

## WHITING OIL & GAS CORPORATION

### Boies C-27K-K3N DRILL PLAN

Surface Location: 2235' FSL & 2553' FWL  
 NESW Section 27, Township 2S, Range 98W  
 Rio Blanco County, Colorado

#### Summary:

The Boies C-27K-K3N will be a test to the Dakota formation. Primary pay section to test will be the Niobrara formation. A conventional core will be taken in the Niobrara formation.

Surface section will be 17-1/2" OH with 13-3/8" casing set at 1,900'. The first intermediate section will be drilled with a 12-1/4" bit from 1,900' to 5,300' and 9-5/8" casing set above the Williams Fork formation. The well will be drilled vertically to the Castlegate formation and 7" casing set at that depth. A 6" openhole will be drilled to TD at 14,789' in the Dakota formation and a 4-1/2" liner will be run in that section.

#### 1. ESTIMATED TOPS OF GEOLOGICAL MARKERS

Ground Level 6,435'      Estimated KB 6,465' (30')

Formation	Est Top-TVD	Interval Thickness	Lithology	Potential
Green River	30'	569'	SH-SS	
Mahogany Bench	599'	1,062'	Oil Shale	
Garden Gulch Mbr, Green River Fm	1,661'	204'	SH-SS	
Orange Marker (Wasatch Fm)	1,865'	3,331'	SH-SS	
Ohio Creek Gongl	5,196'	142'	SS-SH	
Williams Fork Fm	5,338'	2,855'	SS-SH	Gas
Cameo Coal Mbr, Williams Fork Fm	8,193'	493'	Coal-Carb SH-SS	Gas
Rollins SS Mbr, Iles Fm	8,686'	109'	Sandstone	Gas
Cozzette Mbr, Iles Fm	8,795'	333'	SS-SH-Carb SH	Gas
Corcoran Mbr, Iles Fm	9,128'	844'	SS-SH	Gas
Sego SS	9,972'	475'	SS-SH	Gas
Castlegate SS	10,447'	396'	SS-SH	Gas
Mancos SH	10,843'	111'	SH-Silt-SS	Gas
Top Mancos B	10,954'	1,064'	Silt-SS	Gas
Base Mancos B	12,018'	572'	SH-Silt	Gas
Niobrara	12,590'	1,609'	Calc Silt-SH	Gas
Frontier	14,199'	384'	SS-Silt	Gas
Dakota	14,583'	200'	Sandstone	Gas
TD	14,783'			

## 2. S-CURVE DIRECTIONAL PLAN:

Bottomhole Location: 27-T2S-R98W  
2035' FSL 2553' FWL

TABLE OF DIRECTIONAL INPUTS

Kick Off Point	2,000'	TVD (ft)
End of Drop	4,941'	TVD (ft)
TD	14,783'	TVD (ft)
Target Departure	199.6'	(ft)
Target Azimuth	180.73	Degrees
Upper Build Gradient	1.5	Deg/100 ft
Lower Drop Gradient	1.5	Deg/100 ft
Inclination	3.88	Degrees
Hang Angle	0	Degrees

\* See attached Directional Well Plan

## 3. PRESSURE CONTROL EQUIPMENT

**A. Type:** BOPE  
13-5/8" 10,000 psi double ram hydraulic BOP with Blind and Pipe rams.  
13-5/8" 10,000 psi single ram hydraulic BOP with Pipe rams.  
13-5/8" 5,000 psi annular preventer

Rotating Head  
13-3/8", 2,500 psi

Wellhead  
13-3/8" casing, 5,000 psi Casing head, (A Section)  
9-5/8" casing, 10,000 psi Casing spool, (B Section)

After the 13-3/8" casing is landed at 1,900', the 5,000 psi casing head will be welded on and the 10,000 psi casing spool (B Section) will be bolted up to the casing head. The 10,000 psi BOP stack will be bolted up to the upper 10,000 psi flange on the B Section. Once the 9-5/8" casing is landed at 5,300', the packoff will be place around the 9-5/8" casing in the B Section. This will give a full 10,000 psi working pressure through the B Section and the BOP.

### B. Testing Procedure:

The annular preventer will be pressure tested to 50% of stack rated working pressure for ten (10) minutes or until provisions of test are met, whichever is longer. The BOP, choke manifold, and related equipment will be pressure tested to approved BOP stack working pressure (if isolated from surface casing by a test plug) or to 70% of surface casing internal yield strength (if BOP is not isolated by a test plug). Pressure will be maintained for ten (10) minutes or until the requirements of the test are met, whichever is longer. At a minimum, the Annular and Blow-Out Preventer pressure tests will be performed:

1. When the BOPE is initially installed;
2. Whenever any seal subject to test pressure is broken;
3. Following related repairs; and
4. at thirty (30) day intervals.

Annular will be function tested weekly, and pipe & blind rams activated each trip, but not more than once per day. All BOP drills & tests will be recorded in IADC driller's log.

### C. Choke Manifold Equipment:

All choke lines will be straight lines whenever possible at turns, tee blocks will be used or will be targeted with running tees, and will be anchored to prevent whip and vibration.

