

ATTACHMENT TO FORM 3160-3
10 POINT DRILLING PLAN
Keinath Federal 17-11AH (C16OU)

1. **OPERATOR:** Encana Oil & Gas (USA).
WELL NAME: Keinath Federal 17-11AH (C16OU)

LOCATION (SHL): NE NW 16-8S-96W
568 FNL 2530 FWL
Mesa County, CO

LOCATION (BHL): NE SW 17-8S-96W
2681 FSL 2267 FWL
Mesa County, CO

2. **ESTIMATED TOPS OF GEOLOGICAL MARKERS (MD/TVD)**

Formation	MD	TVD
OHIO CREEK (Top Kmv)	2059	2051
WILLIAMS FORK FM	2532	2524
TOP GAS	3683	3675
Coal Ridge (Paludal)	4527	4519
ROLLINS SS (Iles Fm)	4936	4928
COZZETTE	5164	5156
CORCORAN	5407	5399
MANCOS A	6168	6160
MANCOS B	7002	6994
NIOBRARA	8310	8299

NIOBRARA bottom hole MD/TVD: 14,370' / 8,634' (see directional plan)

3. **ESTIMATED TOPS OF POSSIBLE WATER, OIL, GAS OR MINERALS**

The estimated depths at which possible water, oil, gas or minerals will be encountered are as follows:

<u>Substance</u>	<u>Formation</u>	<u>Depth (TVD)</u>
Water	Wasatch	433'
Gas	Williams Fork	3,675'

The proposed casing and cementing program has been designed to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.

The surface casing shall be cemented back to surface either during the primary cement job or by remedial cementing.

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4. OPERATOR'S SPECIFICATIONS FOR PRESSURE CONTROL EQUIPMENT

- a. Minimum working pressure on rams and BOPE will be 5,000 psi.
- b. Function test and visual inspection of the BOP will be conducted daily and noted in the IADC Daily Drilling Report.
- c. Both high and low pressure tests of the BOPE will be conducted.
- d. The Annular BOP will be pressure tested to a minimum of 50% of its rated working pressure.
- e. Blind and Pipe Rams/BOP will be tested to a minimum of 100% of rated working pressure (against a test plug).
- f. Surface casing will be tested from surface to TD (float collar) at 1,500 psi surface pressure (prior to drilling out the float collar).
- g. All other casing will be pressure tested to 0.22 psi/ft or 1,500 psi, whichever is greater, but not to exceed 70% of the internal yield.
- h. BOP testing procedures and testing frequency will conform to Onshore Order No. 2.
- i. BOP remote controls shall be located on the rig floor at a location readily accessible to the driller. Master controls shall be on the ground at the accumulator and shall have the capability to function all preventors.
- j. The kill line shall be 2" minimum and contain two kill line valves, one of which shall be a check valve.
- k. The choke line shall be 3" minimum and contain two choke line valves (3" minimum).
- l. The choke and manifold shall contain two adjustable chokes.
- m. Hand wheels shall be installed on all ram preventors,
- n. Safety valves and wrenches (with subs for all drill string connections) shall be available on the rig floor at all times.
- o. Inside BOP or float sub shall also be available on the rig floor at all times.
- p. Upper kelly cock valve (with handle) shall be available at all times.

Proposed BOP and Choke Manifold arrangements are attached.

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5. PROPOSED CASING AND CEMENTING PROGRAM (Measured Depths)

The proposed casing and cementing program has been designed to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.

The surface casing shall be cemented back to surface either during the primary cement job or by remedial cementing.

Casing	Depth (MD)	Hole Size (in)	Size (in)	Weight (lb/ft)	Grade	Cement Volume
Conductor	0-40'	+/- 24"	20"	0.25" Wall	X42	+/- 5 yds ready mix (to surface)
Surface	0' – 1,400'	14-3/4"	10-3/4"	40.5#	J-55, STC New	Lead: 427 sxs G Ext 12.5 ppg / 2.11 ft ³ /sx (includes 80% on OH) Tail: 238 sxs G Neat 15.8 ppg / 1.17 ft ³ /sx (No excess) <i>TOC - Surface</i>
Intermediate	0' – 7,590'	9-7/8"	7-5/8"	29.7#	HCP-110, LTC New	Lead: 283 sxs TXI 12.0 ppg / 1.79 ft ³ /sx (includes 30% on OH) Tail: 764 sxs TXI 13.0 ppg / 1.43 ft ³ /sx (includes 30% on OH) <i>TOC – 200ft above Mesaverde</i>
Production	0' – TD	6-1/2"	5"	23.2#	P-110EC, VAM SFC New	449 sxs G (acid soluble) 15.0 ppg / 1.98 ft ³ /sk (includes 30% excess on OH) <i>TOC 500ft inside intermediate casing</i>

