			Pipe Ram		
			Double Ram		
			Other*		
8.5"	13-5/8"	5M	Annular	X	50% testing pressure
			Blind Ram	X	WP
			Pipe Ram	X	
			Double Ram		
			Other*		
			Annular	X	
			Blind Ram	X	
			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.

SEE COA

5. Mud Program

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

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
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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

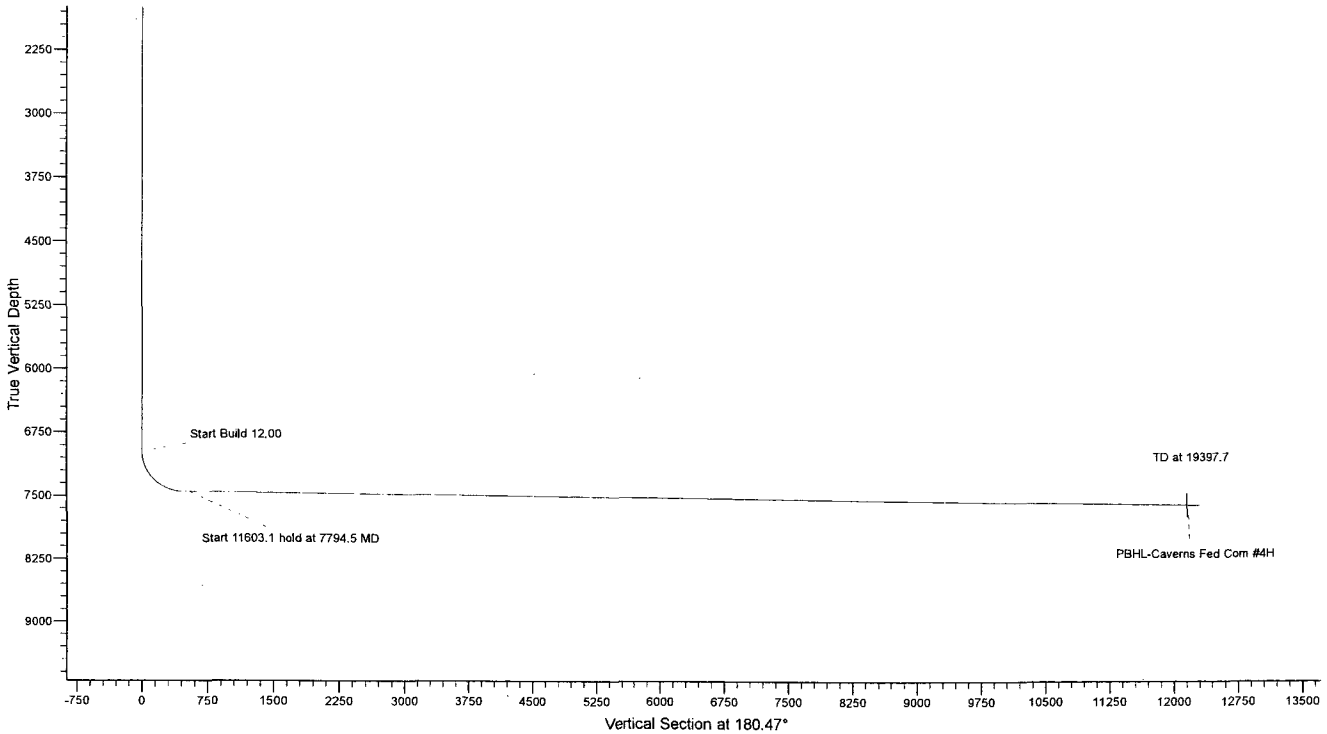
+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	Slot
0.0	0.0	376102.80	477108.80	32° 2' 2.399 N	104° 24' 25.936 W	