**D. Accumulator:**

Accumulator will have sufficient capacity to open a hydraulically-controlled choke line valve; close all rams plus annular preventer, and retain a minimum of 200 psi above pre-charge on the closing manifold without the use of closing unit pumps. The fluid reservoir capacity will be double accumulator capacity and the fluid level will be maintained at manufacturer's recommendations. Accumulator pre-charge pressure test will be conducted prior to connecting the closing unit to the BOP stack.

**E. Miscellaneous Information:**

Choke manifold and BOP extension rods with hand wheels will be located outside rig sub-structure. Hydraulic BOP closing unit will be located at least twenty-five (25) feet from the wellhead but readily accessible to the driller. Exact locations and configurations of the hydraulic BOP closing unit will depend upon the particular rig contracted to drill this hole. A flare line will be installed after the choke manifold with the discharge point of the flare line to a separate pit located at least 125 feet away from the well bore and any existing production facilities.

#### 4. PROPOSED CASING DESIGN PROGRAM

**A. Casing Program: All New**

Section Conductor	Interval 0' – 60'	Hole Size 24"	Footage 60'	Description 20" 94# H-40 STC
Surface	0' – 1,900'	17-1/2"	1,900'	13-3/8" 54.50# J-55 STC
1 <sup>st</sup> Intermediate	0' – 5,300'	12-1/4"	5,300'	9-5/8" 40# L-80 LTC
2 <sup>nd</sup> Intermediate	0' – 10,806'	8-1/2"	10,800'	7" 29# HCP-110 LTC
Production Liner	10,600' – 14,789'	6"	4,183'	4-1/2" 13.5# P-110 LTC

- Conductor, cellar & mousehole are set by third party company before the drilling rig moves to location.
- Base of water at 599'. 13-3/8" casing set to protect water zone.
- Production Liner will have a 200' liner lap.
- 4-1/2" liner has a 5" Collar OD.

13-3/8" surface casing will have five (5) centralizers as follows: Centralizer #1 set 10' above the guide shoe of joint #1 by stop ring, and a Centralizer set across collars of joints #2, #4, #6 and one centralizer set in the conductor.

9-5/8" intermediate casing will have five (5) centralizers as follows: Centralizer #1 set on middle of joint #1 by stop ring, and a Centralizer set across collars of joints #2, #4, #6 and one centralizer set in the 13-3/8" casing.

7" intermediate casing will have twenty-three (26) centralizers as follows: Centralizer #1 set 10' above the guide shoe of joint #1 by stop ring, and a Centralizer set across collars of joints #2, #4, #6. Run a Centralizer every 5th joint to 6,900' top of tail cement. Run a Centralizer every 10th joints from 6,900' to 5,300'. Run one centralizer in the 9-5/8" intermediate.

4-1/2" liner will have twelve (20) centralizers as follows: Centralizer #1 set on middle of joint #1 by stop ring, and a Centralizer set across collars of joints #2, #4, and #6. Run a Centralizer every 6th joint to the 7" casing at 10,800'. Run one centralizer in the 7" intermediate.

Casing string(s) will be pressure tested to 0.22 psi/foot of casing string length or 1500 psi, whichever is greater (not to exceed 70% of the internal yield strength of the casing), after cementing and prior to drilling out from under the casing shoe.

**B. Casing Design Parameters:**

<b>Surface Casing, 13-5/8"</b>				
<u>Interval</u>	<u>Description</u>	<u>Burst (psi)<sup>a</sup></u>	<u>Collapse (psi)<sup>b</sup></u>	<u>Tension (klb)<sup>c</sup></u>
0' – 1,900'	13-3/8" 54.50# J-55 STC	2,730/1.44	1,130/1.27	514/5.75

- a. based on Methane gas kick to surface, 0.0427 psi/ft
- b. based on full evacuation with 9.0 ppg fluid on backside
- c. based on casing string weight in 9.0 ppg mud  
String Weight in 9.0 ppg mud ≈ 89,322 lbs

<b>1<sup>st</sup> Intermediate Casing, 9-5/8"</b>				
<u>Interval</u>	<u>Description</u>	<u>Burst (psi)<sup>a</sup></u>	<u>Collapse (psi)<sup>b</sup></u>	<u>Tension (klb)<sup>c</sup></u>
0' – 5,300'	9-5/8" 40# L-80 LTC	5,730/3.60	3,090/1.12	727/4.05

- a. based on BLM Burst Rules, 0.22 psi/ft.
- b. based on full evacuation with 10.0 ppg fluid on backside
- c. based on casing string weight in 10.0 ppg mud.  
String Weight in 10.0 ppg mud ≈ 179,634 lbs.