Casing String				Casing Strength Properties			Minimum Design Factors		
Size (in)	Weight (lb/ft)	Grade	Connection	Collapse (psi)	Burst (psi)	Tensile (1000 lb)	Collapse	Burst	Tension
10-3/4"	40.5	J-55	STC	1,580	3,130	420	1.00	1.10	1.50*
7-5/8"	29.7	HCP110	LTC	7,150	9,470	769	1.00	1.10	1.50*
5"	23.2	P110EC	VAM SFC	21,840	20,910	647	1.00	1.10	1.50*

*Tension design based on 1.5 OR Max Overpull of 100,000 lbs, whichever provides for higher safety.

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Casing Design Considerations/Safety Factors:

A. Surface casing @ 1,400' MD / 1,380' TVD; 10-3/4" 40.5# J-55 STC

Purpose: Protect shallow fresh water and contain MASP to TD

Maximum anticipated mud weight at surface casing depth: = 9.5 ppg

Maximum anticipated mud weight at Intermediate TD: = 10.0 ppg

Maximum anticipated equivalent formation pressure at Intermediate TD: = 9.6 ppg

TVD at intermediate casing point: = 7,582'

Mancos: pore press at Intermediate TD: = 0.5psi/ft

Collapse Design:

Evacuated casing with 9.5 ppg drilling fluid density:

Load = $9.5 \times 0.052 \times 1,380'$ = 682 psig

Rating: = 1,580

S.F. = 2.3

Burst Design:

Assume kick with partially evacuated hole and an influx gradient of 0.22 psi/ft.
(Calculation assumes shoe will not break down.)

MASP (Load) = $7,582' \times (0.5 - 0.22)$ psi/ft = 2,123 psig

Rating: = 3,130psig

S.F. = 1.4

Tensile Design:

Designed on Air Weight

Load = $1,380' \times 40.5\#$ = 56 klbs

Rating: = 420 klbs

S.F. = 7.5

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- B. Intermediate Casing @ 7,590' MD/ 7,582' TVD; 7-5/8", 29.7#, HCP-110, LTC**
Maximum Anticipated Mud Weight at Intermediate TD: = 10.0 ppg
Maximum Anticipated Equivalent Formation Pressure at Intermediate TD: = 9.6 ppg
Niobrara: pore press at deepest TVD in well of 8,809' TVD: = 0.63psi/ft

Collapse Design:

13.0 ppg cement from surface to TD (7,582' TVD)
Fresh water gradient inside casing

$$\begin{aligned}\text{Load} &= (13.0 \times 0.052 \times 7,582) - (8.33 \times 0.052 \times 7,582) &= 1,842 \text{ psig} \\ \text{Rating:} & &= 7,150 \text{ psig} \\ \text{S.F.} & &= 3.8\end{aligned}$$

Evacuated casing with 10.0 ppg drilling fluid density:

$$\begin{aligned}\text{Load} &= 10.0 \times 0.052 \times 7,582' &= 3,943 \text{ psig} \\ \text{Rating:} & &= 7,150 \text{ psig} \\ \text{S.F.} & &= 1.8\end{aligned}$$

Burst Design:

Assume kick with partially evacuated hole and an influx gradient of 0.22 psi/ft.
(Calculation assumes shoe will not break down.)

$$\begin{aligned}\text{MASP (Load)} &= 8,809' \times (0.63 - 0.22) \text{ psi/ft} &= 3,612 \text{ psig} \\ \text{Rating:} & &= 9,470 \text{ psig} \\ \text{S.F.} & &= 2.6\end{aligned}$$

Tensile Design:

Designed on Air Weight

$$\begin{aligned}\text{Load: } 7,582' \times 29.7\# & &= 225 \text{ klbs} \\ \text{Rating:} & &= 769 \text{ lbs} \\ \text{S.F.} & &= 3.4\end{aligned}$$