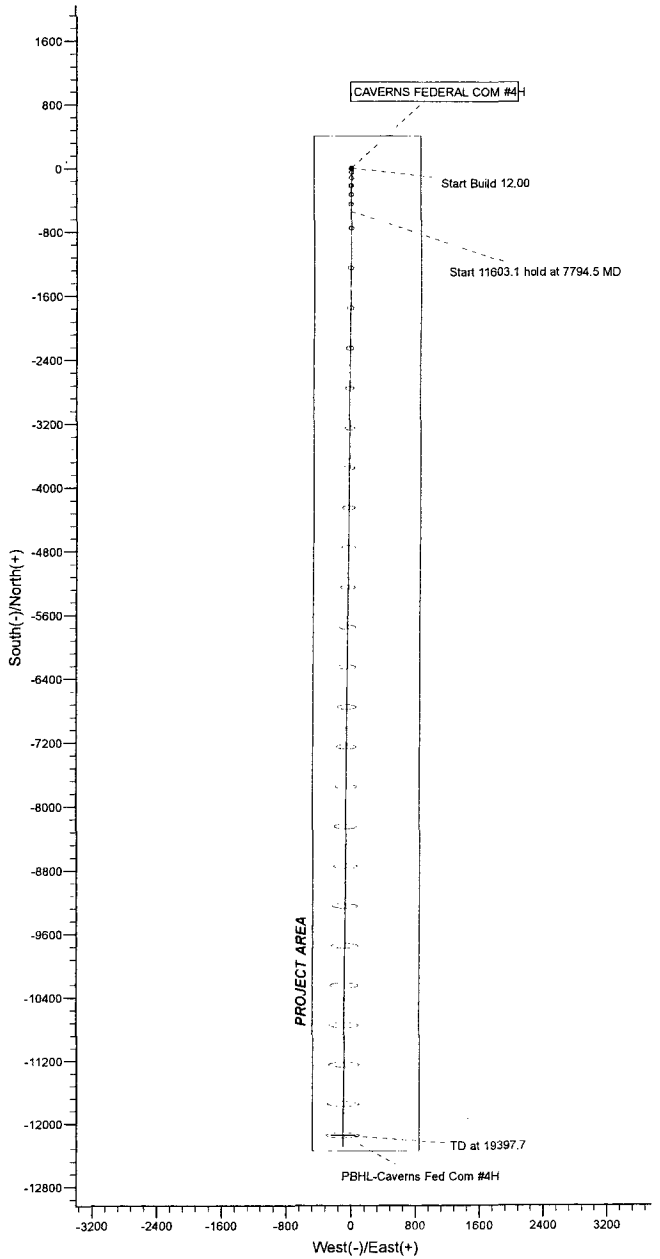
SECTION DETAILS

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





Haque, Mustafa <mhaque@blm.gov>

FW: [External] EC Document Submitted - Caverns Fed Com #4H

Salaz, Robert <rsalaz@blm.gov> Fri, Jan 13, 2017 at 10:16 AM
To: Timothy Smith <TSmith@concho.com>, Teungku Muchlis Krueng <tkrueng@blm.gov>, Mustafa Haque <mhaque@blm.gov>

Tim,

I do understand that concern and it is something that I have had to deal with from my start here at the CFO, but after plenty of conversations with company geologists and reviewing numerous completion reports and mud logs in the vicinity, we feel comfortable that you will not encounter salt. We do not want to drill the surface hole with brine in a high cave karst area.

Being so close to the Guadalupe Escarpment, we expect quite a bit of erosion and alluvial deposits in this area. The Yellowstone 3 Federal 3 encountered TOS at 850 feet and Bell Canyon at 1388 feet. Although this well is approximately 3 miles northeast of the Caverns Federal, It is still likely that salt does not exist to 400 feet. This area is also in a sensitive cave karst area, where groundwater connections are very sensitive. We have approved plenty of wells in this area with fresh water to this depth with no issue. We would first drill with fresh water to 400 feet, then switch to brine and set casing in the Lamar.

The casing program that was initially approved by the BLM is what I would like to see.

If you have any questions or concerns, please feel free to call me at 575-234-5918.

Thanks,
Zeke

Robert Zeke Salaz
Geologist
Bureau of Land Management
Carlsbad Field Office
(575) 234-5918
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