<b>2<sup>nd</sup> Intermediate Casing, 7"</b>				
<u>Interval</u>	<u>Description</u>	<u>Burst (psi)<sup>a</sup></u>	<u>Collapse (psi)<sup>b</sup></u>	<u>Tension (klb)<sup>c</sup></u>
0' – 10,806'	7" 29# HCP-110 LTC	11,150/3.44	9,750/1.74	797/3.00

- a. based on BLM Burst Rules, 0.22 psi/ft.
- b. based on full evacuation with 10.0 ppg fluid on backside
- c. based on casing string weight in 10.0 ppg mud.  
String Weight in 10.0 ppg mud ≈ 265,531 lbs.

<b>Production Liner, 4-1/2"</b>				
<u>Interval</u>	<u>Description</u>	<u>Burst (psi)<sup>a</sup></u>	<u>Collapse (psi)<sup>b</sup></u>	<u>Tension (klb)<sup>c</sup></u>
10,600' – 14,789'	4-1/2" 13.5# P-110 LTC	12,320/4.42	10,690/1.29	338/7.16

- a. based on BLM Burst Rules, 0.22 psi/ft.
- b. based on full evacuation with 10.8 ppg fluid on backside
- c. based on casing string weight in 10.8 ppg mud.  
String Weight in 10.8 ppg mud ≈ 47,227 lbs.

**5. PROPOSED CEMENTING PROGRAM**Surface, 13-5/8" Casing: TOC Surface, (100% Excess)

Lead: 1,923 cu-ft; 825 sx Rockies LT  
 0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)  
 0.25 lbm/sk Kwik Seal (Lost Circulation Additive)

Tail: 731 cu-ft; 355 sx Rockies LT  
 0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)  
 0.25 lbm/sk Kwik Seal (Lost Circulation Additive)

Cement Properties	Tail Slurry	Lead Slurry
Slurry Weight (ppg)	12.80	12.30
Slurry Yield (cf/sack)	2.08	2.34

1<sup>st</sup> Intermediate, 9-5/8" Casing: TOT 4,900', TOL 1,900', 50% excess

Lead: 1,409 cu-ft; 745 sacks Halliburton Light Premium  
 0.3% Halad®-344 (low Fluid Loss Control)  
 0.3% HR-601 (Retarder)

Tail: 253 cu-ft; 215 sacks Premium Cement  
 94 lbm/sk Premium Cement (Cement)  
 0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)  
 0.1% HR-5 (Retarder)

Cement Properties	Tail Slurry	Lead Slurry
Slurry Weight (ppg)	15.60	12.50
Slurry Yield (cf/sack)	1.18	1.90

2<sup>nd</sup> Intermediate, 7" Casing: TOT 6,900', TOL 4,900', (35% Excess)

Lead: 337 cu-ft; 160 sacks EXTENDACEM™ SYSTEM  
 20% SSA-1 (Additive Material)  
 0.125 lbm/sk Poly-E-Flake (Lost Circulation Additive)

Tail: 676 cu-ft; 400 sacks THERMACEM™ SYSTEM  
 0.35% HR-601 (Retarder)  
 0.25 lbm/sk Poly-E-Flake (Lost Circulation Additive)

Cement Properties	Tail Slurry	Lead Slurry
Slurry Weight (ppg)	13.50	12.70
Slurry Yield (cf/sack)	1.70	2.13

Production Liner, 4-1/2" Casing: TOC 10,600', (30% Excess)

Lead: 468 cu-ft; 270 sx Primary Cement  
 BONDCEM™ SYSTEM  
 0.5 % HR-601 (Retarder)

Cement Properties	Tail Slurry
Slurry Weight (ppg)	13.50
Slurry Yield (cf/sack)	1.76

**6. MUD PROGRAM**

Depth	Mud System	MW (ppg)	PV (cp)	YP (lb/100ft <sup>2</sup> )	FL (ml/30min)
0' – 1,900'	Spud	8.5 – 8.8	6 - 10	15 - 25	NA
1,900' - 5,300'	Spud/LSND	8.5 – 9.0	6 - 10	15 - 25	NA
5,300'-10,806'	LSND/Asphalt	8.5 – 9.8	6 - 15	10 - 15	6
10,806' –14,789'	LSND/Asphalt	8.7 – 10.8	6 - 10	10 - 12	6

- Rig will have a trip tank to monitor pit volumes while tripping
- Rig will have a mud pit monitoring system to show active volumes of mud

**7. TESTING, LOGGING AND CORE PROGRAMS**

Cores: 540' in Niobrara

DST: None planned

Surveys: Deviation surveys every 500' to TD in both surface and production hole.

Mud Logger: From 1,900' to TD.

Samples: 30' samples 1,900' to TD

Open Hole Logging Program:	Triple Combo + Sonic	Surface to TD
	Sonic Scanner	5,200' to TD
	FMI	5,200' to TD

**8. ANTICIPATED ABNORMAL PRESSURES OR TEMPERATURES:**

No abnormal temperatures are anticipated. No H<sub>2</sub>S is anticipated.

Maximum anticipated bottom hole pressure equals approximately 6,401 psi (calculated at 0.433 psi/foot) at TD in the Dakota formation at 14,783'.

**9. ANTICIPATED STARTING DATE AND DURATION:**

Dirt work startup:	Upon Approval
Spud:	Upon Approval
Duration:	60 - 90 days