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- C. **Production Casing @ 14,370' MD/ 8,809' to 8,634' TVD; 5", 23.2#, P110, VAM SFC**
Maximum Anticipated Mud Weight at Total Depth: = 12.0 ppg
Maximum Anticipated Equivalent Formation Pressure at Total Depth: = 11.6 ppg
Niobrara: pore press at deepest TVD in well of 9,249' TVD: = 0.63psi/ft
Maximum Surface Treating Pressure for Fracturing Operations: = 9,000 psig
Assumed Gas Gradient for Production Operations: = 0.115 psi/ft

Collapse Design:

Designed on evacuated casing properties with 12.0 ppg drilling fluid density with no internal back-up.

$$\begin{aligned}\text{Load} &= 12.0 * 0.052 * 8,809' &= 5,497 \text{ psig} \\ \text{Rating} &&= 21,840 \text{ psig} \\ \text{S.F.} &&= 3.9\end{aligned}$$

Burst Design:

Assume maximum surface shut-in pressure during production, and maximum surface treating pressure during fracture stimulation operations.

Design Consideration #1: Maximum Surface Shut-In Pressure

$$\begin{aligned}\text{MASSIP (Load)} &= 8,809' * (0.63 - 0.115) \text{ psi/ft} &= 4,536 \text{ psig} \\ \text{Rating} &&= 20,910 \text{ psig} \\ \text{S.F.} &&= 4.6\end{aligned}$$

Design Consideration #2: Maximum Surface Treating Pressure During Frac Operations

$$\begin{aligned}\text{MATP:} &&= 9,000 \text{ psig} \\ \text{Rating:} &&= 20,910 \text{ psig} \\ \text{S.F.} &&= 2.3\end{aligned}$$

Tensile Design:

Designed on Air Weight

$$\begin{aligned}\text{Load} &= 8,809' * 23.2\# &= 204 \text{ klbs} \\ \text{Rating} &&= 647 \text{ klbs} \\ \text{S.F.} &&= 3.1\end{aligned}$$

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***Cementing Volume Design Clarification:**

Surface Casing:

*Slurry designed for full coverage 14 3/4" hole plus 80% excess.

Intermediate Casing

*Slurry designed 200' above Mesaverde. Volume assumes 9 7/8" hole plus 30% excess.

*If open hole logs are run, cement volumes will be determined from the caliper plus 10% excess.

Production Casing

*Slurry designed with 500' overlap inside intermediate casing. Volume assumes 6 1/2" hole plus 30% excess.

*If open hole logs are run, cement volumes will be determined from the caliper plus 10% excess.

6. DIRECTIONAL DRILLING PROGRAM

Directional plans are attached.

The well will be drilled with continuous MWD surveys at least every 200ft.

7. PROPOSED DRILLING FLUIDS PROGRAM

DEPTH (MD)	MUD TYPE	DENSITY lbs/gal	VISCOSITY (sec/qt)	FLUID LOSS (cc)
0' – 1,400'	Fresh Water Gel	8.8 - 9.5	28 – 35	NC
1,400' – 7,590'	LSND	9.0 – 12.0	35 – 45	5 - 15 cc
7,590' – TD	WBM 3% KCOOH or other shale inhibitor	12.0	35 – 45	5 - 15 cc

Mud flow and volume will be monitored both visually and with electronic pit volume totalizers.

8. TESTING, CORING AND LOGGING

- a. Drill Stem Testing – None anticipated
- b. Coring – None.
- c. Mud Logging – Optional
- d. Logging – See Below:

Open Hole

PEX (AIT-GR-Neutron/Litho Density)
(Optional at operator's discretion)
FMI Pipe Conveyed in Lateral
(Optional at operator's discretion)

Logging Interval

from TD to intermediate casing

from TD to intermediate casing

Cased Hole

CBL (intermediate string)

PBTD to 500' above TOC

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9. ABNORMAL PRESSURES OR TEMPERATURES; POTENTIAL HAZARDS

Barite and a selection of 'sized' lost circulation materials will be kept on location during drilling operations.

The anticipated bottom hole pressure is $8,809' \times 0.63 \text{ psi/ft} = 5,550 \text{ psi}$

The maximum anticipated surface pressure is $8,809' \times (0.63 - 0.22) \text{ psi/ft} = 3,612 \text{ psi}$

10. ANTICIPATED STARTING DATE AND DURATION OF OPERATIONS

The desired target spud date is contingent upon the regulatory approval date. However, the spud date could possibly be delayed or accelerated as required to fit rig schedules.

The drilling operation is anticipated to require ± 40 days on this well. Completion operations are anticipated to begin within 10 days of the drilling rig vacating the pad. Completion operations require approximately 90 days.

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